The Art and Science of Cytopathology
Demay, 2012 (p548-551)
History

• 1870 – seeding of thoracentesis needle tracts, considered confirmation of malignancy
• 1885 – tumor implantation during surgery
• 1913 – William Mayo – abdominal wall implants after gastric cancer resection
• 1936 – tumor cells recovered from biopsy scalpels

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History

• 1940s – “Aspiration biopsy is... dangerous because of the possibility of transplanting malignant cells into the tissue through which the needle passes.” Alton Ochsner
• Widely accepted without virtually without proof – “development of needle aspiration delayed by at least a generation.”
• James Ewing thought surgical biopsies contributed to the spread of cancer.
Ewing

• “The burden of proof that surgical excision is a less traumatizing procedure than simple needle aspiration appears to rest on those who advocate for the former method.”

• “It is only logical that aspiration by a relatively small needle should be less harmful than surgical excisional biopsy, which cuts through tumor, lymphatics, and blood vessels.”

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Crile 1956

- Bona fide case, papillary thyroid carcinoma (PTC) in skin over LN with metastatic PTC
  - Large-gauge Silverman needle
  - Pt. died of lung and bone mets

“sticking a needle into an operable cancer could be likened to plunging a percussion cap into a box of dynamite to test whether it is really dynamite or just a lot of sawdust.”
History

• 20 years later (Crile) – danger of needle tract implantation “greatly overestimated”

• “Inexplicably, this practice has not been widely adopted in the United States. As a result, thousands of small benign thyroid nodules are being removed needlessly and the patients subjected to unnecessary anxiety, discomfort, expense, and risk.”

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Tumor seeding/ Tumor cell release

- Skin grafting
- TUR
- Percutaneous ablation
- Laparoscopic
- Mediastinoscopy
- Peritoneoscopy
- Hysteroscopy
- Endoscopy
- Paracentesis
- Bone marrow biopsy
- Catheters/drains
- Brain bx/VP shunt
- Tracheostomy
- Nephrostomy
- Cystostomy
- Gastrostomy
- Thorascopy
- Vertebroplasty
- VATS
- Cryotherapy
- Trabeculectomy
- Cyst aspiration
- I&D
- Mammographic bx
- **Mammographic compression**
- Sutures
- Staples
- Clamps
- Trocars
- Gloves
- **General anesthesia (immunosuppressive)**
- **Vigorous physical examination**
- **Vigorous scrubbing before surgery**
- **Injecting local anesthetic**
Tumor seeding/ Tumor cell release

• Tumors can be detected at needle puncture site in needle tract
• Can be shed into blood but rapidly disappear from circulation
Animal experiments

• Tumors transplanted into animals
  – 126 tumors aspirated with 18-gauge needles 894 times... “literally hashed”
    • No increase in distant metastases nor any evidence of implantation along needle tract
  – 82 animals with transplanted tumors (FNA, FNA with heparin, control [no FNA])
    • Only 2 animals had mets, 1 heparin and 1 control
    • Heparin thought to be protective
  – Another study showed increased mets after incisional biopsy, and FNA to a lesser extent

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Human Experiments (cancer patients and healthy prisoners) 1957, 1967

• Tumors transplanted with 20-gauge needles

• Local inflammatory response
  – Longer and more severe in healthy prisoners
  – Implants developed in both groups
    • Cancer patients – if not immediately excised, lesions usually regressed spontaneously and completely by 4 to 6 weeks, few recurred and 1 metastasized
    • Prisoners – all un-excised lesions regressed by 4 weeks, none recurred
By the numbers

• Estimated that 1 in 100,000 to 1,000,000 tumor cells entering circulation eventually give rise to an overt metastasis

• Tumor cells likely destroyed by host immune response or other process (stroma needed)

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By the numbers

• Tumor cells adhere to biopsy needles
• Polyethylene needle sheaths investigated to reduce risk
• Epithelial cells are commonly displaced but usually don’t form new tumors
  – Estimated **1,000,000 cells needed for successful tumor autotransplantation**
  – Significantly less cells implanted with FNA
Fine needle = 22-gauge or smaller

• Only 500 reported cases of needle tract tumor implantation
  – 100 with fine needles (not all well-documented)
• Large series estimate risk of tumor seeding as 1 in 10,000
  – Getting struck by lightning lifetime risk 1 in 9,000
• Higher rates reported (up to 12.5%), small case series, large diameter needles, or therapeutic procedures

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The great majority of *needle tract seeding* happens in 18-21-gauge needles or tissue core biopsy needles (Tru-Cut etc.)
Other risk factors for seeding

- Multiple passes
- Length/depth of needle tract
- Serrated/rough needle tips
- Withdrawing needle without releasing suction
- Injecting something into lesion (EtOH, anesthetic)
- Deep-seated biopsies
- Immune status
- Tumor grade
- Time course varies – <3 weeks to 10 years

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• Many cases of seeding are in setting of already advanced disease
  – Mesothelioma – large diameter needle/thoracentesis
  – Hepatocellular carcinoma – frequent addition of therapeutic procedures
  – Pancreatic adenocarcinoma

• Needle tract can always be excised
• Radioablation also an option
Non-malignant FNAs

• Seeding rarely happens with benign neoplasms
  – Parathyroid adenoma
  – Pleomorphic adenoma
  – Breast papilloma
  – Hemangioma
  – Thymoma

• Endometriosis, parathyromatosis

• PNI by non-neoplastic epithelial cells

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Effects of FNA tumor seeding

• Needle tract tumor implantation usually has minimal clinical significance
  – No adverse effect on prognosis
  – Can be managed by excision, radiation, or ablation

• Usually occurs in the setting of advanced cancer/disseminated disease

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Summary (what to say if asked)

• FNA does not decrease life expectancy
• No decreased long-term survival
• No increased metastasis
• Better survival in patients who have had FNAs – earlier detection
• Seeding from FNA lower than tissue biopsy

• Physician needle stick injuries are riskier than needle tract implantation

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