

ROBOTIC SURGERY IN CERVICAL CANCER

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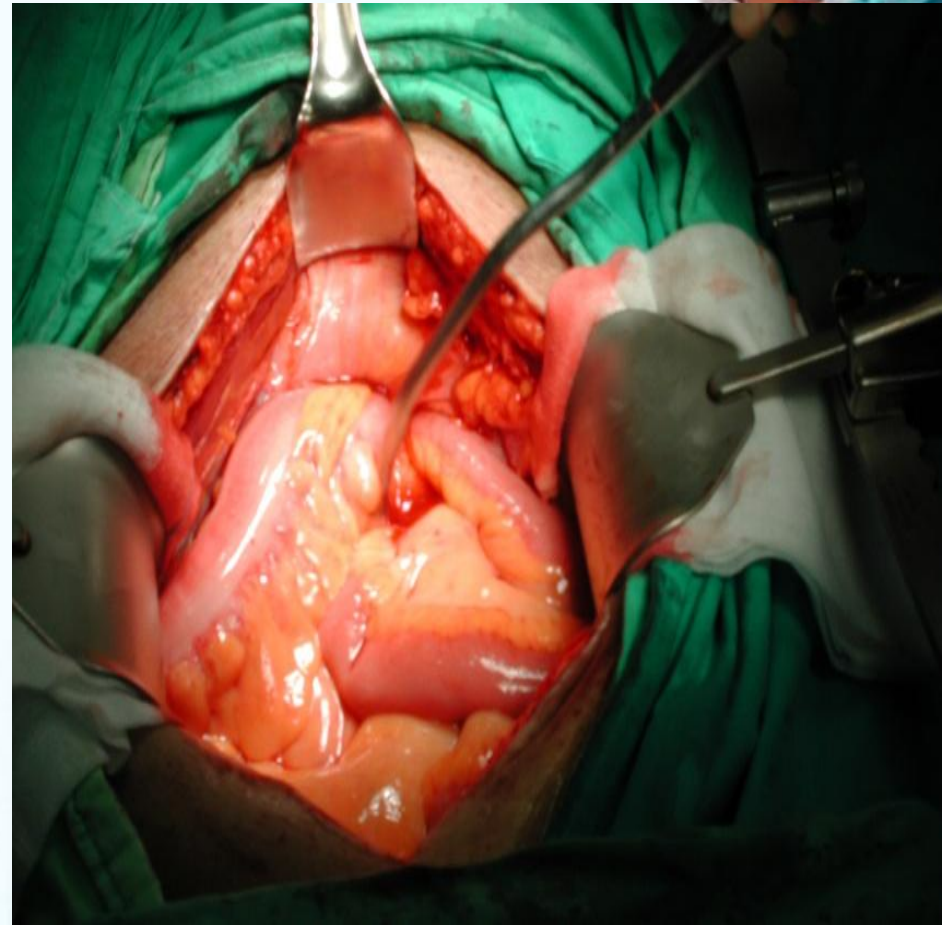
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(ASGO)

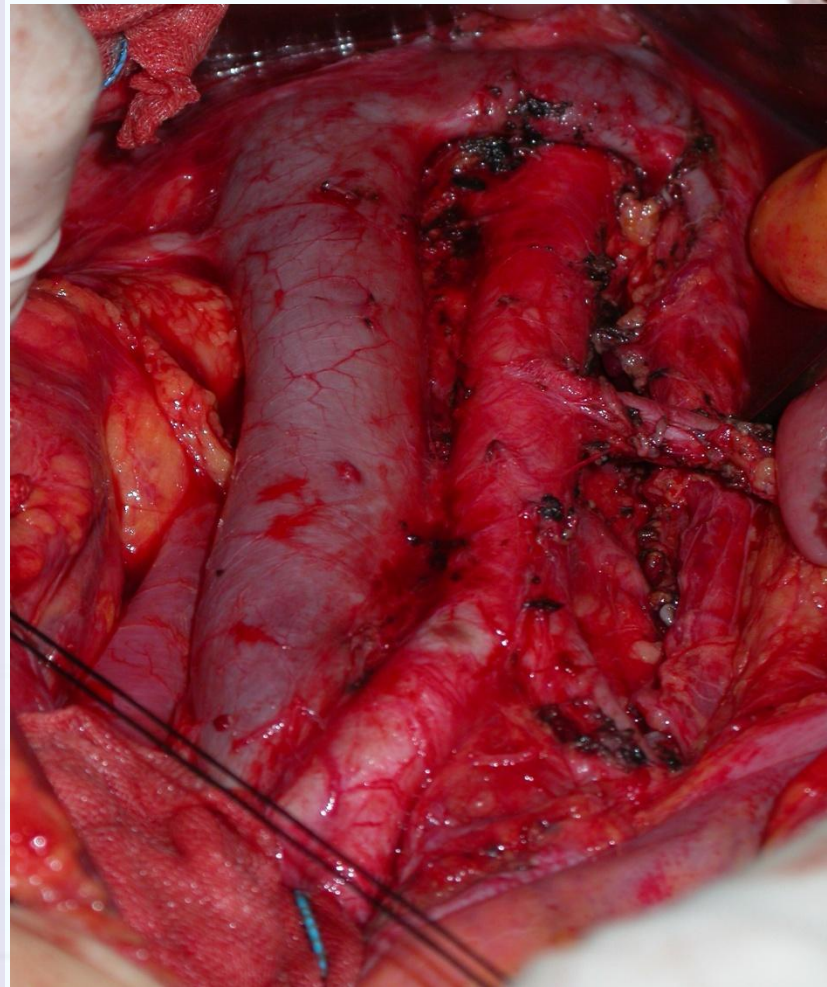
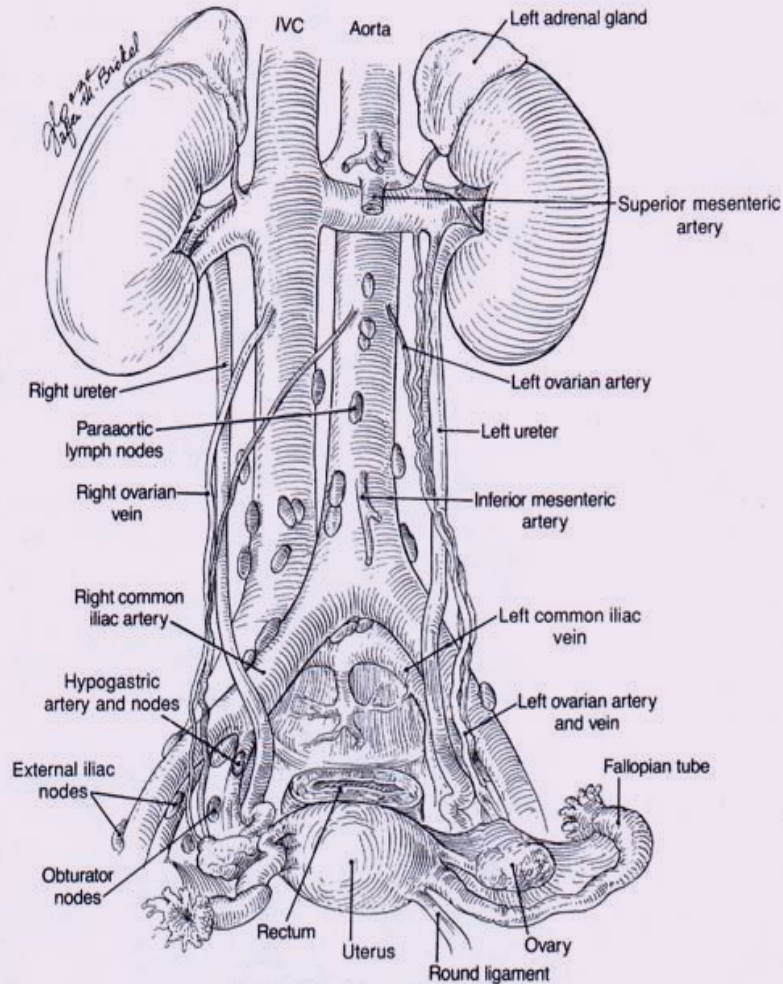


Abdominal radical hysterectomy (Mackay Memorial Hospital)

- ❖ Standard procedure:
modified from Prof.
Okabayashi's procedure
- ❖ (cardinal ligament →
uterosacral ligament →
anterior & posterior
sheath of vesicouterine
ligament; posterior to
anterior method)



Pelvic & Para-aortic lymph nodes



Okabayashi's radical hysterectomy in Mackay memorial hospital, Taipei, Taiwan

GYNECOLOGIC ONCOLOGY 32, 135-142 (1989)

Radical Hysterectomy with Pelvic Lymph Node Dissection for Treatment of Cervical Cancer: A Clinical Review of 954 Cases

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AND CHEN-CHUN WU, M.D.§

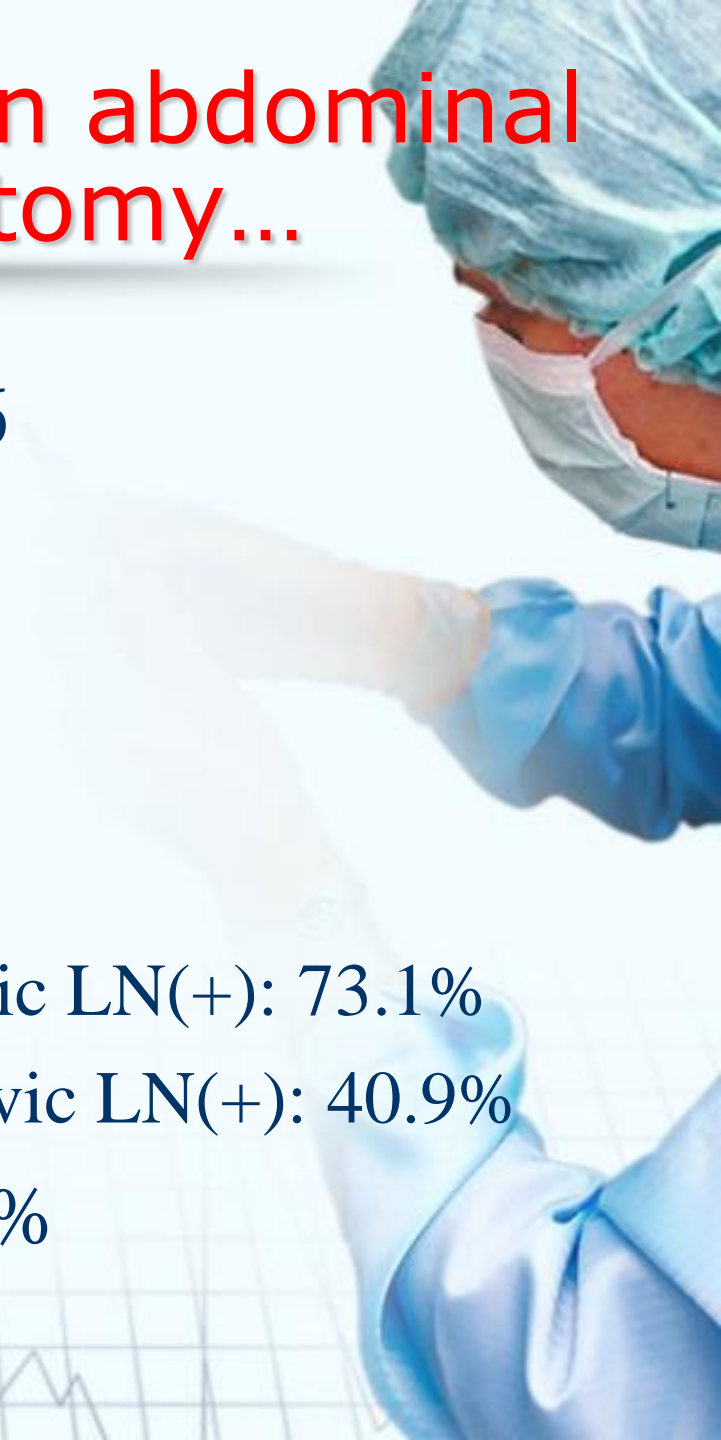
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Received March 10, 1988

Lee YN, et al. Gynecol Oncol. 1989;32: 135-42

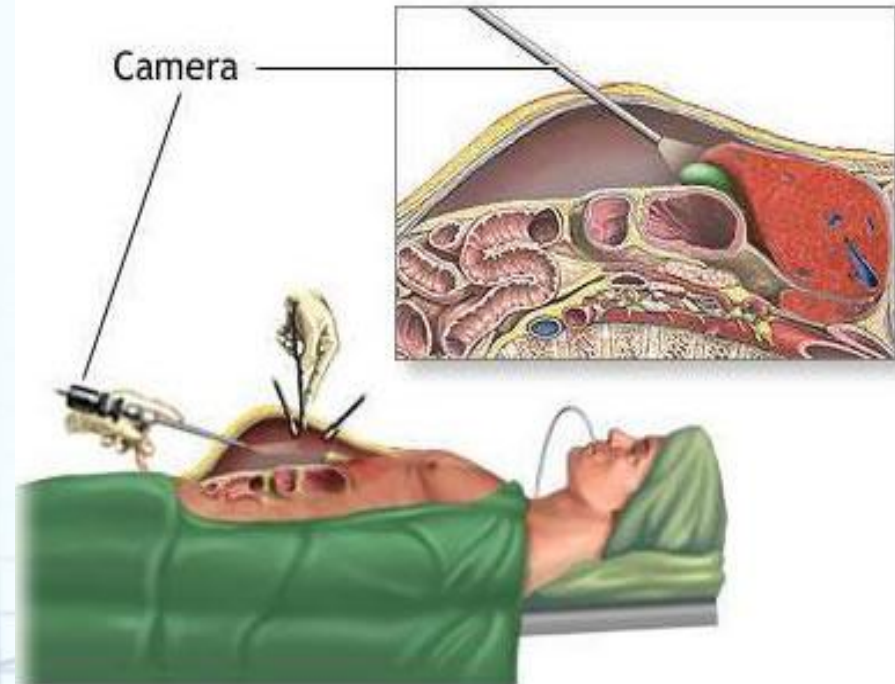
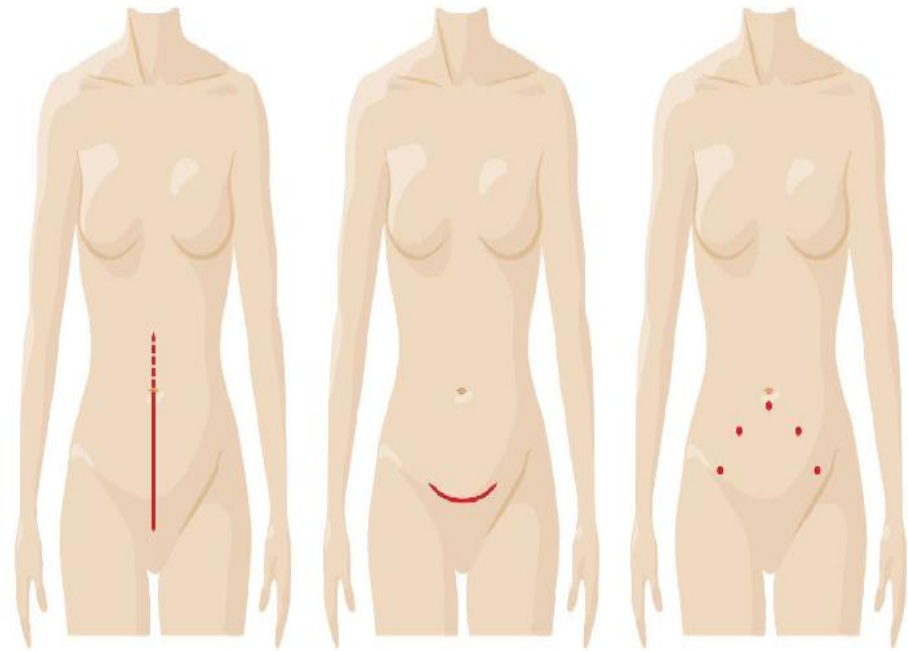
Mackay's experience in abdominal radical hysterectomy...

- ❖ From Jan. 1971 to Dec. 1986
- ❖ Total : 954 cases
 - ❖ 62.5% stage IB
 - ❖ 26.6% stage IIA
- ❖ Respective 5-year survival
 - ❖ IB: Pelvic LN(-): 87.7%, Pelvic LN(+): 73.1%
 - ❖ IIA: Pelvic LN(-): 79.8%, Pelvic LN(+): 40.9%
- ❖ Operative mortality rate: 0.4%



MIS – Laparoscopic Surgery

- Minimally invasive surgery (MIS)
- Ability to operate through small keyhole incisions
- The camera and instruments fit through the keyhole incisions
- Better visualization than open surgery



Challenges of MIS in Treatment of Cervical Cancer

❖ Feasible

-OR time

-Adequacy of lymph node retrieval

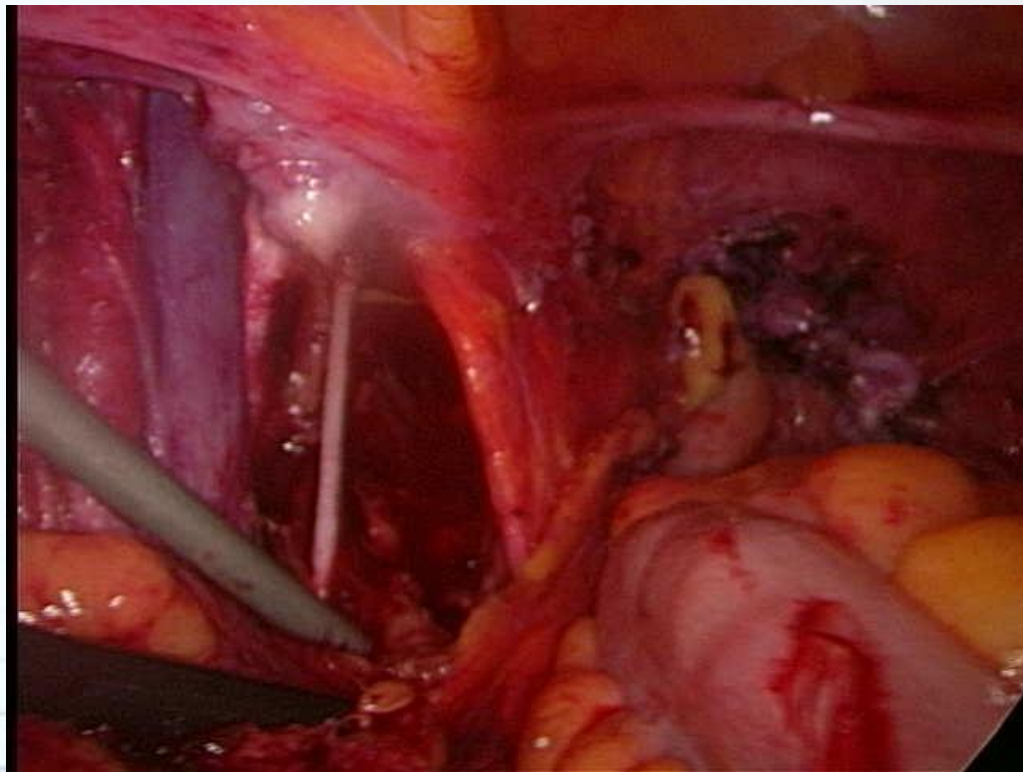
-Complications comparable

❖ Long term outcome



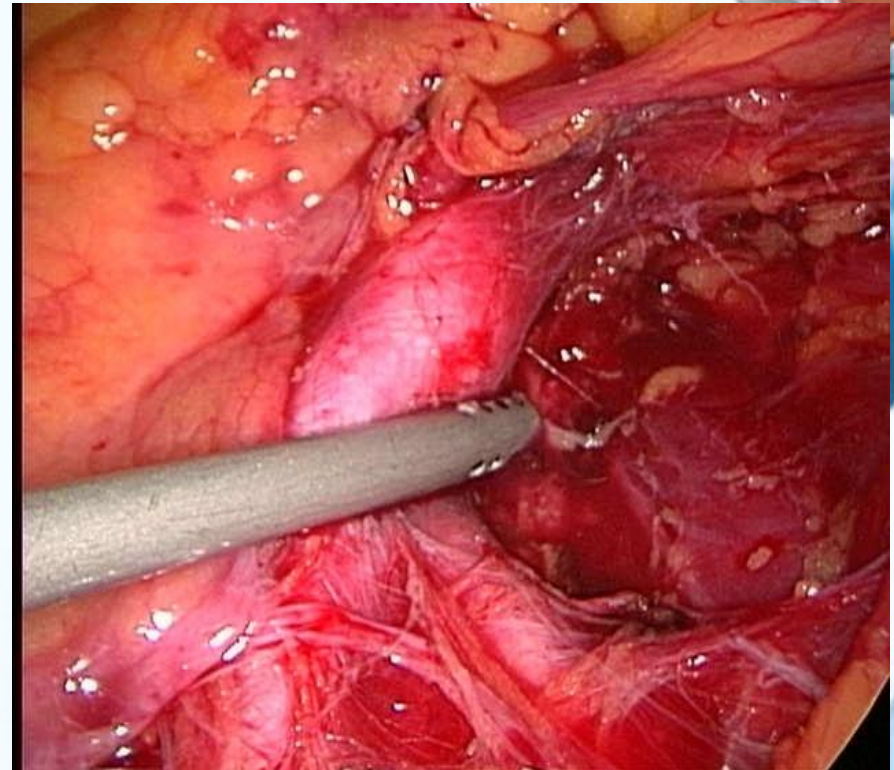
History of laparoscopic retroperitoneal lymphadenectomy

Dargent reported the first case of laparoscopic pelvic lymphadenectomy on early-stage diseases in 1987.



History of laparoscopic retroperitoneal lymphadenectomy (conti.)

1. **Nezhat** described laparoscopic **para-aortic** lymphadenectomy in 1992.
2. Improvements in laparoscopic surgical techniques and instrumentation have made laparoscopic lymphadenectomy in gynecologic malignancies feasible and effective.
3. The development of laparoscopic techniques open the new avenues for laparoscopic treatment in gynecologic malignances.



World's initial cases of Laparoscopic radical hysterectomy



American Journal of Obstetrics and Gynecology

Volume 166, Issue 3, March 1992, Pages 864–865



Laparoscopic radical hysterectomy with paraaortic and pelvic node dissection

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American Journal of Obstetrics and Gynecology

Volume 168, Issue 5, May 1993, Pages 1643–1644



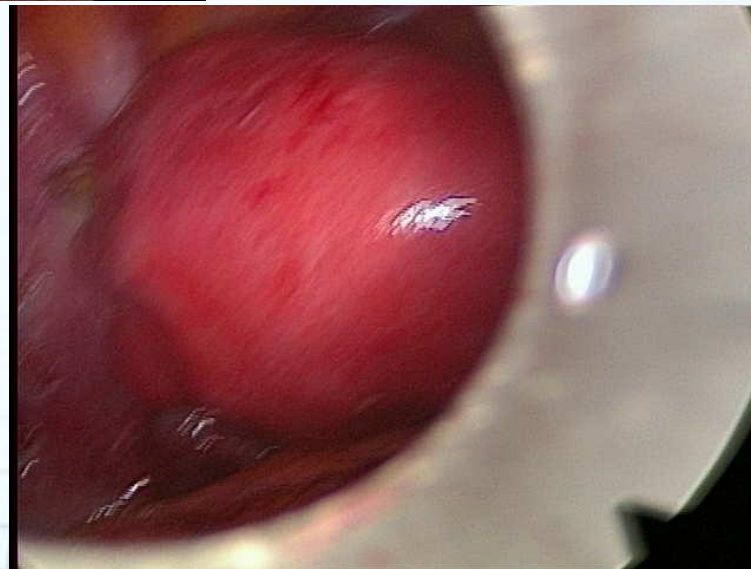
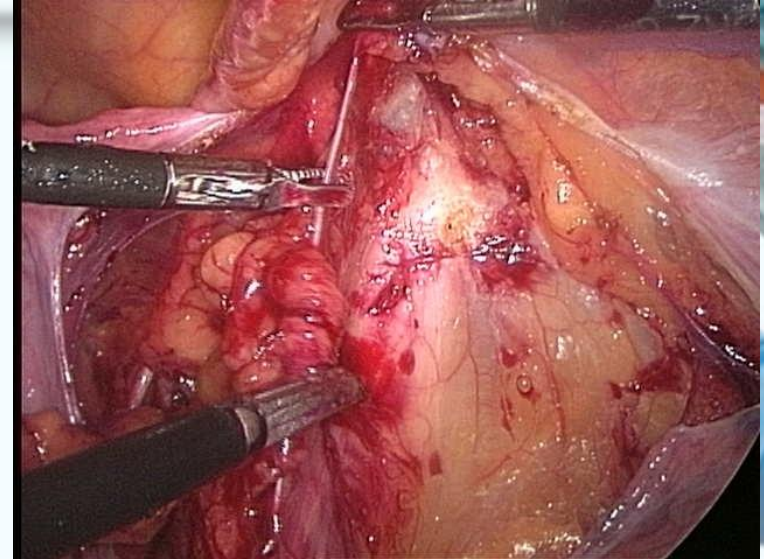
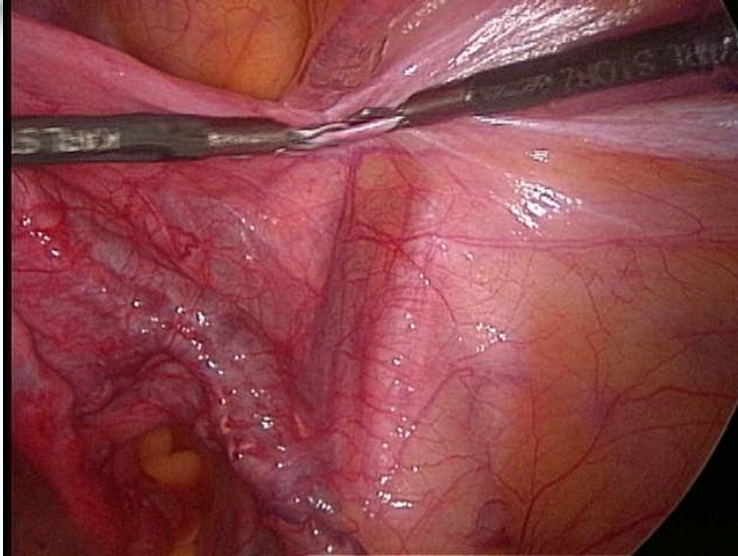
Laparoscopic radical hysterectomy

Denis Querleu, MD

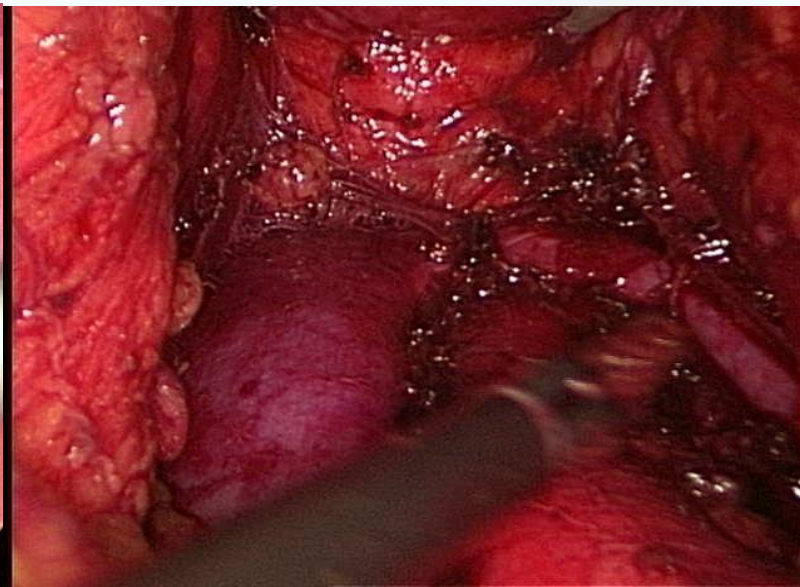
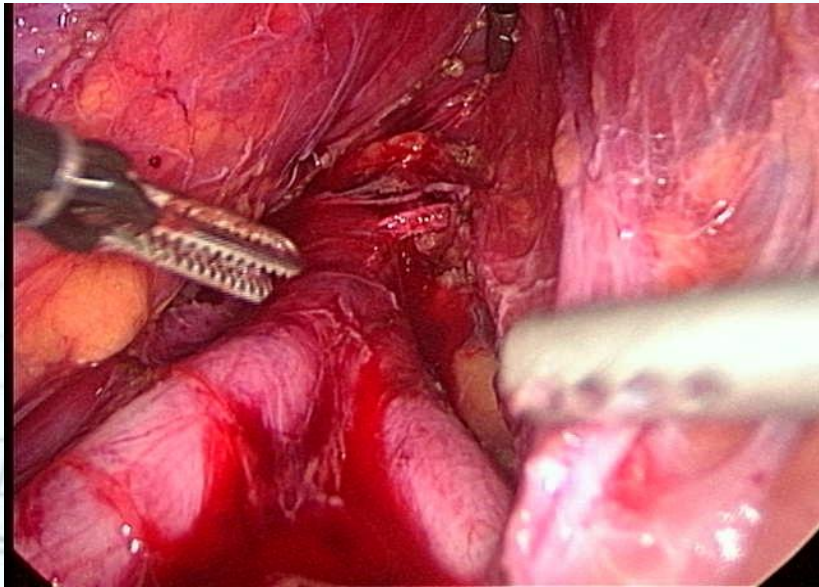
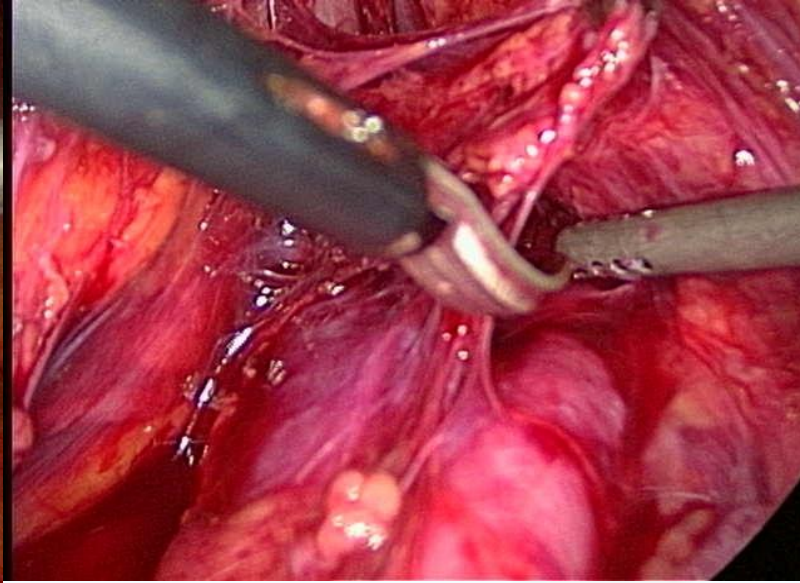
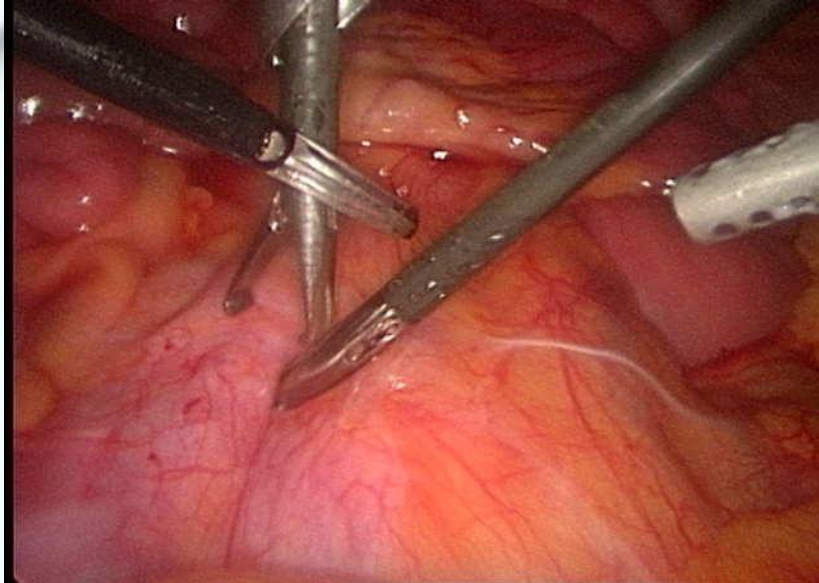
Pavillon Paul Gellé, 91 Ave. Julien Lagache, 59100 Roubaix, France



Procedures of laparoscopic pelvic lymphadenectomy



Laparoscopic transperitoneal paraaortic lymphadenectomy



Laparoscopic para-aortic LN sampling at Mackay Memorial Hospital (Taipei)

- ❖ Invasive cervical cancer, 38 patients
- ❖ From August 1993 to July 1994
- ❖ Average time :77mins, blood loss: 116ml
- ❖ Average nodes: 15, residual nodes: 0.4
- ❖ Conclusions: a less invasive , reliable method , lower risk

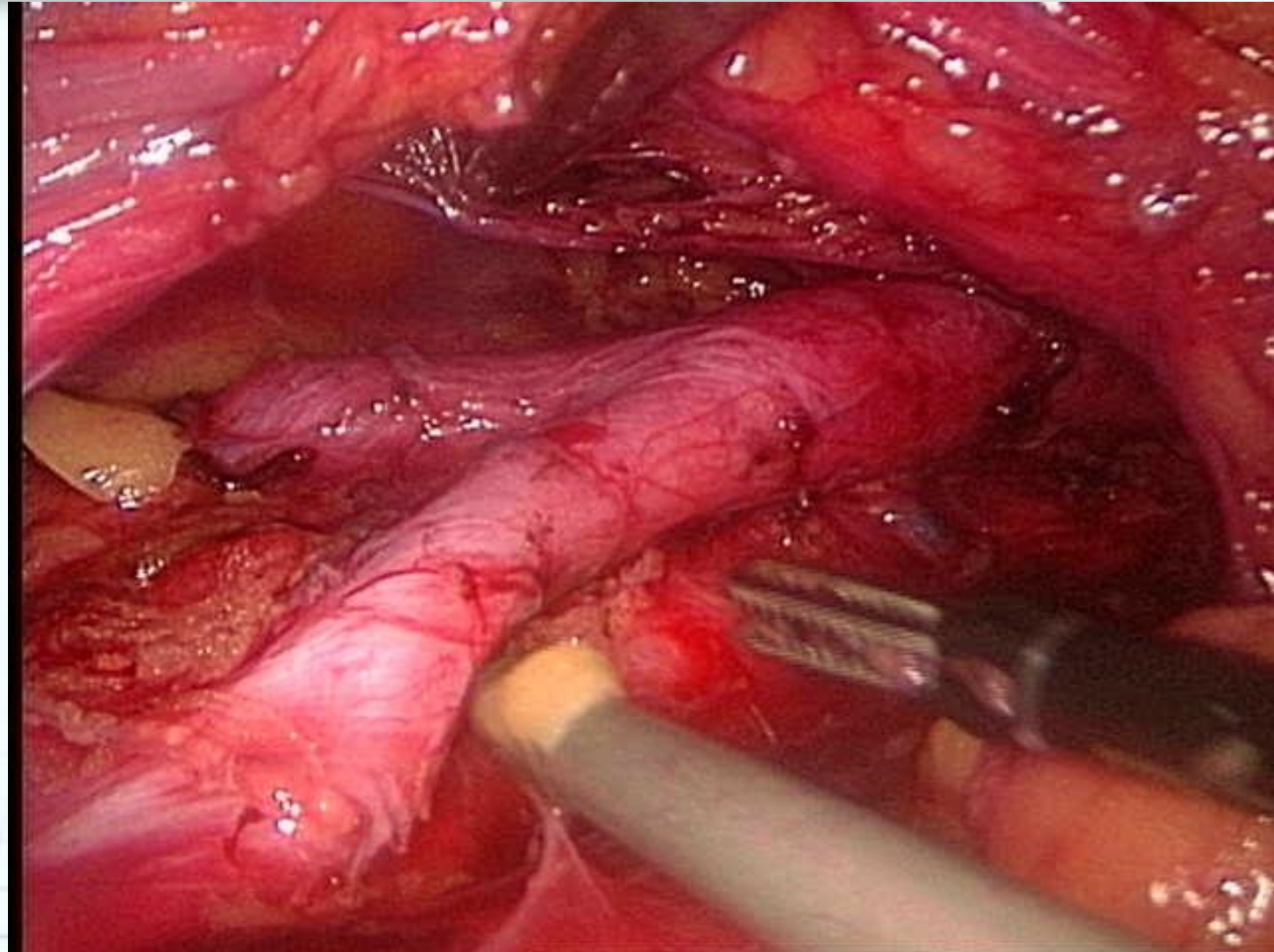
Int J Gyne Obst 1995

GOG study (2002)

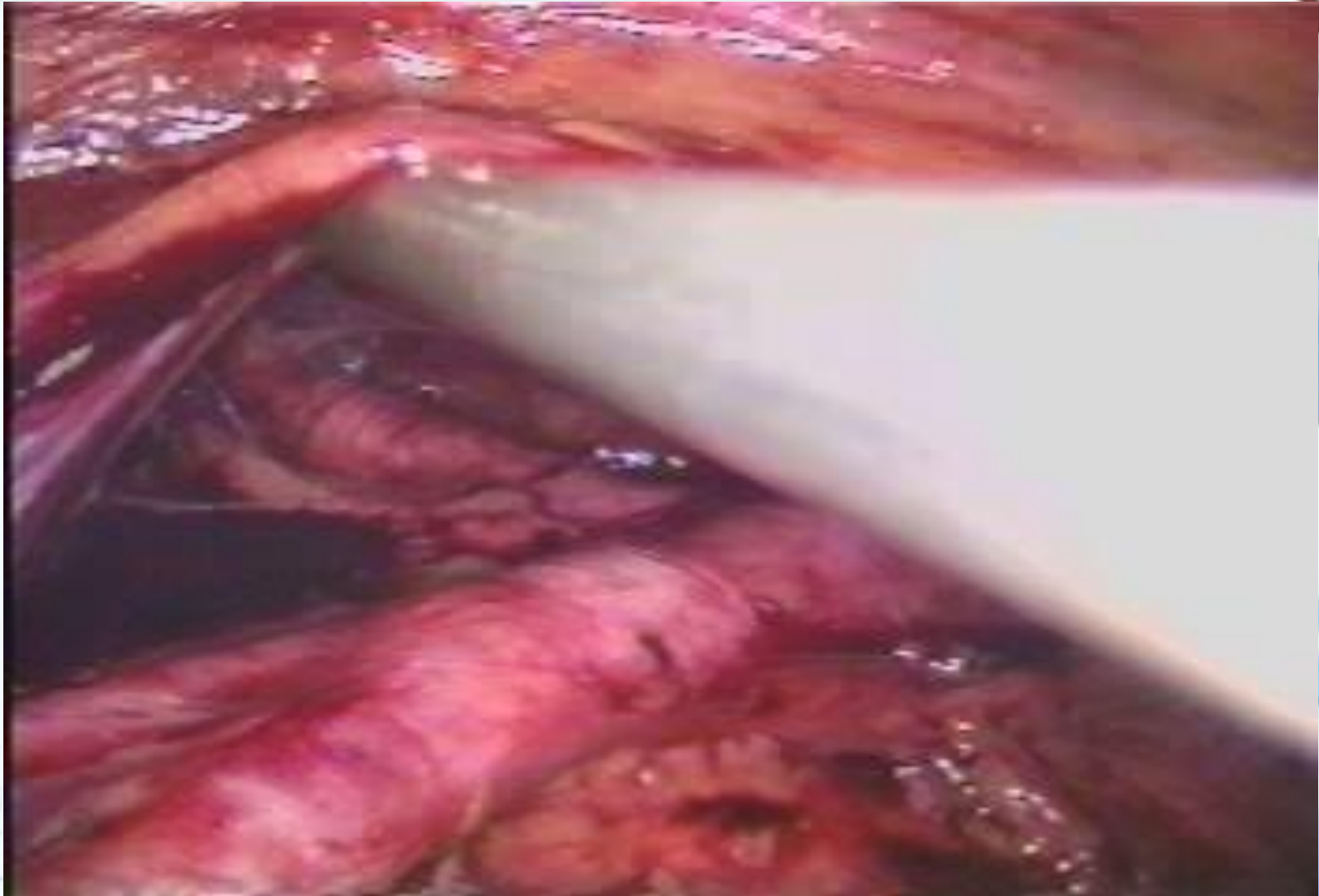
- ❖ Laparoscopic retroperitoneal lymphadenectomy followed by immediate laparotomy in women with cervical cancer
- ❖ From May 1993 to June 1997, 73 patients
- ❖ Laparoscopic bilateral aortic lymph node sampling appeared to be reasonably safe and feasible.
- ❖ Laparoscopic therapeutic bilateral pelvic lymphadenectomy, although having a reasonable complication rate, demonstrated problems regarding adequacy, which are probably correctable.



Laparoscopic extraperitoneal paraaortic lymphadenectomy (IMA)



Laparoscopic extraperitoneal paraaortic lymphadenectomy(Renal vein)



Type III Laparoscopic RH in Mackay memorial hospital, Taipei, Taiwan

- ❖ Started in 1994
- ❖ Laparoscopic assisted radical hysterectomy in selected small **IA2/IB1** cases
- ❖ ([2013-7-29-5分鐘影片\LSC_RH_5_min_work_20130731.mpg](#))

Clinical Data – Laparoscopic RH for Cervical Cancer IA2/IB1(MMH)

From Jan.1995 to Dec. 2008

Patient No.	(n=112)
Mean age (years)	48.5
Mean BMI (kg/m ²)	24.1
Mean length of stay (days)	13
Mean EBL (ml)	350.3
Transfusions (n)	2
Mean operative time (min)	252.2
Mean pelvic lymph nodes (n)	20.5
Complication	1 external iliac vein injury, 1 ureteral injury, 2 bladder injury
Progression free survival (%)	91.1
Overall survival (%)	93.8




why ?

Robotic surgery

Drawbacks with Conventional Laparoscopic Surgery

- ❖ Surgeon operates from a 2D image
- ❖ Straight, rigid instruments (limited range of motion – chopsticks)
- ❖ Instrument tips controlled at a distance- fulcrum effect
- ❖ Reduced dexterity, precision and control
- ❖ Unsteady camera controlled by assistant
- ❖ Dependent on assistant for surgical support through an accessory port
- ❖ Greater surgeon fatigue
- ❖ Makes complex operations more difficult





■ The application of the laparoscopic surgery for treatment of cervical cancer has been limited.

Steep
learning curve

Limitations of the
obese patients

da Vinci[®] Surgical System

A. Surgeon Console Cart System

手術控制台



C. Surgical
Arm

手術機械手
臂



B. Vision Cart System

影像處理設

da Vinci[®] Surgical System

da Vinci's core technology provides surgeons with:

- High resolution, real 3D image
- Wristed instrument
- Intuitive Motions

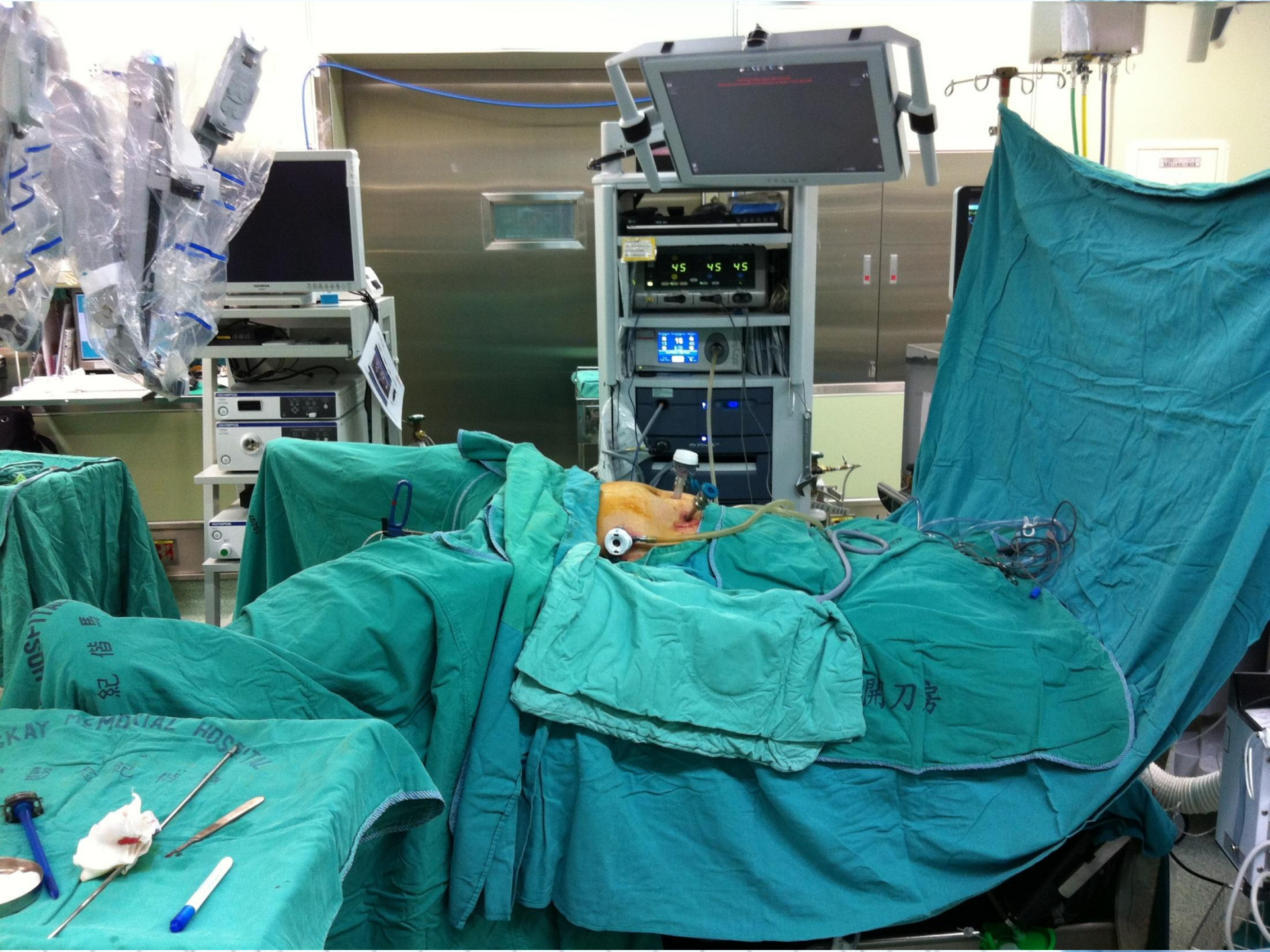




Cervical cancer with robotics



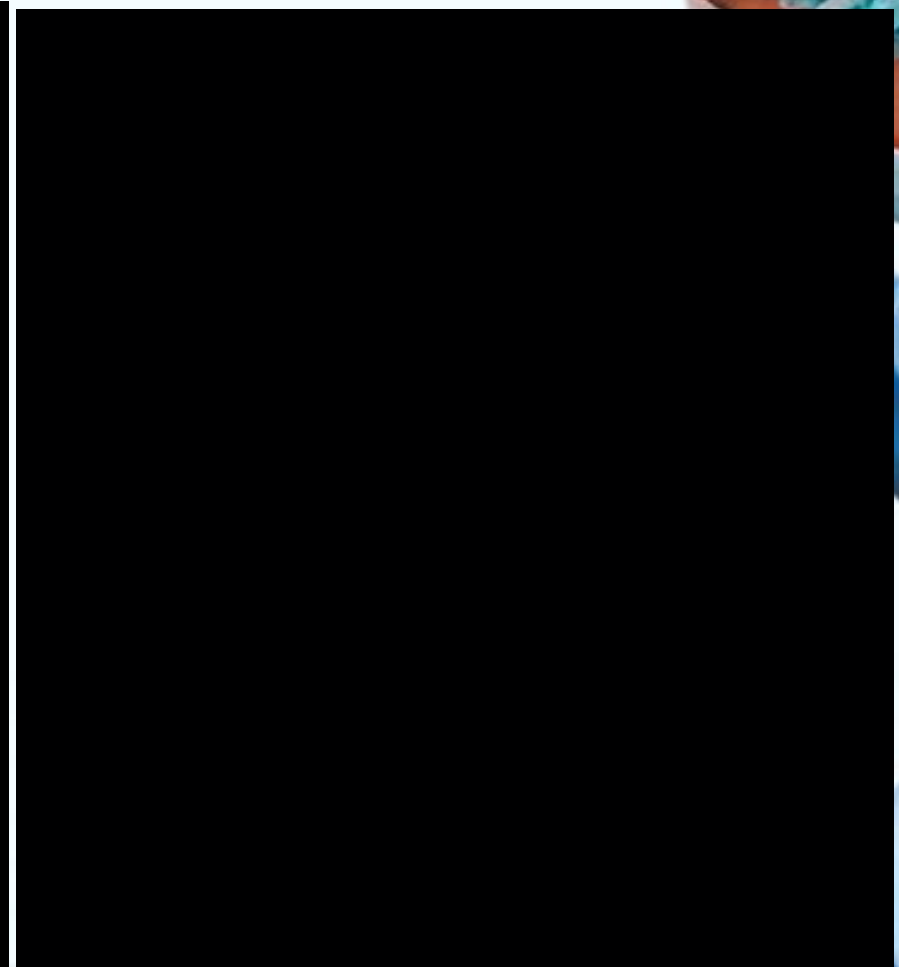


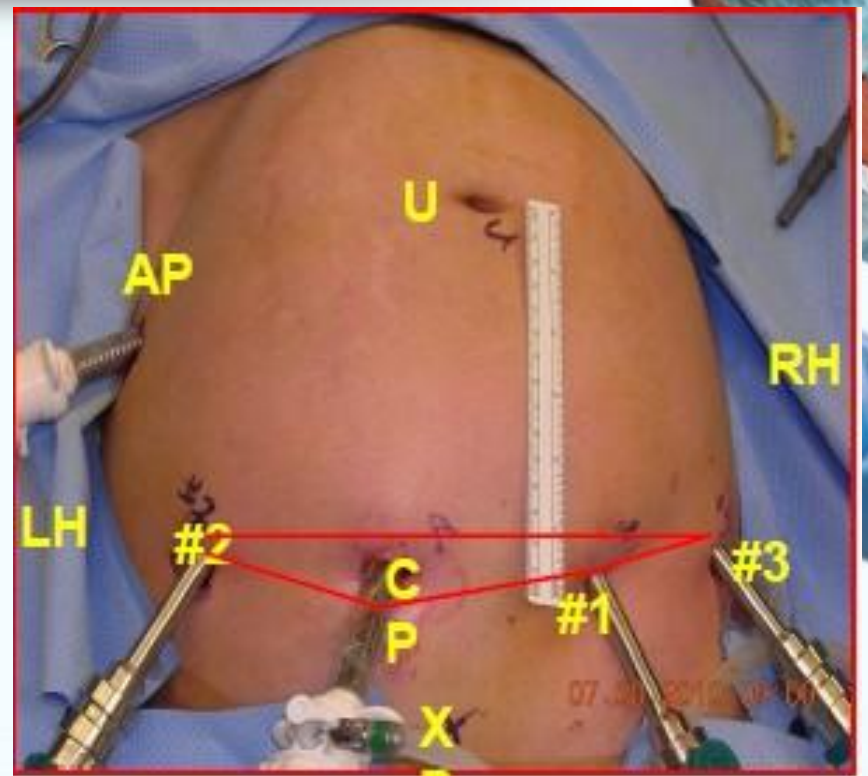
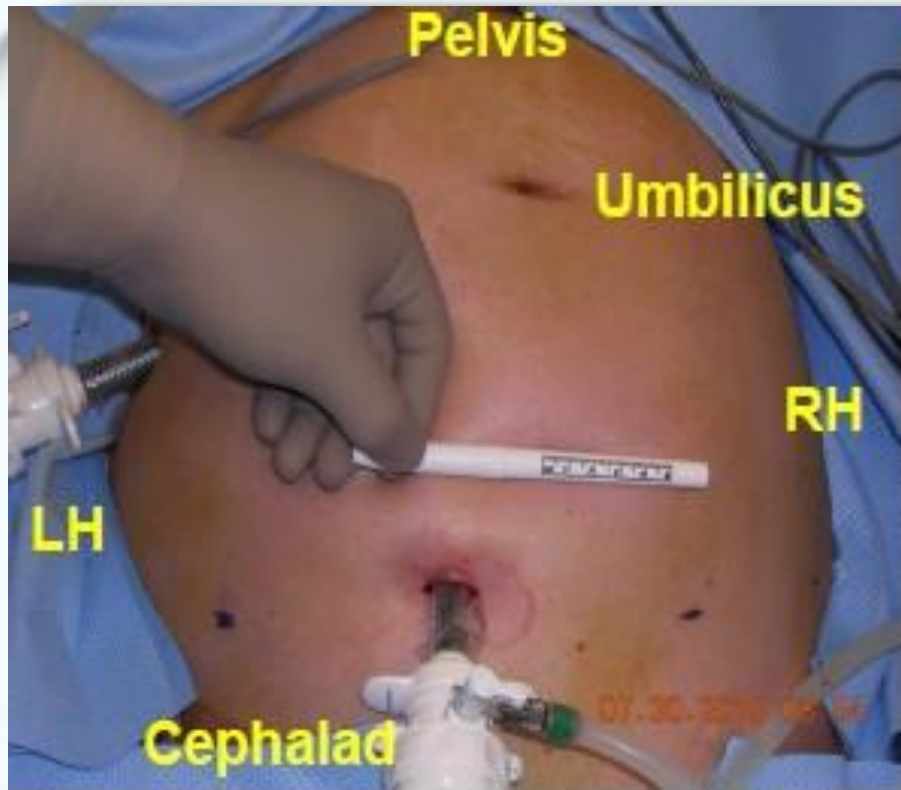




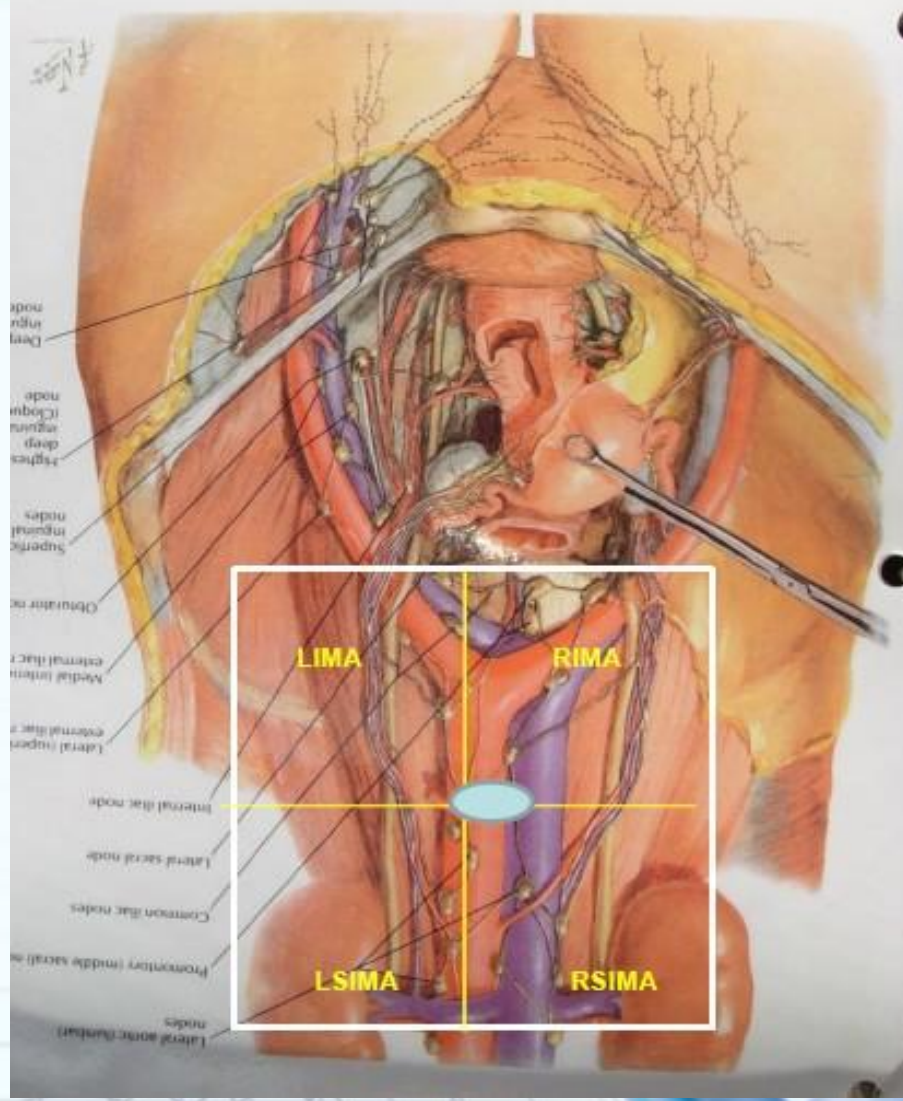
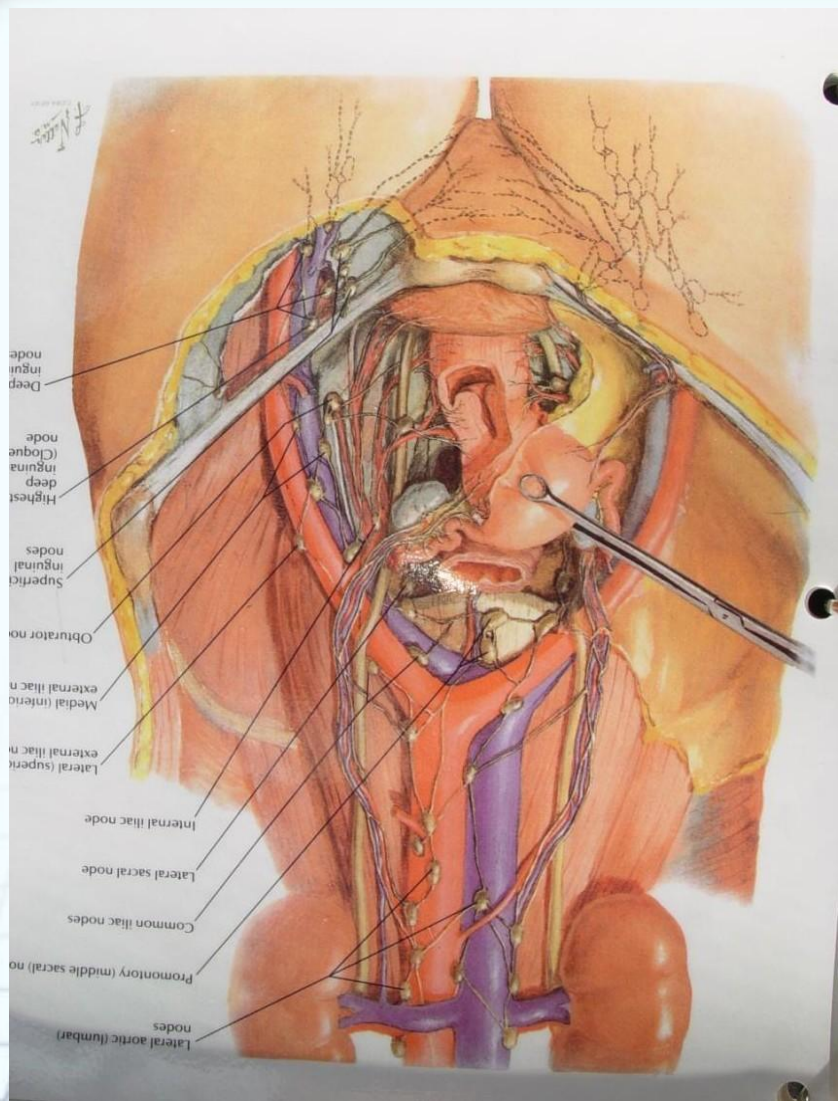


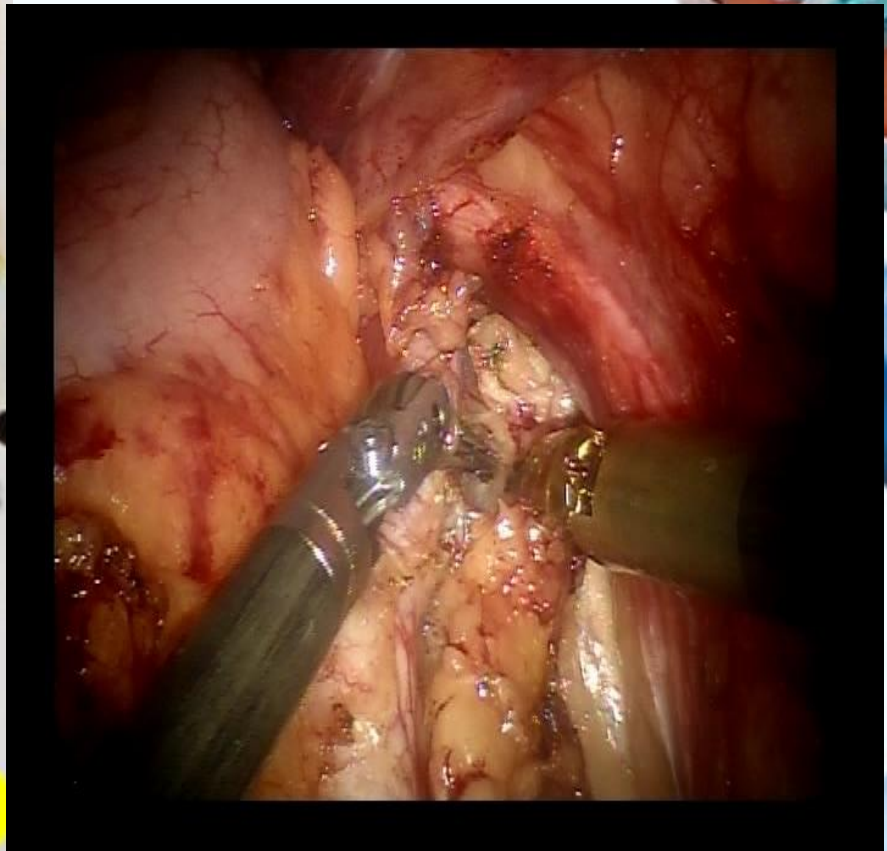
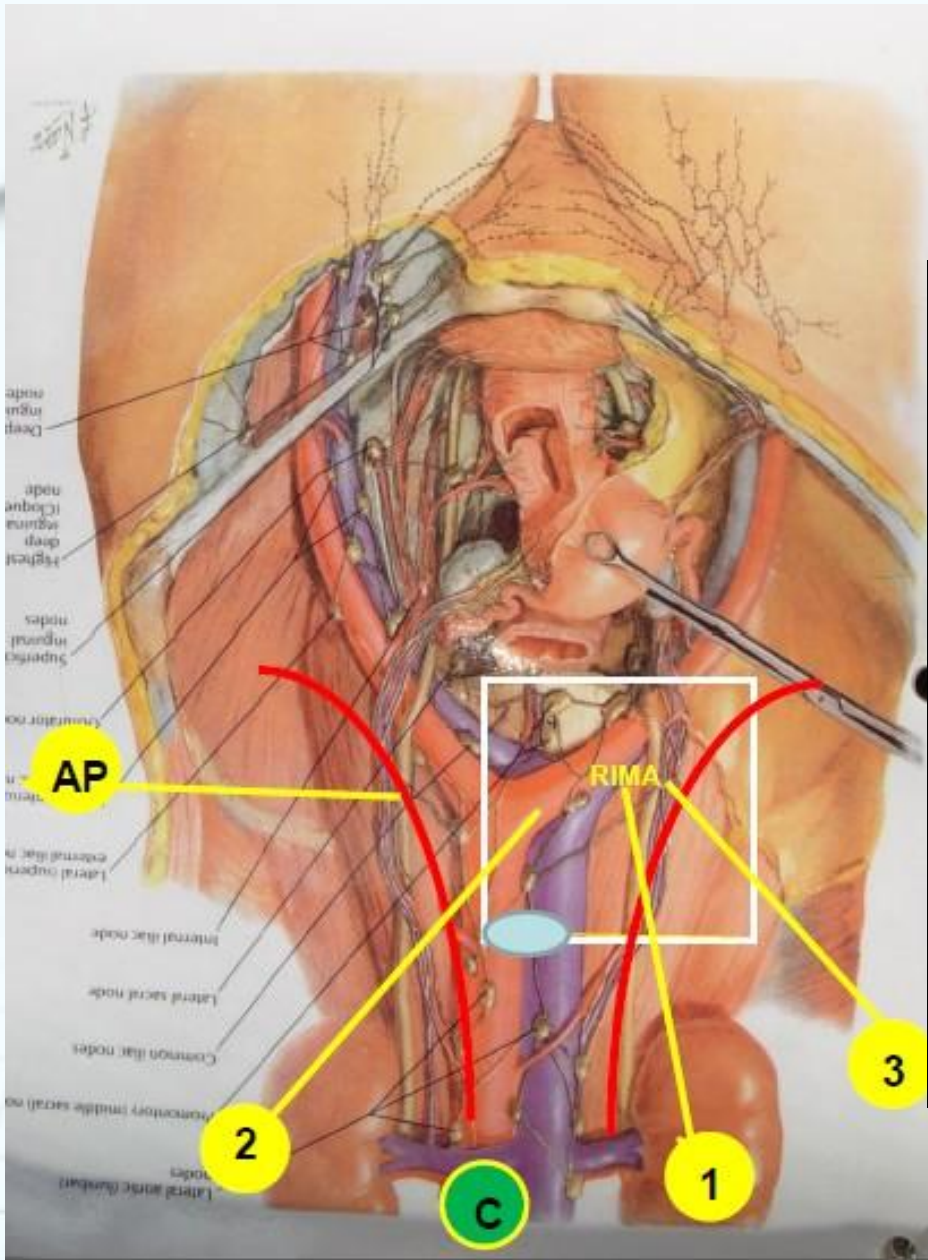
Procedures of Robotic assisted pelvic lymphadenectomy

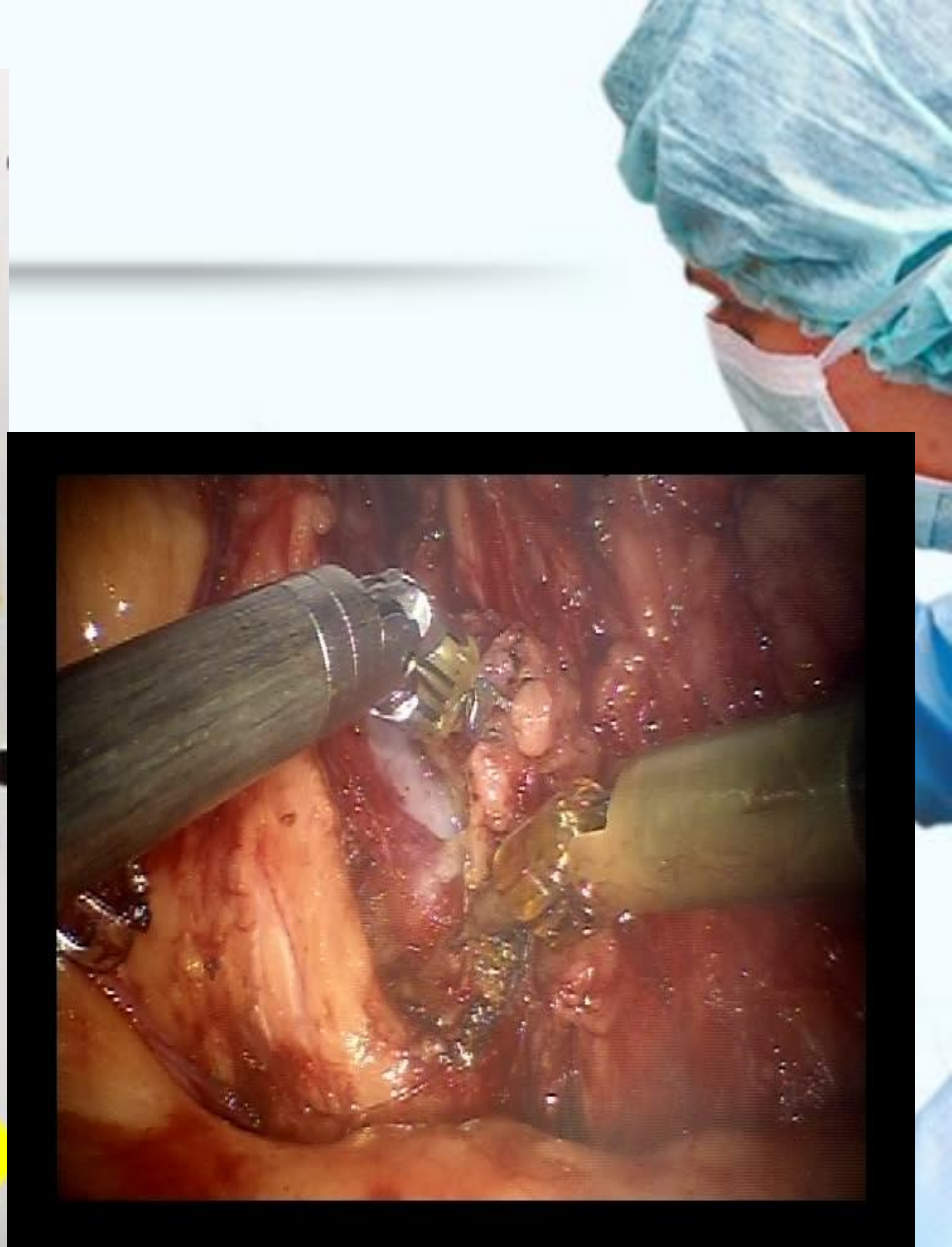
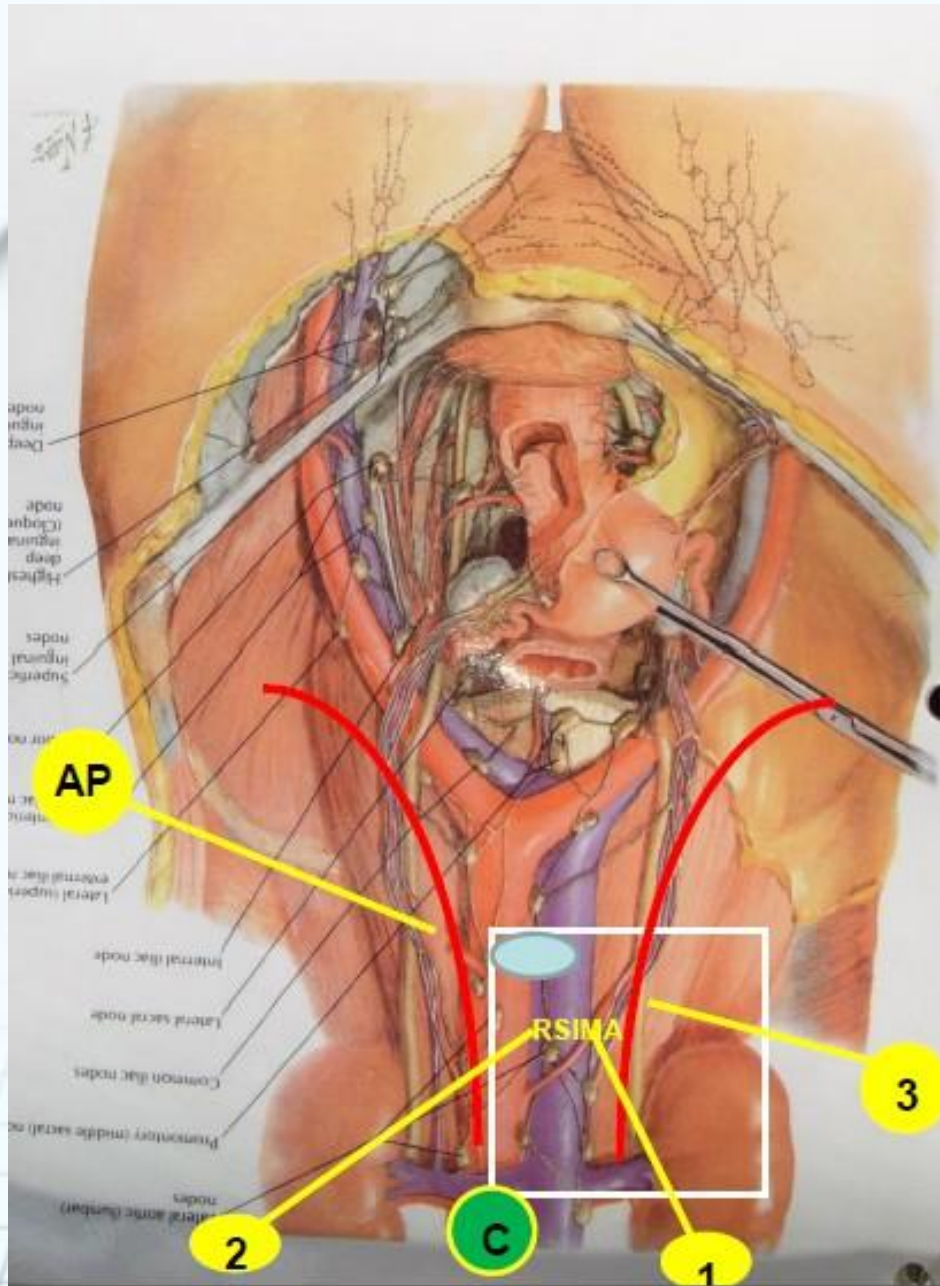


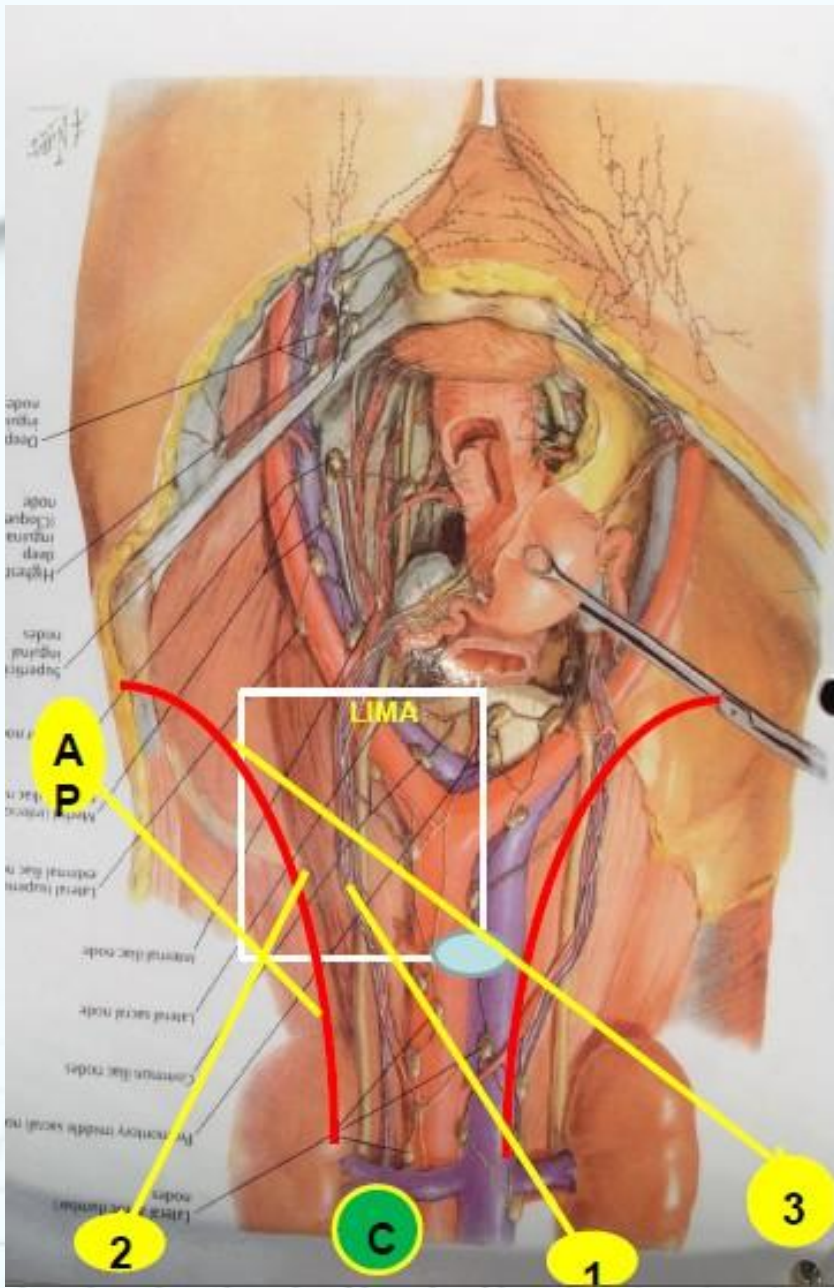


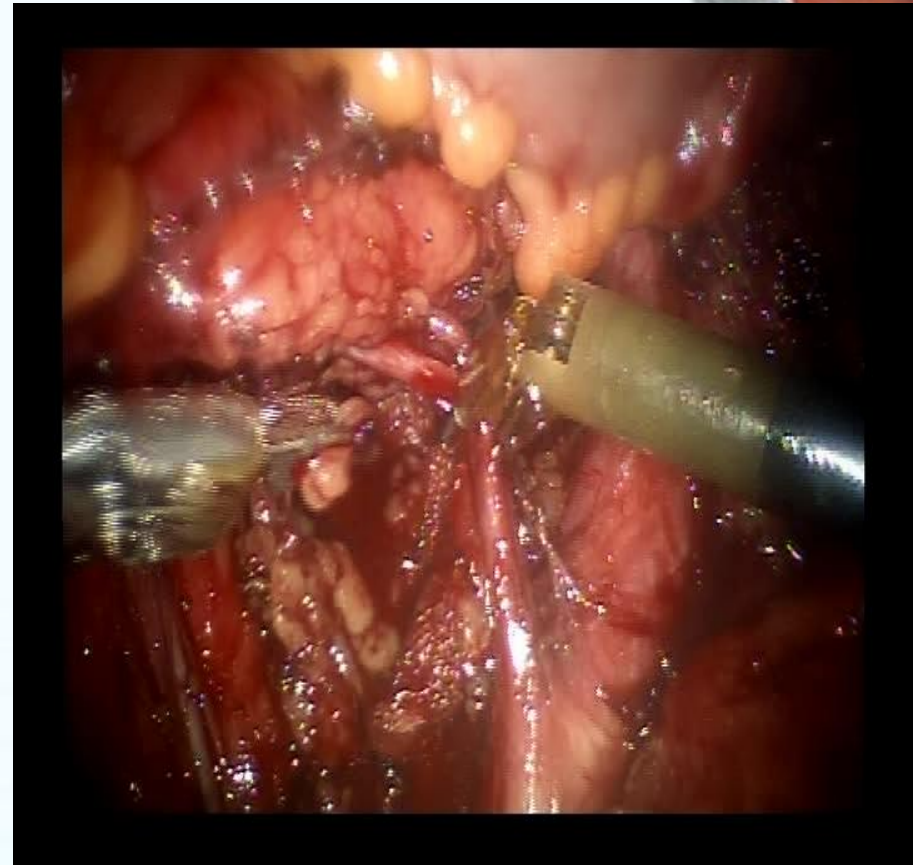
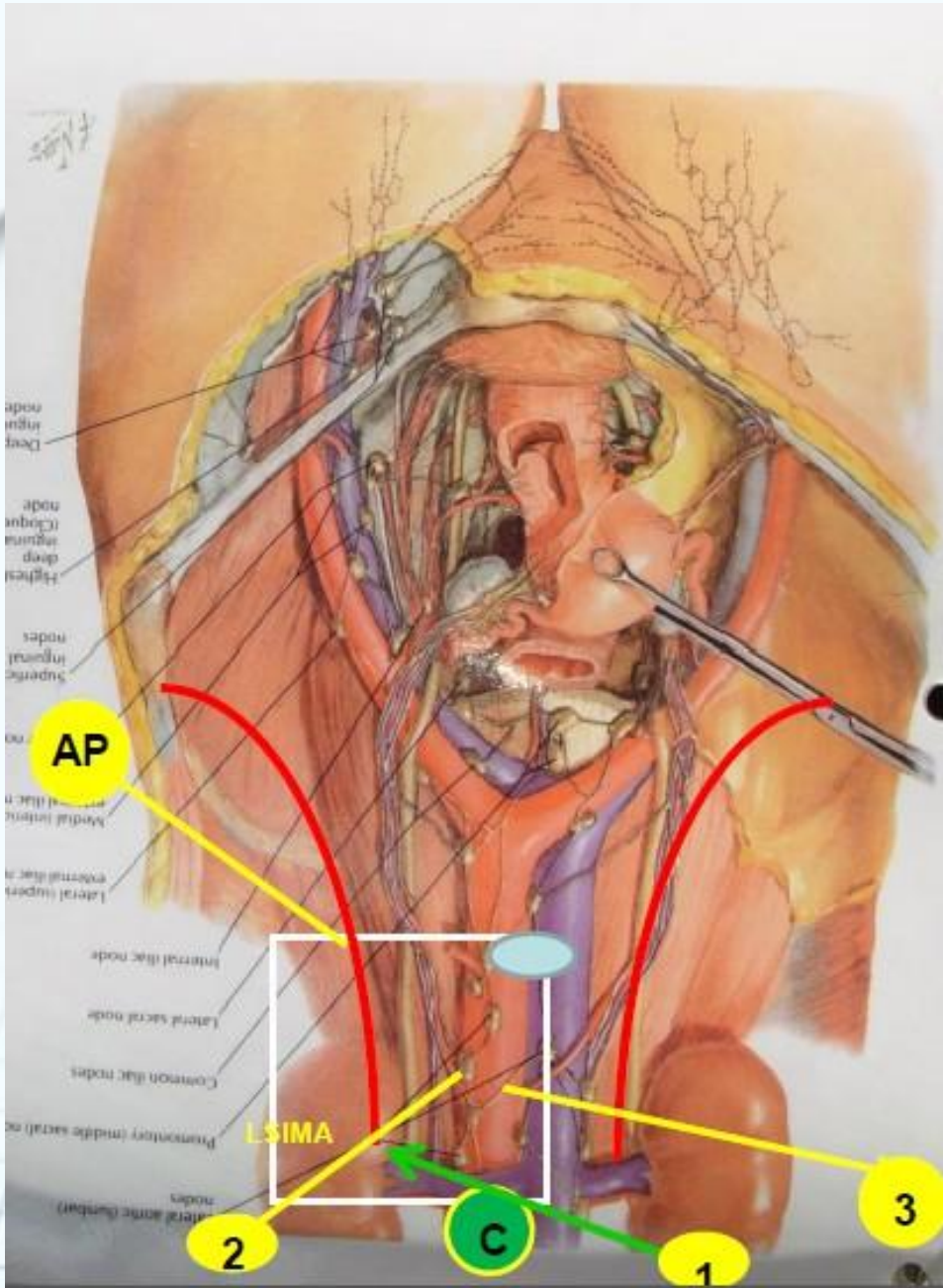
Procedures of robotic assisted paraaortic lymphadenectomy(I)











A surgeon in blue scrubs and a surgical cap is pointing at a monitor. The monitor displays a grid with a blue ECG waveform. The text "Shoulder-Docking High Para-aortic LN dissection" is overlaid in red on the grid.

Shoulder-Docking High Para-aortic LN dissection

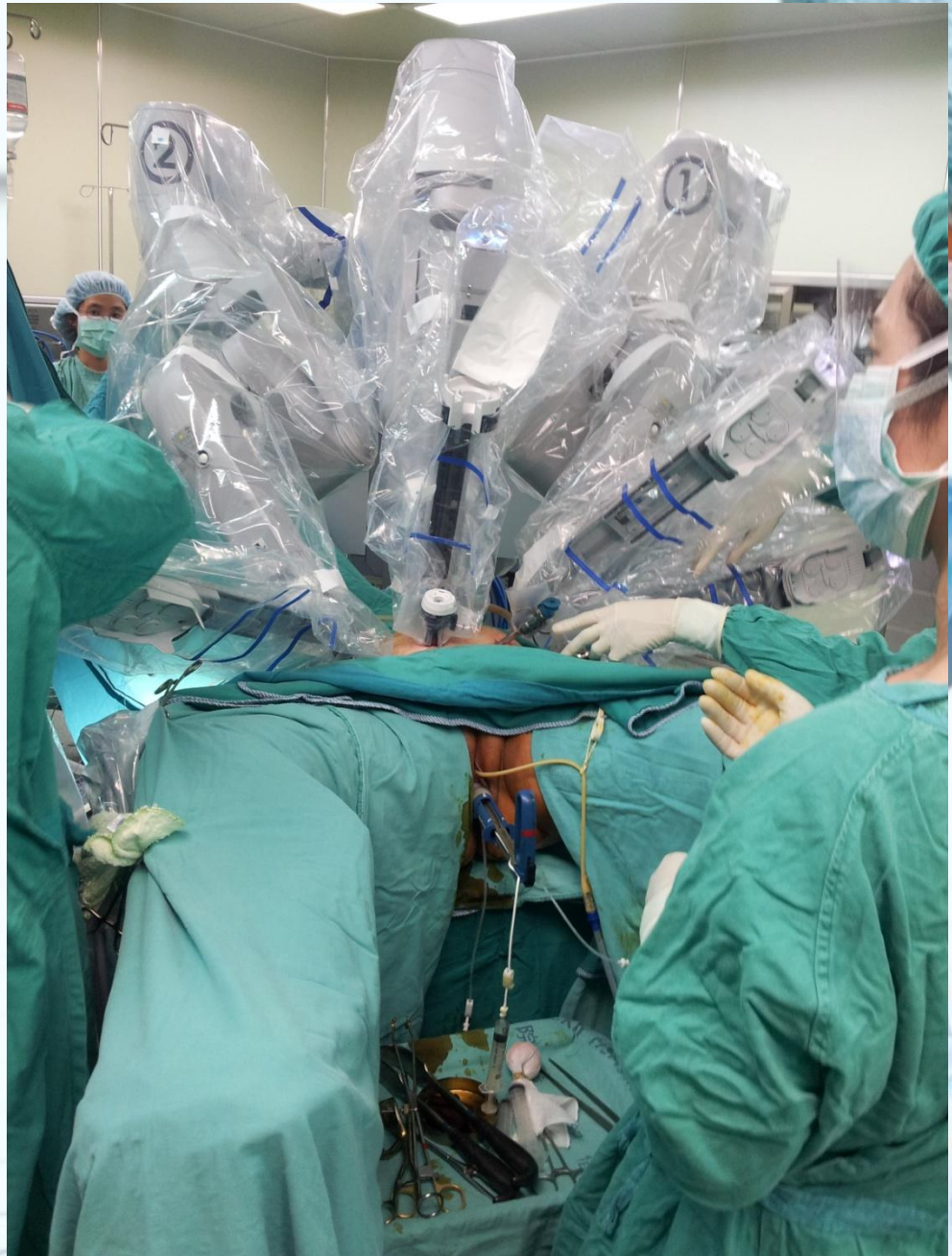
Pre-Docking status



Trocar sites



Docking
completed
-vaginal
view




Docking completed-overall view



Docking completed-ground view





After para-aortic LN
dissection, changed to
left side docking for
pelvic surgery





Robotic Radical Hysterectomy

Steps to Robotic Radical Hysterectomy...

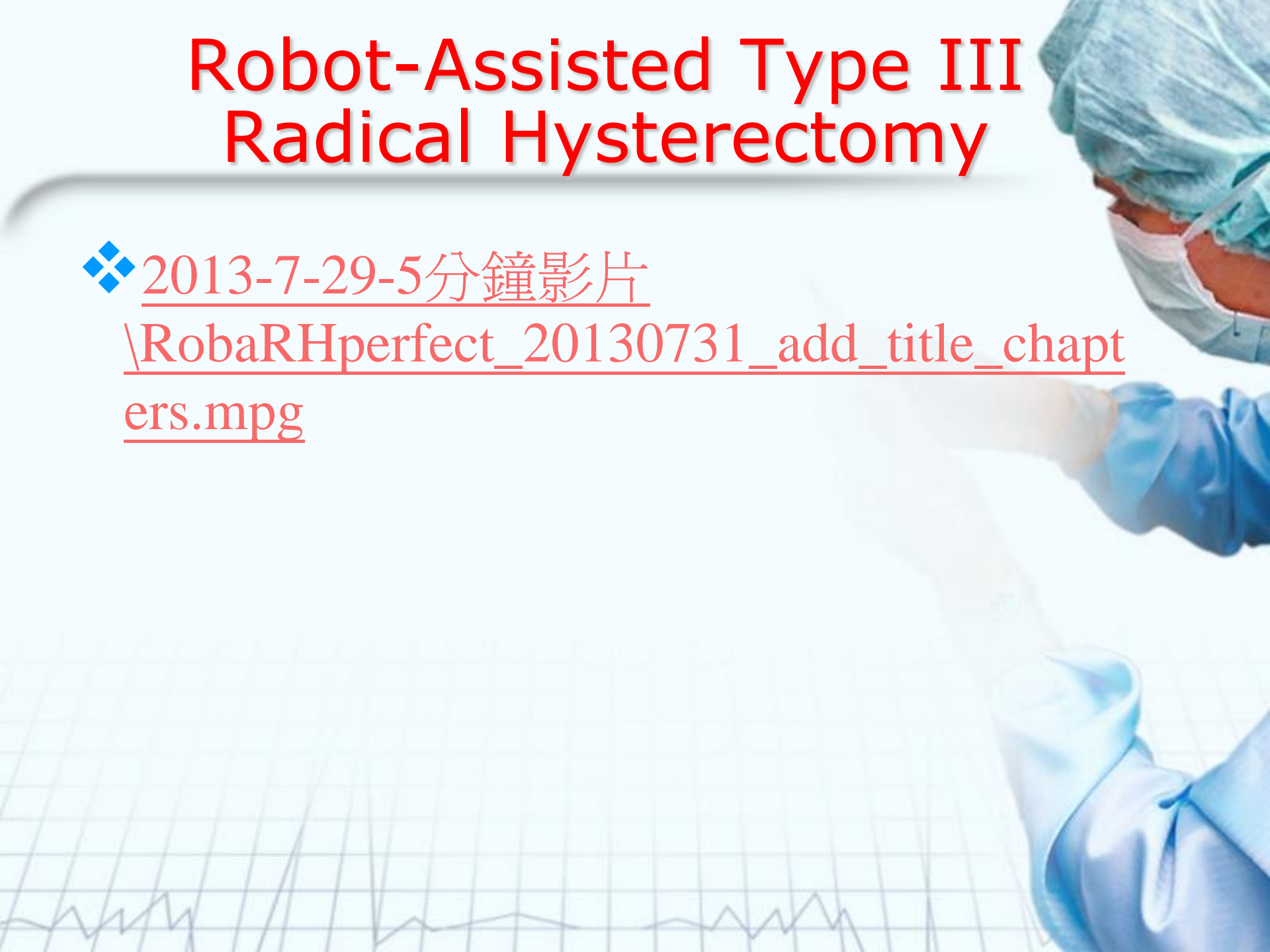
- ❖ Port placement
- ❖ Development of PV/PR spaces
- ❖ Pelvic lymph node dissection
- ❖ Skeletonization of uterine vessels & parametria
- ❖ Development of uterosacral ligament and RV septum
- ❖ Development of bladder flap
- ❖ Unroofing the ureter
- ❖ Dissection of the uterovesical ligament
- ❖ Colpotomy
- ❖ Cuff closure



Robot-Assisted Type III Radical Hysterectomy

❖ 2013-7-29-5分鐘影片

\RobaRHperfect_20130731_add_title_chapters.mpg





Contents lists available at [ScienceDirect](#)

Gynecologic Oncology

journal homepage: www.elsevier.com/locate/ygyno



Survival outcomes for women undergoing type III robotic radical hysterectomy for cervical cancer: A 3-year experience[☆]

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^b UNC Computer And Robotic Enhanced Surgery Center (CARES), USA

Retrospective study, comparing Robotic RH with Open RH, assessment of 3-year survival



Objectives. To assess progression-free (PFS) and overall survival (OS) for women with cervical cancer who underwent type III robotic radical hysterectomy (RRH).

Methods. A retrospective analysis of women who underwent RRH from 2005 to 2008 was performed. The data analyzed included patient demographics, histology, clinical stage, surgical margins, lymph node and disease status. Comparison was made to a group of historical open radical hysterectomies. Survival statistics were analyzed using the Kaplan–Meier method.

Results. Seventy-one women underwent attempted RRH during the study period. Eight were excluded from analysis, 4 for non-cervical primary and 4 cases aborted due to extent of disease. Squamous was the most common histology (62%) followed by adenocarcinoma (32%). Median patient age was 43 years. There was one intraoperative complication (asystole after induction) and two postoperative complications (ICU admission to rule out myocardial infarction and reoperation for cuff dehiscence). Of the patients who underwent RRH, 32% received whole-pelvis radiation with chemo sensitization. The median follow-up was 12.2 months (range 0.2–36.3 months). Kaplan–Meier survival analysis demonstrated 94% PFS and OS at 36 months due to the recurrence and death of one patient. Compared with a historical cohort at our institution, there was no statistically significant difference in PFS ($P = 0.27$) or OS ($P = 0.47$).

Conclusions. RRH is safe and feasible and has been shown to be associated with improved operative measures. This study shows that at 3 years, RRH appears to have PFS and OS equivalent to that of traditional laparotomy. Longer follow-up is needed, but early data are supportive of at least equivalent oncologic outcomes compared with other surgical modalities.





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Review

Robot-assisted versus total laparoscopic radical hysterectomy in early cervical cancer, a review

C.B.M. Kruijdenberg^a, L.C.G. van den Einden^a, J.C.M. Hendriks^b, P.L.M. Zusterzeel^a, R.L.M. Bekkers^{a,*}

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^b Department of Epidemiology, Radboud University Nijmegen Medical Center, Nijmegen, The Netherlands

Objective. The aim of this study was to review current literature on total laparoscopic (TLRH) and robot-assisted radical hysterectomy (RRH) with pelvic lymphadenectomy in the treatment of early stage cervical cancer by analyzing data published in individual case series in order to compare surgical and oncological outcomes.

Methods. Up to January 2010, 27 studies were identified that met the inclusion criteria, together with our own unpublished data of patients, accounted for 342 RRH patients and 914 TLRH patients.

Retrospective study, early cervical cancer, surgical and oncological outcomes

Robotic-assisted RH (RRH, 342) versus Total laparoscopic RH (TLRH, 914)



Intra- and post-operative outcome of robot radical hysterectomy (RRH) and total laparoscopic radical hysterectomy (TLRH).

	n	RRH		n	TLRH		p-Value
		Mean/Median ^a [95%CI]/ n (%)			Mean/Median ^a [95%CI]/ n (%)		
Operative time (minutes)	322	231	[188–273]	830	202	[184–221]	0.22
Blood loss (cc) ^b	251	154	^a [75–314]	792	156	^a [109–223]	0.97
Lymph nodes retrieved (number)	342	24	[19–28]	830	21	[18–23]	0.28
Hospital stay (days) ^c	189	3.3	^a [1.8–5.8]	757	6.2	^a [4.9–7.9]	0.04
Blood transfusion	329	17	(5.4%)	745	72	(9.7%)	0.02
Conversion	342	1	(0.3%)	914	15	(1.6%)	0.08
Positive lymph node	192	13	(6.7%)	776	98	(12.6%)	0.02
Positive surgical margins	264	18	(6.8%)	635	19	(3.0%)	0.02
Adjuvant therapy	201	43	(21.4%)	668	138	(20.7%)	0.84
Recurrence rate	249	13	(5.2%)	497	45	(5.6%)	0.88
IO complications	291	17	(5.8%)	837	50	(6.0%)	1.00
PO complications	342	137	(40.1%)	914	196	(21.4%)	<0.01

Estimated mean operative time, blood loss and number of lymph nodes retrieved, conversion rate, recurrence rate, IO complication did not statistically differ between the RRH and TLRH method.

Less blood transfusions were needed in patients treated by RRH (5.4%) versus TLRH (9.7%) (p<0.05)

Both methods were similar in respect to adjuvant chemo- or (chemo) radiation and recurrence rate.

Major post-operative complications were more frequent in RRH patients (9.6%) than in TLRH patients (5.5%, p<0.05).

More positive LNs in TLRH
More positive surgical margins in RRH (6.8% vs 3.0%, p=0.02)



Major intra- and post-operative complications of robot radical hysterectomy (RRH) and total laparoscopic radical hysterectomy (TLRH).

	RRH	TLRH	p-Value
	n (%)	n (%)	
Intra-operative complications			
Vascular injury	0	13	
Ureteral injury	1	6	
Bladder injury	5	26	
Bowel injury	1	3	
Nerve injury	10	2	
Total	17 (5.8%)	50 (6.0%)	1.00
Post-operative complications			
Vaginal dehiscence	11	3	
Vaginal cuff of pelvic abscess	10	6	
Port site hernia	5	1	
PE/DVT	2	9	
Ileus/bowel obstruction	2	9	
Ureter stenosis	1	5	
Fistula (ureteral/vesicovaginal/colovaginal)	2	17	
Total	33 (9.6%)	50 (5.5%)	<0.01
Reoperation after complication	5 (3.0%)	21 (5.6%)	0.20

Conclusion

RRH (342) and TLRH (914) appears to be equally adequate and feasible. RRH studies had small patient populations and further experience beyond the learning curve phase may improve operative time and complication rate. Both minimal invasive techniques should be investigated in a randomized manner.

Comparing robotic surgery with conventional laparoscopy and laparotomy for cervical cancer management

Chen et al. *Int J Gynecol Cancer* 2014 Jul;24(6):1105-11.

- ❖ Retrospective study
- ❖ IA and IIB Cx Ca patients (n=100; 44 received laparotomy surgery, 32 received laparoscopic surgery, and 24 patients received robotic surgery)
- ❖ Results:
 - 1) Robotic group has shorter operation time, less blood loss, lower transfusion rate, and lower laparotomy conversion rate.
 - 2) As for the postoperative parameters, the robotic group showed reduced postoperative and 24-hour pain scores, shortened length of hospital stay, and decreased time to full diet resumption.
 - 3) No significant differences were found between the groups in perioperative complication rate or disease-free survival.
- ❖ Conclusion: **Robotic surgery is a feasible and potentially optimal option for the treatment of stage IA to IIB cervical cancer with favorable short-term surgical outcomes than laparoscopic or laparotomy group.**

Oncological outcome and long-term complications in robot-assisted radical surgery for early stage cervical cancer: an observational cohort study

Hoogendam et al. *BJOG*. Epub 2014 Apr 16.

- ❖ 100 Cx cancer patients (stages IA1-IIA) on a 3/4-armed robotic system between 2008 and 2013
- ❖ Two gynaecological oncologists performed robot-assisted radical surgery (radical hysterectomy, radical vaginal trachelectomy or parametrectomy) with pelvic lymph node dissection
- ❖ Median follow-up of 29.5 months (range 2.5-67.1 months)

Results:

- ❖ 1) loco-regional (n=8), distant (n=4) or combined (n=1) recurrence at a median of 14.4 months (range 2.9-34.8 months)
- ❖ 2) Overall 5-year progression-free (81.4%) and disease-specific survival rates (88.7%)
- ❖ 3) Complications: lymphoedema (26%), lower urinary tract symptoms (19%), urinary tract infection (17%) and sexual disorders (9%).

Conclusion: The recurrence, survival and long-term complication rates of robot-assisted radical surgery for early stage cervical cancer in this cohort are reassuring concerning its continued clinical use.

Neoadjuvant chemotherapy followed by robotic radical hysterectomy in locally advanced cervical cancer: a multi-institution study

Vizza_et al. *Gynecol Oncol.* 2014 May;133(2):180-5.

- ❖ Retrospective Study (Feb 2008-Apr 2013)
- ❖ After **neo-adjuvant chemotherapy (NACT)**, women with locally advanced Cx CA (FIGO IB2-IIB) undergoing total robotic radical hysterectomy (TRRH) with pelvic lymphadenectomy within 4 weeks from the last chemotherapy cycle.

Results:

- ❖ 1) Median operative time (225 min); median blood loss (150 mL); median no. of removed pelvic lymph nodes (23).
- ❖ 2) Adjuvant therapy administered in 36 patients (60%).
- ❖ 3) 16 pts had optimal response (12 PCR, 4 pPR1) to chemotherapy; 33 pts had pPR2; 11 pts showed stable disease.
- ❖ 4) 1 intra-operative complication; 19 post-operative complications; but no conversions to laparotomy were necessary to manage complications.
- ❖ 5) 6 pts received blood transfusion.
- ❖ 6) At median follow-up of 28.9 months, 50 pts (83%) are free from recurrence.

Conclusion: **This experience demonstrates the feasibility of TRRH pelvic lymphadenectomy after NACT in in locally advanced cervical cancer with good accuracy and safety.**

A Phase III Randomized Clinical Trial of Laparoscopic or Robotic Radical Hysterectomy Versus Abdominal Radical Hysterectomy in Patients With Early Stage Cervical Cancer

Sponsor:	Queensland Centre for Gynaecological Cancer
Collaborator:	M.D. Anderson Cancer Center
Information provided by:	Queensland Centre for Gynaecological Cancer
ClinicalTrials.gov Identifier:	NCT00614211

Estimated Enrollment:	740
Study Start Date:	January 2008
Estimated Study Completion Date:	July 2017
Estimated Primary Completion Date:	July 2017 (Final data collection date for primary outcome measure)

Robotic radical trachelectomy

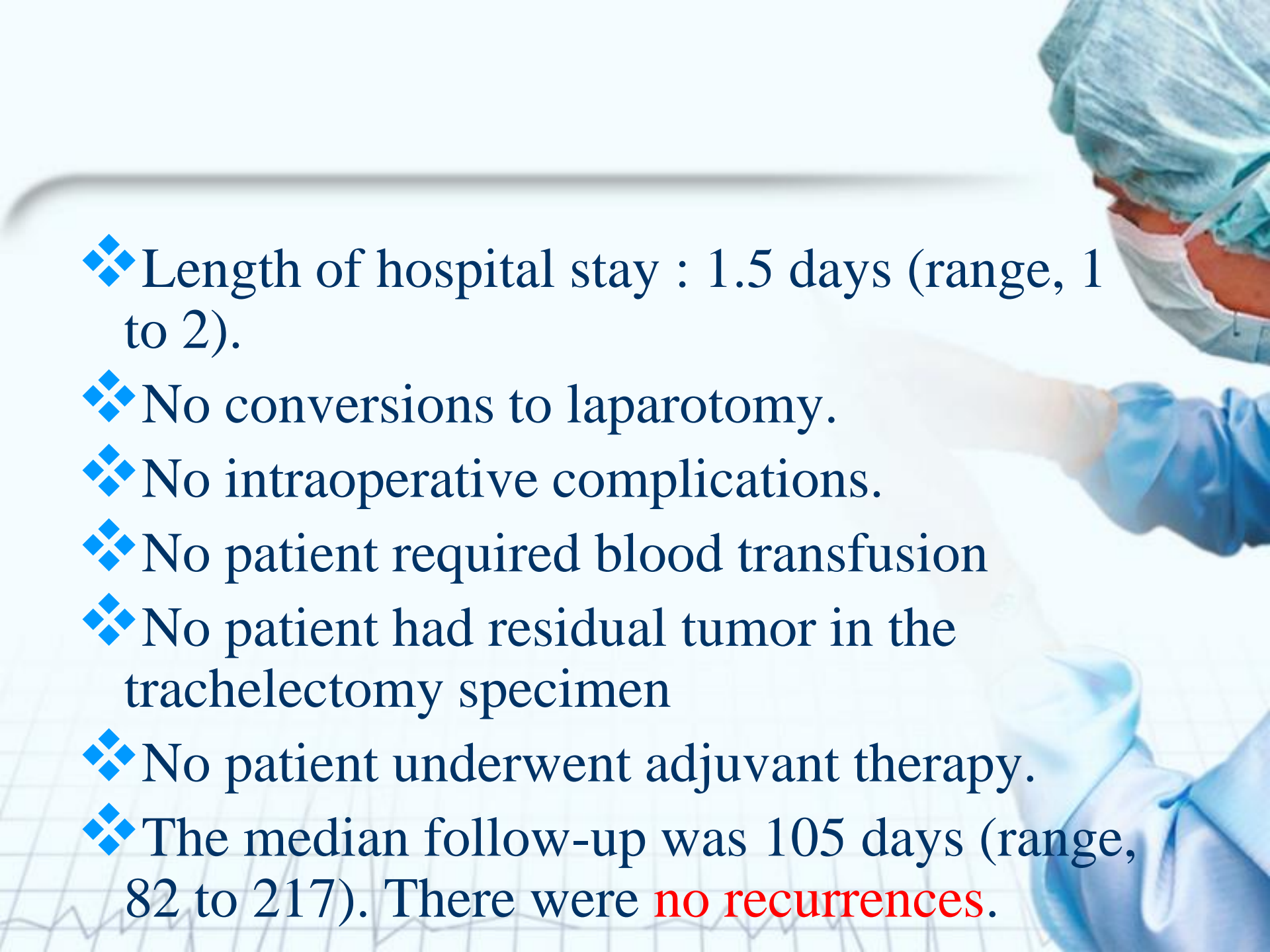
A surgeon wearing blue scrubs and a surgical cap is pointing at a medical monitor. The monitor displays a grid with a red ECG waveform. The text 'Robotic radical trachelectomy' is overlaid in red on the monitor's display area.

Radical trachelectomy for early stage cervical cancer

- ❖ In recent years, there is a tendency of **increasing incidence** of invasive cervical cancer in the young age group worldwide.
- ❖ The standard treatment of early -stage (IA2- IIA) cervical cancer is either RT or a RH-PLND. Both could offer very high probability of cure, but lead to **inevitable loss of fertility potential.**

Safety and feasibility of robotic radical trachelectomy

- ❖ 8 cases: 4 early-stage SCC, 3 stage IA2 adenocarcinoma, 1 stage IA1 adenocarcinoma with lymph-vascular space invasion.
- ❖ Operative time : 339.5 min (245 ~ 416).
- ❖ Console time : 282.5 min (217 ~ 338).
- ❖ Blood loss : 62.5 ml (50 ~ 75).
- ❖ Number of pelvic lymph nodes removed : 20 (18 ~ 27).
- ❖ The median time to a successful voiding trial : 8 days (7 ~ 9).

- 
- ❖ Length of hospital stay : 1.5 days (range, 1 to 2).
 - ❖ No conversions to laparotomy.
 - ❖ No intraoperative complications.
 - ❖ No patient required blood transfusion
 - ❖ No patient had residual tumor in the trachelectomy specimen
 - ❖ No patient underwent adjuvant therapy.
 - ❖ The median follow-up was 105 days (range, 82 to 217). There were **no recurrences**.

Uterine artery sparing robotic radical trachelectomy (AS-RRT)

- ❖ Case report & surgical technique review
- ❖ AS-RRT is feasible and could be performed by any gynecologic oncologist who is skilled in radical pelvic surgery and the robotic system.
- ❖ The long-term obstetric and oncologic outcome of this technique are not clear now.

Radical trachelectomy Open(ORT) vs. robotic(RRT)

- ❖ 32 patients
 - ❖ 20 with 1B1
 - ❖ 11 with 1A2
 - ❖ 5 with 1A1 with LVSI/poorly differentiated histology
- ❖ 5 (1 open/4 robotic) underwent conversion to radical hysterectomy secondary to close (<5mm) endocervical margin (p=0.08).

Result

- ❖ 25 patients (68%) underwent ORT and 12 (32%) underwent RRT.
- ❖ RRT was associated with
 - ❖ less blood loss (62.5 mL vs. 300 mL, $p=0.0001$)
 - ❖ decreased length of postoperative stay (1 vs. 4 days, $p<0.001$),
- ❖ **No difference in operative time or histopathologic outcomes.**
- ❖ Common long-term morbidities were
 - ❖ irregular menstrual bleeding or amenorrhea (25%)
 - ❖ cerclage erosion (13%)
 - ❖ cervical stenosis (9%).
- ❖ The median time of follow up is 17.0 months (range 0.30-64.9 months). There are no documented recurrences

Robot-Assisted Type III Radical Trachelectomy

- ❖ [Radical trachelectomy video\Data 2014-02-04~\Total_procedure_Radical_Trachelectomy_2013-12-31_KLWang.mpg](#)





Conclusion

- The learning curve of robotic surgery for treatment of cervical cancer appears to be easier when compared to laparoscopic surgery .
- The number of lymph nodes retrieved for robotic procedure is acceptable.
- The surgical outcomes of robotic surgery for treatment of cervical cancer appears to be favorable for blood loss, DOH, intraoperative complications.





Thanks for Your Attention

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