# Establishment of Robotic Esophagectomy Program in New Hospital

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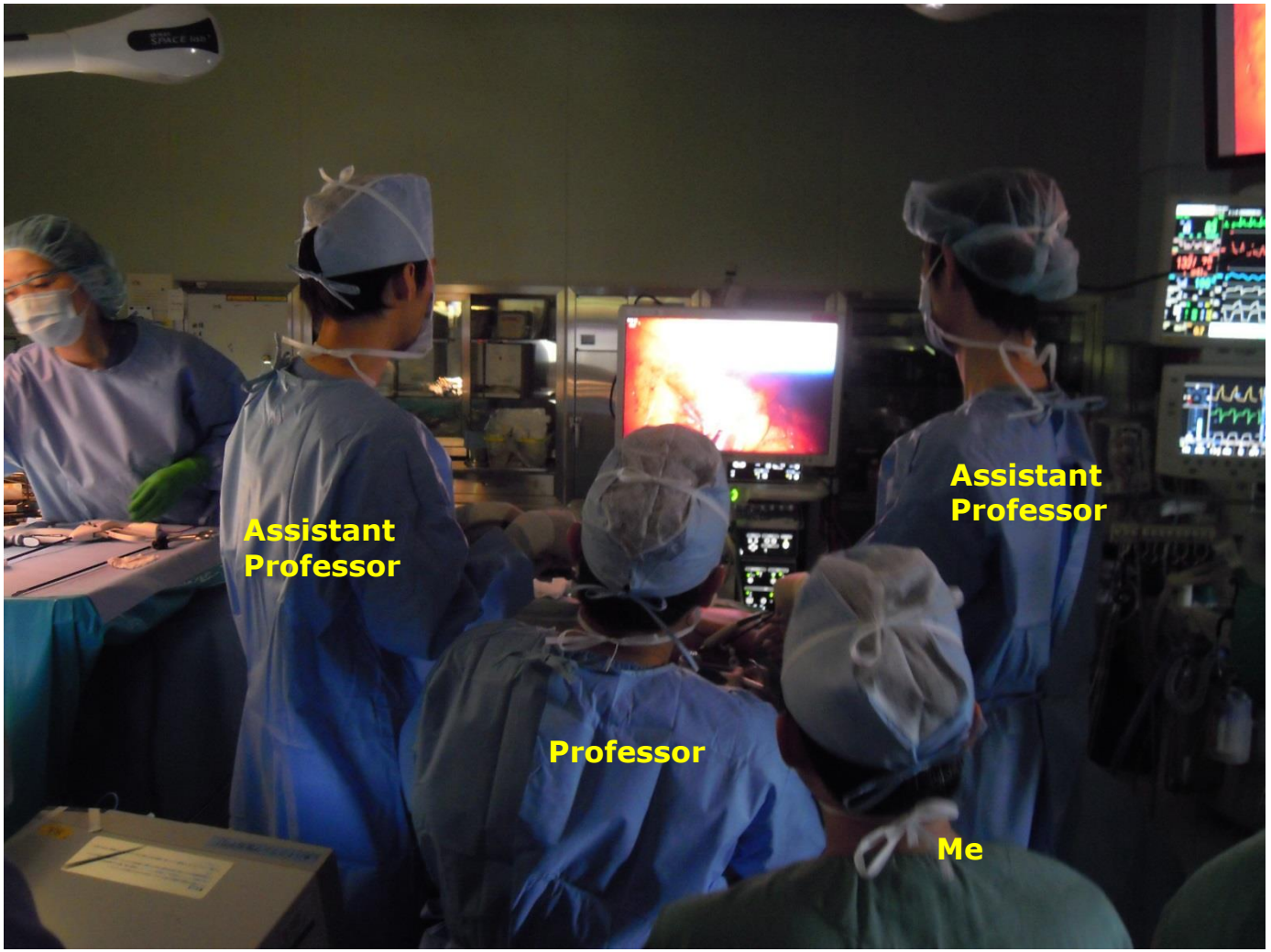
# Minimally Invasive Esophagectomy

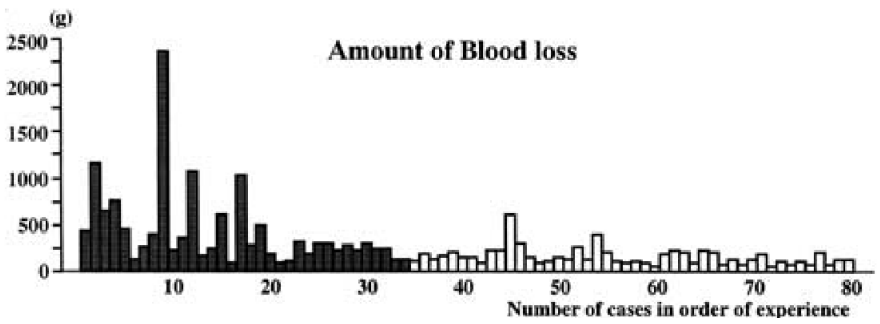
- Esophagectomy
  - One of the invasive procedures in thoracic surgery
  - Open esophagectomy vs. MIE (VATS esophagectomy, Robotic esopagectomy)

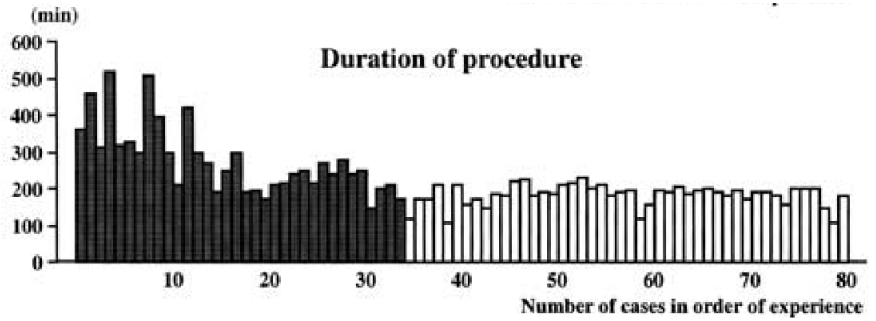
- Minimally Invasive Esophagectomy (MIE)
  - Less surgical trauma for patients
  - Low morbidities and mortalities rate
  - Difficult to learn

# VATS esophagectomy



# Learning Curves of VATS esophagectomy




*Surg Endosc (2003) 17: 515–519*

- Osugi suggested minimum 34 cases for achieving the safe VATS esophagectomy

- VATS esophagectomy needs sufficient cases of operation to achieve the learning curve
- Education and instruction from experienced surgeon is essential
- Also educated surgical assistants are needed

# Why Robotic Esophagectomy?

- Most advanced technology

- No needs for experienced assistants
- No needs for longer learning periods
- It can offer the most meticulous dissection for lymphadenectomy
  (VATS vs. Robot)

# Setting the New Operations

- Capacity of surgeon
  - Experienced 20 cases of open esophagectomy as an operator
  - Observation of more than 50 cases of RATE as bed-side surgeon
  - Moved to new hospital at 2014.3

- No previous experiences on Robotic thoracic surgery in new hospital
  - Capacity of anesthesiologist
  - Capacity of assistant (SA)
  - Capacity of scrub nurse

# Education

- Conference with Anesthesiologists
  - Bronchial blocker, Volume management, Ventilator management
- Education to SA (surgical assistant)
  - Few experiences of VATS operation
  - Teaching the concepts of VATS, especially VATS lobectomy
  - Review of unedited surgical video, focused on role of bed-side surgeon
- Education to scrub nurses
  - Devices, Position

# Current Protocol

- Robot assisted esophagectomy and total lymphadenectomy
  (3 ports and 1 accessory port in semiprone position)
- Gastric mobilization under laparotomy or HALS (by thoracic surgeon)
- Cervical esophagogastrostomy with EEA 25mm (substernal or posterior mediastinal route)
- Feeding jejunostomy

- Neck dissection in case of upper esophageal cancer or metastasis to upper mediastinum (by ENT)

# Intubation & Port placement

# Outcomes of my series (2014.5~)

| No | Gender /Age | Operation time | Robot console time | Blood loss | pStage | Number of dissected LNs | Number of dissected RLN LNs | Complications |
|---|---|---|---|---|---|---|---|---|
| 1 | M/48 | 302 | 148 | 350 | IA | 70 | 34 | RLN palsy |
| 2 | M/59 | 250 | 69 | 20 | IIIC | 44 | 2 | |
| 3 | F/55 | 300 | 185 | 420 | IA | 42 | 8 | RLN palsy<br>anastomotic leakage |
| 4 | M/72 | 425 | 210 | 450 | IIIA | 32 | 14 | |
| 5 | F/60 | 300 | 155 | 300 | IIIB | 44 | 14 | RLN palsy |
| 6 | M/46 | 330 | 160 | 300 | IIIC | 93 | 7 | RLN palsy |
| 7 | M/59 | 385 | 160 | 250 | IIB | 75 | 9 | |
| 8 | M/48 | 360 | 165 | 250 | IA | 36 | 7 | |
| 9 | M/69 | 490 | 175 | 200 | IIB | 50 | 9 | RLN palsy |
| 10 | M/64 | 370 | 225 | 400 | IIIC | 40 | 7 | RLN palsy |
| 11 | M/71 | 300 | 255 | 300 | IIIC | 52 | 14 | RLN palsy |
| 12 | M/74 | 435 | 225 | 450 | IA | 39 | 6 | Pneumonia |
| 13 | M/81 | 275 | 115 | 100 | IA | 50 | 6 | RLN palsy, hernia |
| 14 | M/49 | 312 | 180 | 550 | IIIC | 50 | 13 | RLN palsy |
| Mean | 61 | 345.28 | 171.57 | 322.85 | | 51.21 | 10.71 | RLN palsy; 64.3% |

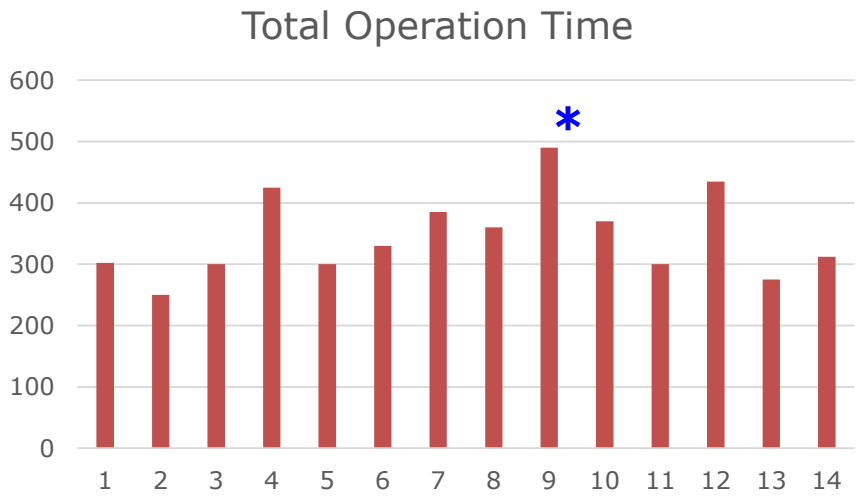
# Complication Profile

- Mortality; 0
- RLN palsy; 9/14 (64.3%)
  - All left vocal cord palsy, recovered during follow-up periods
- Anastomotic leakage; 1/14 (7.1%)
- Hernia; 1/14 (7.1%)
  - Reoperation for reduction of colon at POD 4
- Pneumonia; 1/14 (7.1%)
  - In patient with pneumoconiosis, poor lung function
- Anastomotic stricture requiring balloon dilation; 2/14 (14.2%)

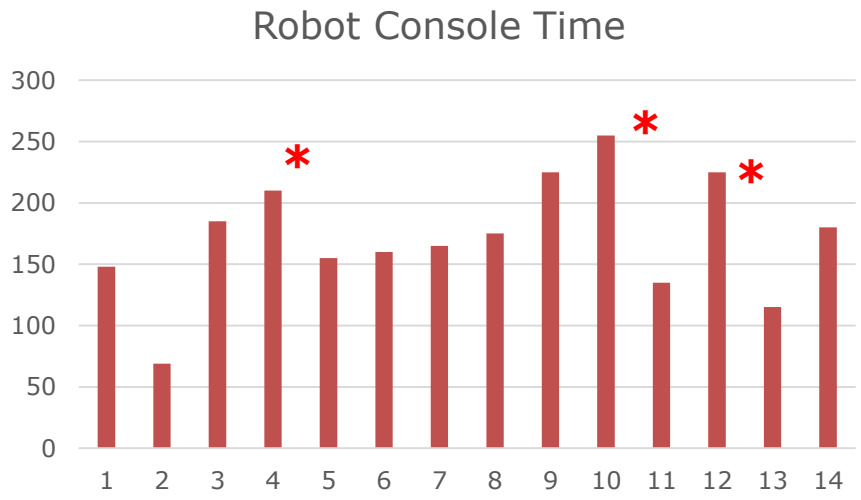
# Comparison with Other Series

| | van Hillegersberg | Kernstine | Boone | Puntambekar | Weksler | Suda | De La Fuente | Cerfolio | Sarkaria | Kim (Park) | Current |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Publication year** | 2006 | 2007 | 2009 | 2011 | 2012 | 2012 | 2013 | 2013 | 2014 | 2015 | 2015 |
| **No. of patients** | 21 | 14 (12) [b] | 47 | 32 | 11 | 16 | 50 | 22 | 21 | 114 | 14 |
| **Operation time (min)** | 450† | 666 [d] | 450† | 210† | 439 | 692.5† | 445 | 367† [e] | 556† | 419.6 | **345.3** |
| **Robot console time** | 180† | 300 [d] | 180† | 100† | NR | 335.5† | NR | NR | NR | 206.6 | **171.6** |
| **EBL (mL)** | 950† | 275 [d] | 625† | 80† [f] | 200 | 144.5† | 146 | 60 [e] | NR | 208.7 | **322.8** |
| **Conversion (%)** | 3 (14.3) | 1 (7.1) | 7 (14.9) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 10 (48) [g] | 1 (0.8) | 0 |
| **R0 resection (%)** | 16 (76.2) | 12 (100) | 36 (76.6) | NR | 11 (100) | 14 (87.5) | 50 (100) | 22 (100) | 17 (81.0) | 111 (97.4) | 14 (100%) |
| **No. of dissected Lymph nodes** | | | | | | | | | | | |
| **total** | 20† | 18 | 29† | 36† | 19† | 37.5 | 20 | 18† | 20† | 43.5 | **51.2** |
| **RLN chains** | NR | NR | NR | NR | NR | 5.5 | NR | NR | NR | 9.7 | **10.7** |
| **Pneumonia (%)** | 10 (47.6) | 3 (21.4) | 21 (44.7) | 2 (6.2) | 1 (9.1) | 1 (6.3) | 5 (10.0) | NR | 3 (14.3) | 11 (9.6) | **1 (7.1%)** |
| **Anastomotic leak** | 3 (14.3) | 2 (14.3) | 10 (21.3) | 3 (9.3) | 1 (9.1) | 6 (37.5) | 1 (2.0) | 1 (4.5) | 6 (28.6) | 17 (14.9) | **1 (7.1%)** |
| **Vocal cord palsy (%)** | 3 (14.3) | 2 (14.3) | 9 (19.1) | 2 (6.2) | 1 (9.1) | 6 (37.5) | 0 (0.0) | NR | 1 (4.8) | 30 (26.3) | **9 (64.3%)** |
| **Mortality (%)** | 1 (4.8) | 1 (7.1) | 3 (6.4) | NR | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 1 (4.8) | 3 (2.6) | 0 |

# Robot Console & Total Operation Time




* Neck dissection




* Pleural adhesion

# Evaluation of RLN palsy

- Preoperative vocal cord examination
- Preoperative VDL test (음성검사)

- Postoperative vocal cord examination
- Postoperative VDL test (음성검사)

- Routine vocal cord injection by ENT
- No pulmonary complications or aspiration signs among 9 patients with left vocal cord palsy

# Learning Curves of Robot Esophagectomy

- The learning curve of robot esophagectomy seem s to be more flat and short than VATS esophagect omy

- Parameters
  - Operation time
  - Bleeding (amount of blood)
  - Number of dissected lymph nodes
  - Incidence of vocal cord palsy

# Future Direction

- Robotic abdominal phase
- Robotic intrathoracic anastomosis; Complete robotic esophagectomy
- Clinical research on learning curves of Robotic esophagectomy
- RLN palsy rate below 30%

# Conclusion

- Establishment of robot esophagectomy needs not only capacities of surgeon, but also support of oth er medical personnels
- Endurance is most needed virtue for establishing t he new operation; hospital and other medical pers onnels are not supportive as you expect
- Robot esophagectomy can be performed safely, if surgeon prepared many things before operation