SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr MGR Medical University, Chennai

DEPARTMENT OF RADIOGRAPHY AND IMAGING

TECHNOLOGY

COURSE NAME : EQUIPMENTS OF ADVANCED MODALITIES

UNIT : MAMMOGRAPHY SYSTEM

TOPIC : INTERVENTIONAL PROCEDURES TO FUTURE

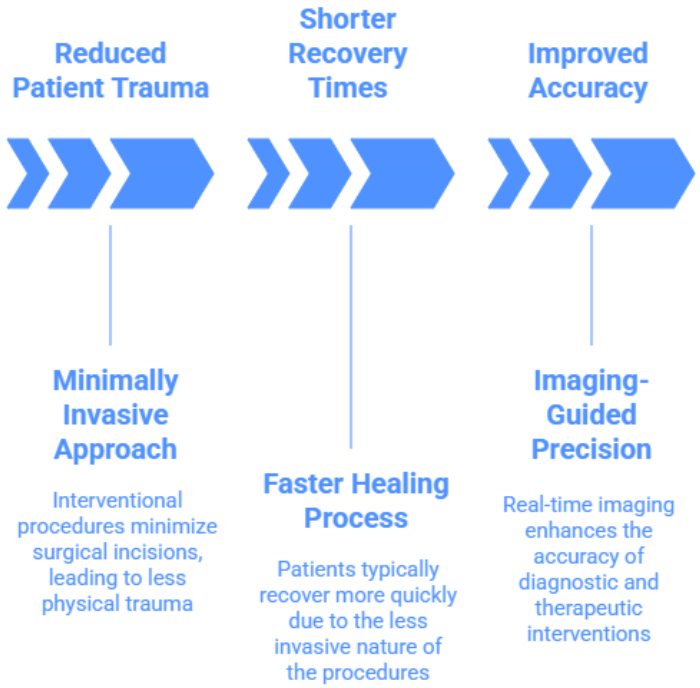
DEVELOPMENTS - RECAP

FACULTY NAME: MRS.G.HELANA JOY

INTRODUCTION - DEFINE

Interventional Procedures in Breast Imaging

Interventional procedures utilize imaging guidance to perform minimally invasive diagnostic and therapeutic interventions. These procedures offer advantages such as reduced patient trauma, shorter recovery times, and improved accuracy compared to traditional surgical approaches.



TYPES OF GUIDANCE

- **Ultrasound-guided**: Real-time visualization; most common for palpable or visible masses; quick and comfortable.
- **Stereotactic (Mammography-guided)**: Uses 2D/3D mammogram coordinates; ideal for microcalcifications or non-palpable lesions; prone or upright systems (e.g., Hologic Affirm).
- **MRI-guided**: For lesions only visible on MRI; uses grid compression and contrast enhancement.

BIOPSY DEVICES

- Fine Needle Aspiration (FNA): Thin needle for cytology (less common for diagnosis).
- Core Needle Biopsy (CNB): 14-18G needle; spring-loaded or vacuum-assisted.
- **Vacuum-Assisted Biopsy (VAB)**: Preferred (9-12G); pulls larger samples with suction; reduces under-sampling (e.g., Hologic ATEC, BD EnCor Enspire, Celero).

Procedure Steps (General):

Local anesthesia → Needle insertion under guidance → Multiple samples (6-12 cores) → Marker clip placement → Post-biopsy mammogram.

Advantages: High accuracy (>98% for malignancy), outpatient, low complication rate (<1% hematoma/infection).

Concordance: Always correlate pathology with imaging; discordance → excision.

ACCESSORIES & BIOPSY EQUIPMENT ATTACHMENTS

Common Systems:

- Hologic: Affirm upright biopsy system (2D/3D-guided), lateral arm accessory for difficult lesions, Brevera (real-time imaging + marking).
- BD: EleVation/EnCor Enspire (multi-modality: US/stereo/MRI).
- INRAD: Core needles + unique markers.

COMPRESSION DEVICE

- **Needle Guides**: Stabilize needle (e.g., in upright systems).
- **Lateral Arm**: Access posterior/axillary lesions.
- **Vacuum Tubing & Handpiece**: For VAB; disposable probes.
- **Biopsy Markers/Clips**: Titanium/nitinol shapes (e.g., Hologic SecurMark, INRAD Trilogy); bio-absorbable netting for US visibility; deployed post-sampling.
- **Specimen Radiography**: Faxitron Core for immediate verification.
- **Prone Tables vs Upright Add-ons**: Prone (patient comfort, less vasovagal); upright (faster, uses existing mammo unit).

RADIATION DOSE CONSIDERATIONS

- **ALARA Principle:** "As Low As Reasonably Achievable" - a guiding principle for radiation safety.
- **Optimization of Imaging Parameters:** Using the lowest possible radiation dose settings while maintaining adequate image quality.
- **Shielding:** Using lead aprons, thyroid shields, and other protective barriers.
- **Collimation:** Restricting the X-ray beam to the area of interest.

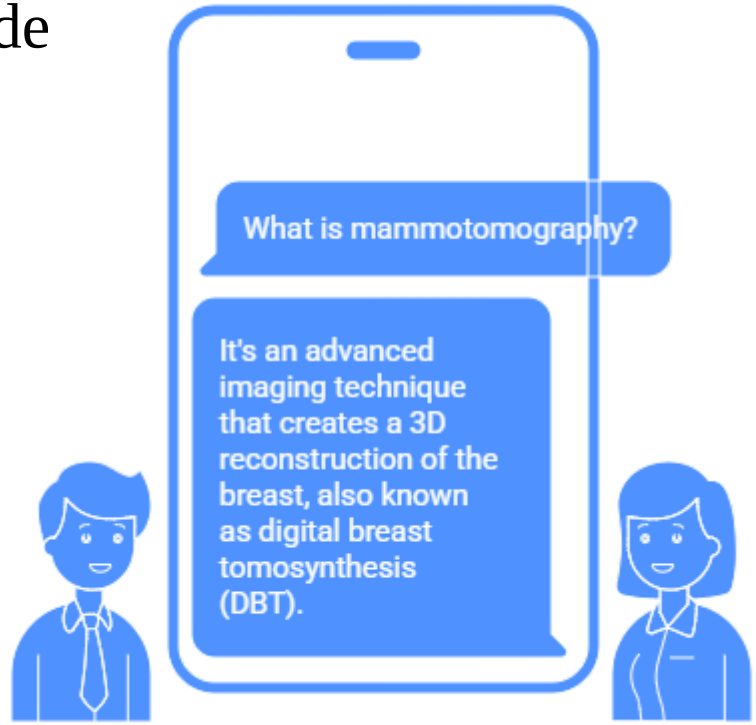
- **Pulsed Fluoroscopy:** Reducing radiation dose by pulsing the X-ray beam.
- **Dose Monitoring:** Using dosimeters to monitor radiation exposure levels.
- **Operator Training:** Ensuring that operators are properly trained in radiation safety practices.

MAMMOGRAPHY TOMOSYNTHESIS (DBT / 3D MAMMOGRAPHY)

Mammotomography, also known as digital breast tomosynthesis (DBT), is an advanced imaging technique that creates a 3D reconstruction of the breast.

- **Principle:** Multiple low-dose X-ray images are acquired from different angles and reconstructed into a series of thin slices.
- **Advantages:** Improved detection of breast cancer, especially in dense breasts; reduced recall rates; better visualization of overlapping structures.

- **Applications:** Screening and diagnostic mammography.
- **Interventional Procedures:** DBT can be used to guide breast biopsies, improving accuracy and reducing the need for multiple passes.



SONOMAMMOGRAPHY (BREAST ULTRASOUND)

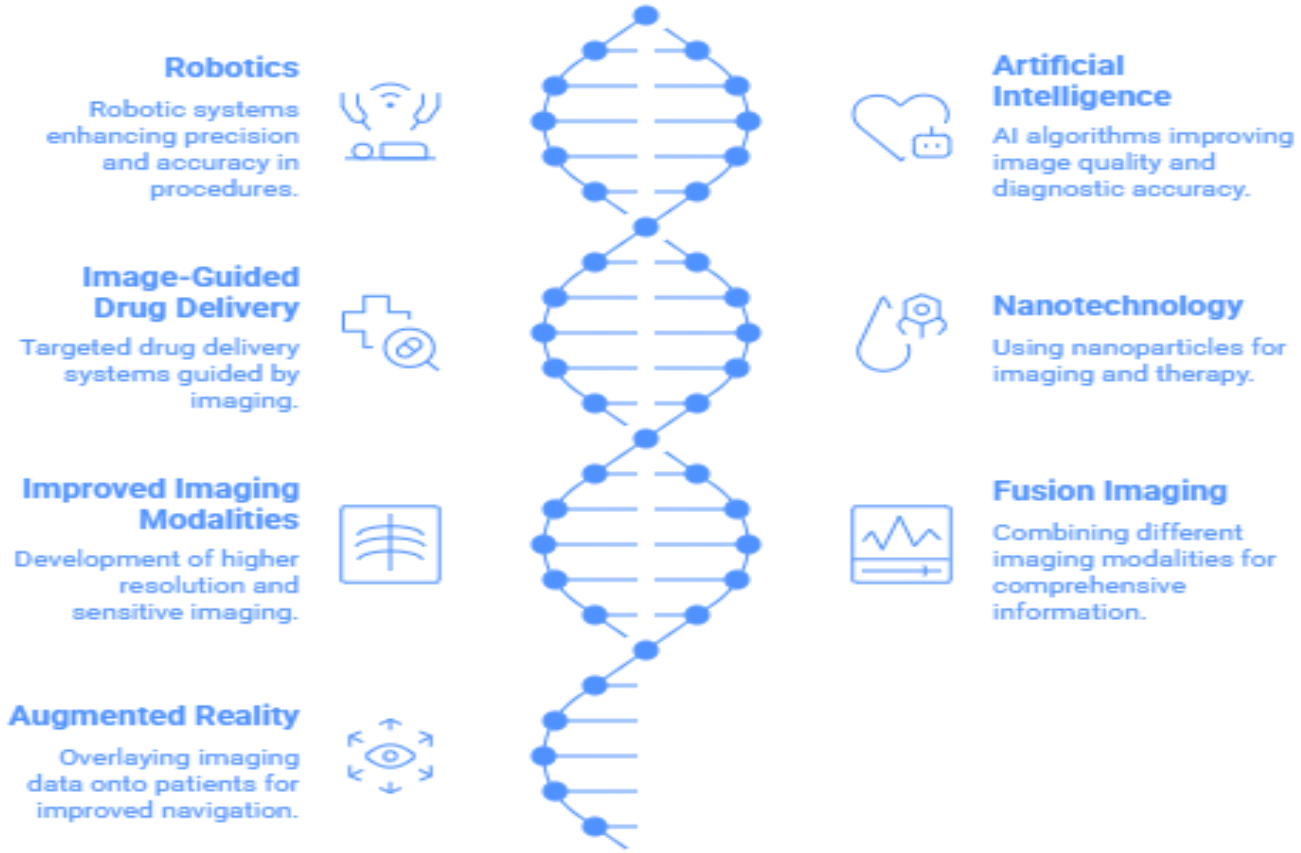
Sonomammography, or breast ultrasound, is a valuable adjunct to mammography in breast imaging.

- **Principle:** Uses sound waves to create images of the breast tissue.
- **Advantages:** No ionizing radiation; useful for evaluating dense breasts; can differentiate between solid and cystic lesions; real-time imaging.
- **Applications:** Evaluating palpable lumps, characterizing mammographic abnormalities, guiding breast biopsies.
- **Interventional Procedures:** Ultrasound is commonly used to guide fine-needle aspiration and core needle biopsies of breast lesions.

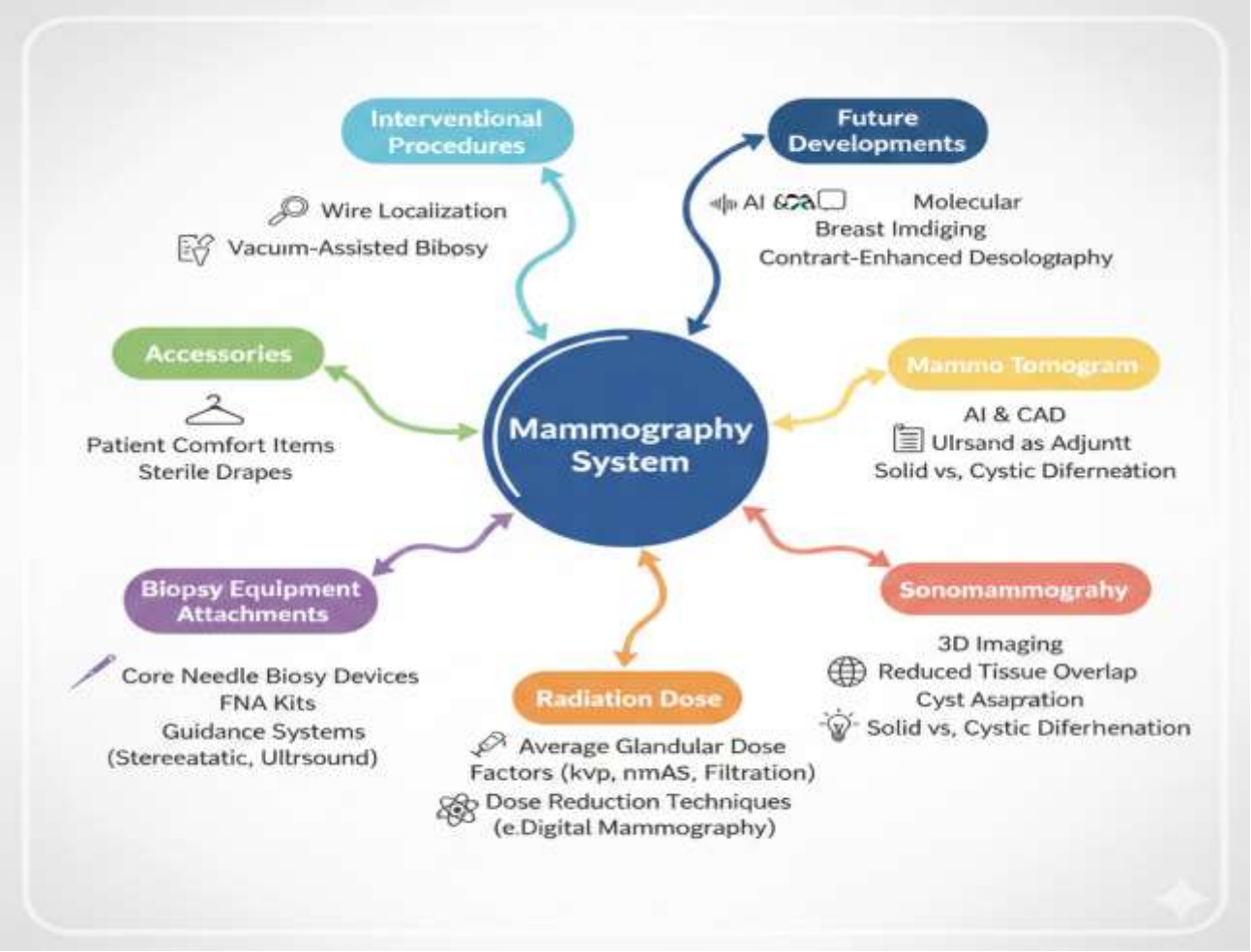
FUTURE DEVELOPMENTS

- The field of interventional procedures is constantly evolving, with ongoing research and development of new technologies.
- **Robotics:** Robotic systems are being developed to improve the precision and accuracy of interventional procedures.
- **Artificial Intelligence (AI):** AI algorithms are being used to enhance image quality, automate tasks, and improve diagnostic accuracy.
- **Image-Guided Drug Delivery:** Developing targeted drug delivery systems that can be guided to specific locations using imaging.

- **Nanotechnology:** Using nanoparticles for imaging and therapy.
- **Improved Imaging Modalities:** Development of higher resolution and more sensitive imaging modalities.
- **Fusion Imaging:** Combining different imaging modalities (e.g., PET/MRI, SPECT/CT) to provide more comprehensive information.
- **Augmented Reality (AR):** Using AR to overlay imaging data onto the patient during interventional procedures, improving navigation and accuracy.


Robotics
Robotic systems enhancing precision and accuracy in procedures.
Image-Guided Drug Delivery
Targeted drug delivery systems guided by imaging.
Improved Imaging Modalities
Development of higher resolution and sensitive imaging.
Augmented Reality
Overlaying imaging data onto patients for improved navigation.
Artificial Intelligence
AI algorithms improving image quality and diagnostic accuracy.
Nanotechnology
Using nanoparticles for imaging and therapy.
Fusion Imaging
Combining different imaging modalities for comprehensive information.

SUMMARY


Interventional Procedures
Wire Localization
Vacuum-Assisted Bibosy
Future Developments
AI
Molecular
Breast Imdiging
Contrart-Enhanced Desologiaphy
Accessories
Patient Comfort Items
Sterile Drapes
Mammography System
Mammo Tomogram
AI & CAD
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Solid vs, Cystic Diferneation
Biopsy Equipment Attachments
Core Needle Biosy Devices
FNA Kits
Guidance Systems
(Stereeatatic, Ultrsound)
Radiation Dose
Average Glandular Dose
Factors (kvp, nmAS, Filtration)
Dose Reduction Techniques
(e.Digital Mammography)
Sonomammograhy
3D Imaging
Reduced Tissue Overlap
Cyst Asapration
Solid vs, Cystic Diferhenation

References:

- **Mammography Quality Standards Act (MQSA) Regulations.**
- **https://www.apollohospitals.com/diagnostics-investigations/sonomammography**
- **https://www.radiologyinfo.org/en/info/tomosynthesis**