

Introduction to Dedicated Breast CT – Early Studies



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- The contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH or the NCI

What is breast CT ?

- Similar concept as conventional body CT, except that it is designed to limit the x-ray beam to the breast being imaged.
- In typical geometry:
 - Subject lies prone on the table with the breast to imaged pendant through an aperture
 - Several hundred low-dose projections are acquired by the source-detector assembly
 - Reconstruct projection dataset along coronal planes



Dedicated Breast CT: 1970's

- Almost on the heels of the invention of CT itself, two systems were built by GE
 - Mayo clinic, and
 - University of Kansas Med Center
- System used:
 - 127 Xe detectors
 - 127 x 127 reconstruction
 - 1.56 x 1.56 x 10 mm
 - CT#: -127 to 128



Image source: Chang et al., Cancer 46:939-946, 1980. © American Cancer Society

Dedicated Breast CT: 1970's

- In the study by Chang et al. [Cancer 46:939-946, 1980]:
 - 1625 patients underwent breast CT imaging between October 1, 1976 and July 31, 1979
 - There were 78 histology-verified cancers
 - IV contrast administration
 - The cancer detection rate was 94% with dedicated breast CT vs. 77% for mammography
- Continues to be the largest study

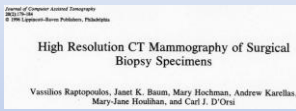


Breast Imaging with Body CT: 1980's

➤ Two studies – both using IV administration of contrast media

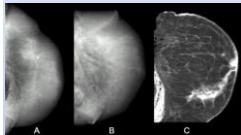
- | | |
|--|---|
| <ul style="list-style-type: none"> • Chang, et al., AJR 138: 553-8, 1982 • GE CT/T 8800 • 120 kV; 80 mA; 4.8 s/rot • Experience from 67 patients • 17 cancers in the cohort • CT detected 16/17 cancers (94%) vs. 12/17 cancers (71%) by mammography | <ul style="list-style-type: none"> • Muller et al., JCAT 7:650-4, 1983 • Philips TomoScan 300 • 188 kV; 180 mA; 4.8 s/rot • All patients had lesions identified on mammography • CT identified 32/34 lesions • 2 calcified lesions missed by CT |
|--|---|

Surgical breast specimens with body CT: 1990's



- Non contrast study comparing body CT (GE Advantage 9800) with high-resolution x-ray specimen radiography
- 44 surgical biopsy specimens
- Fatty specimens: CT ⇔ specimen radiograph for masses
- Dense specimens: CT ↑↑ specimen radiograph for masses
- Microcalcifications: CT ↓↓ than specimen radiograph

Radiation dose and Feasibility: 2001



John M. Boone, PhD
 Thomas R. Nelson, PhD
 Karen K. Lindfors, MD
 Anthony Siebert, PhD

Dedicated Breast CT: Radiation Dose and Image Quality Evaluation¹

Radiology 221: 657-67, 2001
 Image source: Boone et al., Radiology 221: 657-67, 2001
 © 2001 Radiological Society of North America

- Reported on average glandular dose (AGD) estimates for dedicated breast CT
- Showed the potential of breast CT at radiation dose comparable to two-view mammography

Ongoing Research (Partial list)

Clinical prototypes

- University of California, Davis
- Univ. of Rochester Medical Center
- Radboud University, Nijmegen
- Two systems in China (Tianjin & Guangzhou)
- UMass Medical School
- Institute of Medical Physics, Erlangen
- Duke University

Bench-top systems

- (specimen/phantom imaging)
- University of California, Irvine
- US FDA
- M.D. Anderson Cancer Center
- INFN (Napoli, Bologna, Pisa, Trieste)
