How to address the incidental pulmonary nodule in a child

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Conflict of Interest Disclosure

Sjirk J Westra, MD

I have no financial relationships with a commercial entity producing healthcare-related products and/or services.
18 y/o F scanned for chest wall deformity
No pulmonary symptoms and negative history
Donnelly Radiology 1997: low yield study
Overlapping 1.25 mm slices
<-160 HU: ground glass nodule
How to manage incidental 3 mm ground glass nodule?

• Ignore
• “Hide” in body of report body
• Mention in impression, no recommendation
• Recommend CT follow up
• Recommend biopsy
The Ulysses syndrome
Dr. Mercer Rang, Can Med Assoc J 1972

A recent paper on mass laboratory screening by Korvin and Pearce (Can Med Assoc J 105: 1053-1055, 1157-1161, 1971) focuses attention on the problem of apparently abnormal results in healthy people. It is usually accepted that the normal range in laboratory investigation excludes the upper and lower 2.5% of the results. Therefore 5% of the normal population will be labelled abnormal even if there is nothing the matter with them. If each person has 20 tests performed then 66% of these healthy people will have one or more abnormal results.

False positive results are not restricted to pathology. Such results and most physicians recall examples. After studying some time it to classify the cause of pathogenesis.

1. The mischievous investigation. Every unnecessary investigation puts the patient in jeopardy of the Ulysses syndrome. Causes of this are: (1) mass screening; (2) insurance which covers the cost of investigation; (3) residents carrying out investigative “overkill” to avoid being criticised by the staff member; (4) laboratory request forms on which are printed such a feast of tests that the doctor who requests only one or two feels that he has
Pediatric lung mass

- Primary neoplasm 1
- Secondary (metastasis) 5
- Non-neoplastic 60

Cohen Pediatr Pulmonol 1992
Pediatric lung mass: Benign

- Developmental: hamartoma
- Inflammation/infection:
  - granuloma
  - inflammatory myofibroblastic lesion
  - pneumonia, atelectasis
- Intrapulmonary lymph node
- Scar
Intrapulmonary lymph node

- Tends to be subcarinal
- Within 15 mm of a pleural surface (incl. fissure)
  - Connected via pleural tag
- Uniformly solid (> 0 HU)
- Oval/polygonal shape
Pediatric lung cancer

- Pleuropulmonary blastoma: < 6 yr
  - Large solid, small cystic
- Primary (bronchogenic ca): rare
  - Squamous cell ca: ~ papillomatositis
- Airways (carcinoid, ...): symptomatic
Pediatric lung cancer (cont.d)

- **Leiomyoma/-sarcoma**
  - HIV, Tx, immune deficiency (EBV)

- **Bronchioalveolar carcinoma (BAC, adenocarcinoma)**
  - Tx for extrathoracic malignancy
  - Chronic infections
  - CPAM
  - Ground glass nodule
The incidentally-detected lung nodule

• Fleischner guidelines do not apply
  – Solid nodule: intrapulmonary lymph node, granuloma, etc., not cancer (?)
  – Ground-glass nodule not a precursor for adenocarcinoma in children
  – Irregular nodule (“ditzel”): inflammation, scar, atelectasis
Lung Nodule on CT in Child

Asymptomatic
Unexpected Nodule

Negative History
Incidental Nodule

Symptomatic
- Pneumonia
- Obstructed airway

Work-up if no resolution with treatment
- Carcinoid
- Infection/inflammation
  - TBC
  - Histoplasmosis
  - Vasculitis
  - Malformation
  - Hamartoma
  - Immune deficiency
  - Papillomatosis
  - ...

Positive History
- Malignancy
- Immune deficiency
- CPAM?
- Travel, exposure to TBC etc.

Ground glass
(< 0 HU)
- Inflammatory
- Infectious
- Scarring
- Microatelectasis

Individualized Care
(Appropriate Treatment versus Follow-up CT versus Tissue Sampling at the discretion of referring Physician in consultation with Radiologist)

Solid
(> 0 HU)

Classic Features of Benignity
- Fat, “Popcorn” calcification: Hamartoma
- Peripheral location, elongated, pleural tag: Intrapulmonary Lymph Node
- Uniformly calcified: Granuloma
- Stability compared with prior studies

Non-Specific Appearance

Concern for Malignancy
Lowest 0?
Low
Lowest 0?
Intermediate
Intermediate
Incidental nodules in Rio de Janeiro
Tronco Alves AJR 2015

- 99 children scanned for pectus: 225 nodules (75% of patients)
- 2-8 mm, mean 2.8 mm
- 10.7% calcified
- Endemic for granulomatous disease

OBJECTIVE. Existing data are very limited on incidentally detected pulmonary nodules or mediastinal lymph nodes in healthy children who undergo chest MDCT. We aimed to evaluate the prevalence, distribution, and average dimensions of these occasional findings in a cohort of otherwise healthy patients.

MATERIALS AND METHODS. Two radiologists reviewed in consensus the scans of patients referred for chest MDCT during the preoperative workup for pectus carinatum or pectus excavatum treatments. Exclusion criteria included the presence of any documented malignancy (by date of MDCT or during the 2 years after the examination), history of recent infections, or trauma. Patients’ records were assessed after 2 years for the development of any malignancy.

RESULTS. A total of 99 individuals (63 boys, 36 girls; mean age, 13.5 years; range, 4–18 years) who fulfilled the study criteria were evaluated. The presence of at least one pulmonary nodule was observed in 75% of the patients, with a mean diameter of 2.8 mm. Of a total number of 225 pulmonary nodules, only 24 (10.7%) were calcified. Medialstinal lymph nodes were also identified in 16% of the cases, with a maximum diameter of 7 mm (smallest axis).

CONCLUSION. The presence of pulmonary nodules or mediastinal lymph nodes on the basis of preoperative chest MDCT scans in healthy children is frequent. Given that 85% of the nodules and 100% of the lymph nodes measured less than 6 mm and 7 mm, respectively, we conclude that incidental findings under these limits are very unlikely to be pathologic thoracic malignancies or who had experienced high-energy trauma [2, 3, 7, 8].

Materials and Methods
We conducted an individualized, transectional, prospective, noninterventional study. We investigated the presence of pulmonary nodules and thoracic lymph nodes in patients referred for chest MDCT during the preoperative assessment of either pectus carinatum or pectus excavatum surgery between January 2007 and December 2013. Because of radiation exposure, we cannot perform this study in healthy children without a clinical indication. Imaging for preoperative planning and postoperative examinations are performed mostly for cosmetic reasons and cosmetic-related psychological disorder [9]. Diagnostic techniques for pectus surgery include chest MDCT and cardiothoracic evaluation. Therefore, we believe that this population is the closest we can get to a healthy population.

The exclusion criteria involved any history of the following: malignancy (thoracic or other) documented by the date of MDCT or during the 2 years after the examination, based on the patient’s re-
Geography of fungal disease
Pectus excavatum: Haller Index
Use of CT Scans in Selection of Patients for Pectus Excavatum Surgery: A Preliminary Report

By J. Alex Haller, Jr., Sandra S. Kramer, and Steven A. Lintman
Baltimore, Maryland

A pectus index can be derived from dividing the transverse diameter of the chest by the anterior-posterior diameter on a simple CT scan. In a preliminary report, all patients who required operative correction for pectus excavatum had a pectus index > 3.25 while matched normal controls were all < 2.28. A simple CT scan may be a useful adjunct in objective evaluation of children and teenagers for surgery for pectus excavatum.

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INDEX WORDS: Pectus excavatum; CT scans in chest disease.

As pointed out by Blickman and associates, the role of surgery in the management of patients with pectus excavatum is controversial. But experienced pediatric chest surgeons are convinced that children with severe pectus excavatum can and should be safely operated on with predictably normal chest growth and development during their pulmonary growth spurt. Equally good data show that teenagers and young adults with marked funnel chest deformities have measurable physiologic abnormalities in pulmonary function during exercise and some patients have significant hemodynamic abnormalities as well.

Dr. J Alex Haller
1987
minute. It is like requiring a car salesman to explain the risks of dying in a car accident every time he sells a car.
Patients want, expect more information about radiation

Despite increasing concerns about ionizing medical radiation and medical imaging, as well as numerous reports in the media over the last several years on the subject, a study in the journal *Radiology* has found that benefit/risk discussions about ionizing radiation from imaging are few and far between and seldom initiated by clinicians.

Quality

Defensive medicine drives ED physician imaging overutilization

Emergency room doctors are ordering CT and MRI exams that may be unnecessary because of fears of malpractice lawsuits, according to an article in the journal *Academic Emergency Medicine*.

Quality
Role of decision support?

Sistrom Radiology 2009
National trend in CT utilization: 5.5% decline per year since 2011
Sjirk J Westra, MD

- I get paid for reading CT scans
Conflict of Interest Disclosure (3)

Sjirk J Westra, MD

- I get paid for reading CT scans
- I have helped develop new applications for pediatric cardiovascular CTA
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