NEW IMAGING MODALITIES IN BREAST CANCER MANAGEMENT

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MANAGEMENT OF BC PATIENTS

High quality staging

Neoadjuvant therapy: need to quantify early primary tumor response

MRI: high morphological accuracy, functional potentials

FDG PET: metabolic information

US and axillary nodal status
PRETHERAPEUTIC ASSESSMENT OF THE TUMOR EXTENT

Unquestionable indication

Factors for breast-conserving surgery ineligibility:

• Lobular histology
• Initial multicentric presentation (MRI > MAMMO)
• Associated microcalcifications

[Newman 2002]
MRI more effective than clinical examination, mammography or US
Excellent correlation between histologic and MRI tumor size [Partridge AJR 2002, Rosen AJR 2003].

Two patterns of tumor shrinkage: concentric or dendritic [Tozaki AJR 2005].
PREDICTION OF TUMOR RESPONSE/MORPHOLOGY

Initial morphologic patterns
Likelihood of response to treatment
Rate of breast conservation

Partial or complete response: 77% in pattern 1 >< 25% in pattern 5 [Esserman An surg oncol 2001]
PREDICTION OF TUMOR RESPONSE/MORPHOLOGY

Volumetric measurements
Reduction >65% tumor volume after 2 cycles of chemotherapy predict major histopathological response [Martincich BCRT 2004]. Tumor volume more predictive than tumor diameter [Partridge AJR 2005].

MRI & THERAPY MONITORING
PREDICTION OF TUMOR RESPONSE / FUNCTIONAL

Studies about tumor enhancement kinetics (neoangiogenesis):

- Reduction in the intensity of enhancement

- Quantification of washout changes
  [El Khoury AJR 2005]

- Transfer constant measures
  [Padhani Radiology 2006]

... to differentiate responders from non-responders
H MR Spectroscopy quantify total choline level
Adjunct to breast MRI: improves specificity [Bartella Radiology 2006].
Monitoring therapy: changes in tCho within 24 h after 1st dose of chemotherapy [Meisamy Radiology 2004]
Numerous technical limitations…
Diffusion-weighted MRI assess tumor cellularity
Differentiate benign from malignant


False-positives (papilloma...) and false-negatives (DCIS...)

Preliminary results: early change in diffusion coefficient in response to chemotherapy


Technical limitations...
PET & BREAST CANCER STAGING

• Assessment of the metabolic activity of tissue
• Limited diagnostic value for detection
• Co registration FDG PET & CT : better diagnostic accuracy
LOCOREGIONAL STAGING

- M+ in regional nodal sites outside axilla
- Mediastinal and internal mammary M+: predict failure of primary therapy [Rosen Radiographics 2007].
- Specific role for patient with inner-quadrant disease?
SYSTEMIC STAGING

- Single whole body examination: Se 86%, Sp 90% distant M+ [Dose Nucl Med Com 2002]
- Limitations: lung microM+, brain, blastic bone M+
- Complementary to bone scintigraphy
PET & BREAST CANCER STAGING

BONE M+

Bone Scinti Blastic M+  PET Lytic and intramedullary M+
PET & BREAST CANCER STAGING

BONE M+ & SPECT/CT
DETECTION OF BC
RECURRENT & RESTAGING

• 90% accuracy of PET > 74% accuracy of conventional imaging [Gallowitsch Inv Rad 2003]

• FDG PET/CT comparing to whole body MRI:
  – Both very reliable for detection of organ M+ (94% MRI, 90% PET)
  – PET/CT more sens for lymph node involvement [Schmidt EJR 2008]
DETECTION OF BC RECURRENCE & RESTAGING

• Restaging cases of locally recurrent disease in up to 44% [Eubank AJR 2004]

• Rising levels of tumor marker in asymptomatic treated BC patients: change clinical management in 51% [Radan 2006]
Tumor response to NAC

- FDG metabolism precedes morphologic changes
- Residual disease: lower accuracy of PET (43.5 %) than MRI (91 %)
Recurrent or M+ disease

- Response of M+ BC to systemic therapy is prognostic [Franc Sem Roent 2007].
- Future: other PET agents (18F fluoroestradiol, 18F-MISO marker for tumor hypoxia, 18F fluoropaclitaxel...).
Important prognostic indicator

• Axillary lymph node dissection □□ overtreatment!
• Sentinel lymph node dissection (SLND)
• Noninvasive imaging test (PET, SCINTI, MRI …) to predict nodal M+ and obviate SLND??
AXILLARY US

- Suboptimal accuracy (10-50% FN, 5-35% FP)
- Sens. increases with tumor size
  [Koelliker Radiology 2008].
- Morphology >> size; relationship between adjacent LN
- M+ = subcapsular and cortical process
AXILLARY NODAL STATUS

[STAVROS, BREAST ULTRASOUND 2004]
AXILLARY NODAL STATUS

AXILLARY US + FNAC

• High specificity ≈ 100% [Alvarez AJR 2006].

• Target = thickened cortex (2 mm threshold) [Duchesne 2005].

• Cost saving by maximizing the rate of “one-step-surgery” [Genta W J Surgery 2007].
FUTURE?

• Preliminary results of functional imaging techniques □□ clinical role in routine?
• Need for prospective multi center trials, comparative
• ACRIN 6657: MRI in monitoring patients under neoadjuvant chemotherapy
FUTURE?

• MRI: reproducible and comparable protocols (help of the constructors!)
• Other imaging modalities : PET mammography,…
• Characterization of the lesions
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From the Nuclear Medecine
CAVELL - CHIREC