Electromagnetic Navigation Bronchoscopy and TTNL- a Thoracic Surgeons Perspective

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Scientific Advisor/Royalties

- Johnson and Johnson (Ethicon)
- Verb Surgical/Verily
- CSA Medical
- Boston Scientific
- Merit Medical
- Veran Medical
- Medtronic
- Astra Zenica
Medtronic-Super Dimension System: iLOGIC
Veran Medical System-SPiN
ENB Technology

- Electromagnetic navigation bronchoscopy (ENB) is an technique that allows accurate navigation to peripheral pulmonary lesions, using technology similar to GPS

- Pre procedure CT scan. 1.25mm cuts, inspiration and expiration

- Planning Phase. CT loaded into proprietary software. Navigational developed. 3-5 mins

- Procedure. EM field created around the patient. Patient anatomy is synchronized to CT, creating a virtual operating environment. Location of instruments is tracked.
Veran ENB Technology

Respiratory Gating
- vPad™ technology can track nodules as they move during the respiratory cycle

Tip Tracked Instruments
- Instruments themselves have electromagnetic sensors that track throughout the procedure and during biopsy.

SPiN Perc™
Transition from ENB to navigated TTNA in one procedure
Outline

- Why be involved as a Thoracic Surgeon in ENB
- Why the need for ENB in my practice
- How ENB fits into a thoracic surgical practice
- The Add Value of an ENB Program
- Setting up a ENB program- Tips for Success
- Case Examples
- Novel uses of ENB and SPiN
- Future
Why be involved as a Thoracic Surgeon (TS) in ENB

- TS have a comprehensive understanding of lung cancer
- TS have a unique perspective on thoracic anatomy and perhaps best qualified to triage optimum method of biopsy
- TS are competitive and generally more open to new technology
- TS have learnt from Cardiac Surgeons about loosening control of patients and loss of decision making
Why I felt the need for ENB

- With increasing lung cancer screening and coronary CT scans being performed, there is a growing number of indeterminate pulmonary nodules: NLCST 28%, 72% needed further investigation

- We do have excellent and aggressive interventional radiology (IR) in our program- significant pneumothorax rate 15%

- When IR not feasible- watchful waiting- FUP CT in 3/6 months
  - Anxiety
  - Increased cumulative radiation
Why I felt the need for ENB

- Most nodules can be biopsied by capable and aggressive IR; however, gaps remain for:
  - Central nodules, especially smaller nodules
  - Patients with significant emphysema
  - Efficient localization of small nodules in the OR

ENB is a tool that allows diagnosis and/or localization and immediate resection at one setting—once stop shop
ENB in my Practice

- I use it about 40% for diagnosis and 60% for intraoperative localization for resection - mostly with percutaneous coil placement

- Economic model makes sense

- Compliments Lung Cancer Screening Program
## Current Strategies for Localization of Non-Palpable Lung Nodules

<table>
<thead>
<tr>
<th>Technique</th>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Palpation</td>
<td>No additional equipment or cost</td>
<td>50%-70% Failure rate</td>
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<tr>
<td>Microcoils</td>
<td>Up to 100% success, good randomized evidence</td>
<td>13% Pneumothorax</td>
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<td>Equivalent cost to palpation</td>
<td>2.7% microcoil displacement</td>
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<tr>
<td>Hook wire</td>
<td>94% success (RCT)</td>
<td>24% pneumothorax</td>
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<tr>
<td></td>
<td></td>
<td>2%-10% hook wire dislodgement</td>
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<tr>
<td>Radiolabeled aggregates</td>
<td>96% success</td>
<td>4-29% pneumothorax</td>
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<tr>
<td></td>
<td></td>
<td>Nuclear medicine coordination</td>
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<tr>
<td>Liquid (Methylene blue, ICG,</td>
<td>Low cost</td>
<td>13% failure rate</td>
</tr>
<tr>
<td>Lipodiol, etc…)</td>
<td></td>
<td>Dye diffusion</td>
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<td></td>
<td></td>
<td>No information on depth</td>
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<tr>
<td>Intraoperative Ultrasound</td>
<td>93% success</td>
<td>Lung deflation</td>
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<td>Operator dependent</td>
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CT-Guided Microcoil Insertion

- CT guided microcoil placement vs finger palpation
  - Yield: 93% (27/29) Vs 48% (13/27)
  - Operative time: 37min Vs 100min

R.J. Finley, J.R. Mayo, K. Grant, et al.
CT-Guided Microcoil Insertion

- Patient anxiety
- Extra procedure
- Scheduling conflicts and OR delays
Potential Advantages of ENB Localization

- “One-stop shop” approach and streamline care
- Decrease the waiting time prior to surgery
- Does not require planning and coordination with the interventional radiology suite
- Use it if you need it
- Can reduce the need for fluoroscopy
- Precision, lung sparing targeted surgery
How ENB fits into a thoracic surgical practice

- RVU or reimbursement per case is low

- Can be time consuming if work flow not well organized (case 30 minutes, but OR turn overtime much more)

- However, allows the thoracic surgeon to provide “soup to nuts” care

- Increases referrals and pulmonologists especially refer

- Allows the thoracic surgeon to be involved at beginning of care-gatekeeper

- Allows diagnosis and treatment in one setting
Setting up an ENB program for success - Surgeon Factors

- Interest in learning new technology
- Have some time flexibility - ideal for junior partner
- Have endoscopic interest
- Need the skill set
- Helps to have collaboration with pulmonary, esp for diagnostic cases
Setting up an ENB program for success

- Interest, skill and volume of surgeon
- Set up a seamless work flow
- Excellent communication of rep with surgeon and team
- Case selection
Setting up an ENB program for success—Case Selection

- Lesion size
- Lesion location
- Bronchus sign
Setting up an ENB program for success—Program Aspects

- Type of anesthesia
- Same day CT
- Rapid onsite cytology (ROSE)
- Learning curve
Tricks of the Trade

- Upper lobe lesions vs Lower lobe lesions
- Instruments: TBNA vs biopsy?
- Multiple passes?
- Suction or not?
- Handling of pathology: slide vs cell block
Setting up an ENB program for success

- Don’t oversell
- Help market program, both internally and externally
Examples of ENB and SPiN cases
RUL Lesion ENB
RUL lesion ENB
RUL ENB Anterior Segment Dye-VATS
LUL GGO- SPiN
LUL GGO- SPiN
RUL GGO ENB and SPiN
RUL GGO ENB and SPiN
RUL GGO ENB and SPiN
RUL GGO ENB and SPiN
SPiN Lateral Left Lower Lobe
SPiN Lateral Left Lower Lobe
SPiN Lateral Left Lower Lobe - VATS
SPIN-Left Upper Lobe
Novel uses of NB

Navigation guided resection: N-VATS™
Worlds First Case of N-VATS™
Worlds First Case of N-VATS™
Worlds First Case of N-VATS™
Worlds First Case of N-VATS™
N-VATS™ Lung Resection
Lumen Registration
N-VATS™ Lung Resection
N-VATS™ Lung Resection
N-VATS™ Lung Resection
Future for Navigation
Bronchoscopy, SPiN....
Future

- ENB guided catheter based ablation- Nuwave just got FDA approval

- “GPS guided resections”- ENT, Neurosurgery, and other fields

- Stay abreast of technology and see how best it can help us provide the best care