Interventional Options

Olive Peart MS, RT (R)(M)
http://www.opeart.com

The Need For Interventional Techniques

- Only a histological or cytological analysis can definitely confirm a malignancy

Cytological Analysis

- An examination of the cells
- Results in 24-48 hours

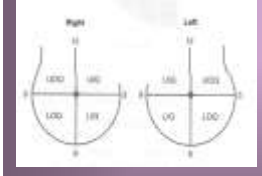
Histological Analysis

- A study of the tissues of a specimen
- Frozen section - preliminary results in 10 min
- Accurate results: 3-5 days
  - Fixed in formaldehyde
  - Embedded in wax
  - Cut
  - Stain

Patient Preparation

- Comfortable clothing
- Avoid deodorant
- Powders
- Creams
- Eat a light meal to minimize nausea
- No blood-thinning medication e.g. aspirin – certain herbal remedies
- Get informed consent

Triangulation



- Quadrant method
  - Breast divided into four quadrants
- Clock face method
  - Breast becomes the face of a clock
- Region
  - Posterior, medial, anterior (subareola)

Methods of Localization

- Stereotactic
- Preoperative
  - –Hook & Wire

Stereotactic Breast Localization

- Biopsy method used to locate non-palpable lesions
- Images taken at different angles to triangulate the exact coordinates of a lesion
- Computer calculates the location
- Lesions can be biopsied after localization
- Stereo can be a prelude to an FNB or core biopsy
- Add-on or dedicated units available

Add-on Units

- –Units attach to a regular mammography unit
- –Patient is seated during the examination

Dedicated Prone Units

Patient lies prone
- Affected breast protrudes through opening in the table
- Physician and technologist can remain seated during exam
- Newer tables allow imaging 360-degrees around breast

Prone vs. Add-On Units

- Prone Units
  - Requires more space
  - More expensive
  - 300lb weight limit
  - Safe for most patients
- Add-on Units
  - Requires less space
  - Less expensive
  - Not best option for elderly, anxious or physically impaired patient
  - Increase chance of vasovagal reaction

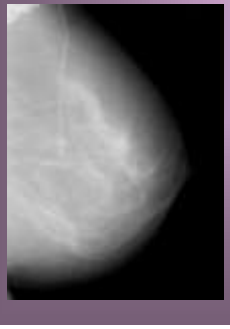
Combination Units

GIOTTO IMAGE 3D

Preoperative Localization

- A prelude to the surgical biopsy
- Used if stereo localization is not available
- Performed under mammographic or ultrasound guidance

Localization Procedure



- Long needle with a hook wire is inserted into breast – to a point beyond lesion
- With wire in place – needle is withdrawn
- Hook holds wire within breast tissue

Breast Intervention Procedures

- Fine needle aspiration (FNA)
- Fine needle biopsy (FNB)
- Minimal invasive biopsies
  - Core needle biopsy (CNB)
  - Vacuum biopsy
- Open surgical

FNA/Cyst Aspiration

- Removal of the content of a cyst
- Done to relieve pain
- Assess contents

Often performed under ultrasound guidance

FNB

- Ideal for cyst evaluations and aspirations

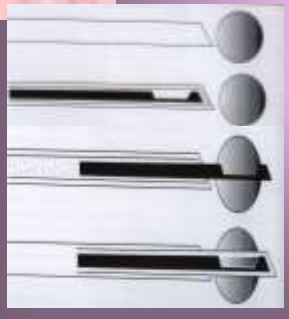
Biopsy method

- Uses 22 to 25-gauge needles
- Needs cytotechnologist evaluation of sample

FNB – Analysis

- Fastest and easiest biopsy method
- Cheaper and less invasive than core
- Less accurate than core
- Rapid results
- No stitches or scarring
- Needs multiple needle sticks
- Cannot be used for chest wall lesions

Core Biopsy



- Use of large-core needles (11-16) to remove core samples
- Needles have special cutting edge
- Mammography, U/S or MRI guided

Core Biopsy Analysis

- Core or Tru-cut
  - More invasive that FNA/FNB but results more definitive
- Requires several needle samples
- Poor for small or hard lumps

Vacuum-Assisted Biopsy

- Removes more than core
- Typically requires 8-10 samples
- Needs local anesthetic
- Mammographic or U/S guidance

Vacuum Biopsy - Analysis

- Often provides definitive diagnosis
- Good for calcifications
- No stitches required
- Minimal scarring
- More accurate than FNB & CNB
- Not recommended for hard to reach lesions

Open Surgical Biopsy

- Used with lesions that are
  - –Difficult to approach
  - –Close to breast surface
- Confirmation after FNA/FNB

Methods of Surgical Biopsy

- Incisional
  - –Removes sample of lesion
- Excisional
  - –Removes entire lesion

Open Biopsy Analysis

- Open surgical analysis has the lowest false negative rate but the highest complication rate

Lymph Node Biopsy

- **Or Axillary Node Dissection**
- To determine cancer spread to the lymph nodes
- Needs general anesthesia
- Often performed at the time of lumpectomy or mastectomy

Analysis

- More node removal= more complications
- Major complication - lymphedema

Alternative option include

- Sentinel lymph node biopsy
  - –Removal of the 1st node in the lymphatic chain plus 2-3 others

Ultrasound Guided Biopsy

- Highly accurate
- The lesion must be palpable or visualized on ultrasound
- Commonly used with FNA/FNB or core biopsy

Ultrasound Biopsy - Analysis

- Ultrasound is quick and is better than MR when biopsy of the axilla and chest wall areas are needed
- Ultrasound allows patient to lie in comfort
- Allows biopsy from any orientation and continuous imaging during the biopsy

MR Guided Biopsy

- The lesion must be visualized under MRI
- All equipment used must be MRI compatible
- Procedure is slower and very expensive

Specimen Imaging

Performed after every biopsy

- To confirm the lesion was removed
- Magnification to visualize calcifications

Specimen Imaging

- Surgical specimen must be compressed
- Magnification can help
- All microcalcifications must be counted and noted

Ductography or Galactography

Used to evaluate

- Nipple discharge
- Detects duct filling irregularities
- Duct expansions
- Duct defects

Cosmetic Intervention

- Three options for mammoplasty
  - Breast augmentation
  - Breast reduction
  - Breast lift
- Cosmetic surgery is usually not covered by health insurance

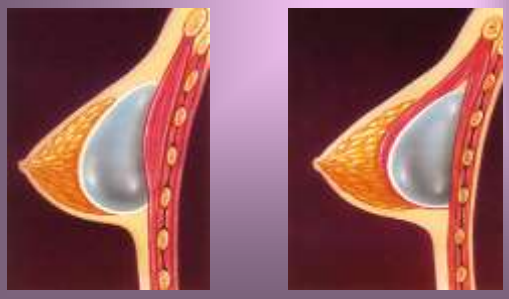
Mammoplasty

- Breast augmentations or reductions are contraindicated for anyone aged younger than 18 years
  - Breast are immature
  - Person may not be mature enough to make an informed decision
- Personal choice
- Elective

Augmentation

- Performed with implants
- Placement
  - Under chest muscle
  - Over chest muscle.
- In general, all breast augmentations are minimally invasive procedures

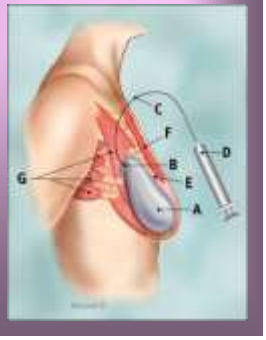
Subglandular vs. Subpectoral



Surgical Incisions

- Transaxillary
- Periareolar
- Inframammary

Tissue Expansion



Types of Reconstruction

- Saline implants
  - Fixed or adjustable volume
  - Silicon shell filled with salt water
    - Stage 1 – tissue expander
    - Stage 2 – placement of implant
    - Stage 3 – nipple and areola creation
- Silicone
  - Silicone shell filled with a silicone gel

Problems With Implants

- Implants do not last forever
  - Rupture
  - Scar tissue can form around the implant
  - Capsular contracture occurs when the scar or capsule around the implant begins to tighten and squeeze the implant, making the breast feel hard
    - Capsular contracture can require surgery to remove the scar tissue, or the implant may be removed or replaced

Anaplastic Large Cell Lymphoma (ALCL)

- Extremely rare cancer - Identified in 2011
- Affects cells in immune system around implant
  - Also found in the skin or lymph nodes
- Associated with textured surface implants
- Symptoms:
  - fluid buildup, hardening or a mass around implants, swelling and redness around the implants
- ALCL is slow-growing and treatable when detected early. It is not a breast cancer

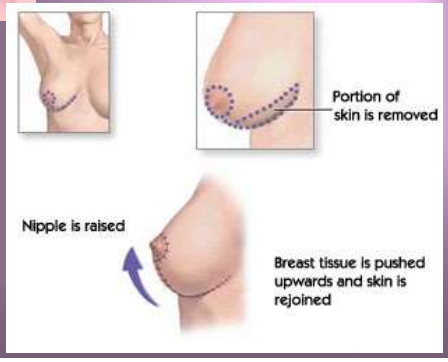
Reduction

- Reduces the size of large or heavy breasts
  - Removal of skin, fat and breast tissue
- Can be medically related
  - Women who experience significant discomfort including neck and back pain, numbness or weakness due to the weight of the breasts
- Breastfeeding can be affected

Mastopexy

- A **breast lift**
- Raises the breasts by removing excess skin and tightening the surrounding tissue
- Reshapes and support the new breast contour
- Sometimes reduces the size of the areola

Procedure



Prophylactic Surgery

- Preventive surgery to remove the entire breast when a woman has a very high risk factor for breast cancer
- Consultation plus mammography to rule out breast diseases is recommended prior to the surgery

Breast Cancer Treatment

- Breast cancer is not an emergency
- Second opinions are often recommended
- Treatment options include surgery, radiation, drugs – or any combination
- Treatment cannot begin until stage, size & location of cancer is known

Other Options to Consider

- In 1st or 2nd trimester pregnancy can only be treated with radiation if the pregnancy is terminated
- In 3rd trimester surgical treatment can proceed and radiation delayed until after delivery
- Breast conservation surgery is usually followed by radiation - travel considerations

Staging Breast Cancer

Stage	Tumor Size	Lymph Node	Metastasis
I	Less than 2 cm	No	No
II	between 2-5 cm	No	No
III	more than 5 cm	No/ in same side	No
IV	Not applicable	Yes/ same side	Yes

http://www.cancer.org

Surgical Options

- Radical mastectomy
  - Entire breast plus lymph nodes, chest wall tissue and muscle
- Modified radical mastectomy
  - Breast tissue, nipple and areola complex plus lymph nodes.
  - The skin of the breast is preserved.
- Lumpectomy
  - Tumor plus surround margins

Radical Mastectomy & Effects

Modified Radical Mastectomy

- A day hospital stay
- Surgery lasts 2-3 hours
- Generally needs a drainage tube after surgery

Complications of Mastectomy

- Wound infection
- Hematoma
- Seroma
- Lymphedema
- Numbness in upper arm and skin
- Phantom breast pain

Lumpectomy

- Lumpectomy is possible only on women with small or localized breast cancer

Analysis

- There is no significant difference in overall survival rates between women who undergo lumpectomy & radiation vs. mastectomy
- Lumpectomy is possible only on women with small or localized breast cancer

Poor Candidates for Lumpectomy

- Multiple cancers in one or both breasts
- Prior radiation to chest/breast area
- Previous lumpectomy
- Connective tissue disease e.g. rheumatoid arthritis, osteoarthritis
- Pregnancy
- Large tumors in small breast
- Larger tumors

Combination Therapy

- Lumpectomy sometimes combined with
  - 6-weeks of radiation therapy
  - And/or chemotherapy
  - And/or Molecular/Hormone or Gene therapy

Radiation Therapy

- Use of high-energy radiation to destroy cancer cells
- Can be used before or after surgery
- Generally treatments run 6-7 weeks
- External or internal beam

External Beam Radiation

- Treatment begins 1 month after surgery
- 15-30 minutes of treatment 5 times per week for 5-7 weeks
- During treatment, patients are monitored by closed circuit television

Side Effects of External Beam Radiation Therapy

Side effects often temporary

- Fatigue
- Swelling of breast
- Heaviness in the breast
- Sunburn-type appearance of the breast skin
- Loss of appetite

Intensity-Modulated Radiation Therapy - IMRT

- Use of computer-controlled x-ray accelerators to deliver precise radiation doses to tumor
- Radiation designed to conform to 3-D shape of a tumor
- Minimize radiation exposure to surrounding normal tissue – higher dose to affected tissue

Internal Beam Radiation - Brachytherapy

- Reduction of treatment duration from 6 weeks to one
- Less delay before the start of treatment
- Treatment can begin before chemotherapy
- Less radiation to skin, lungs, heart, ribs – other healthy parts of breast and body
- Fewer skin reactions
- Research is still ongoing

There are two types

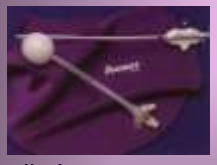
Multiple Catheter Treatment

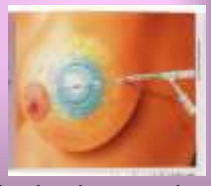
- 10-20 plastic catheters surgically placed into the breast tissues.
- The catheters are connected to a high-dose rate brachytherapy machine 9 times over a 5 day period for about 15-minutes.
- Catheters are removed after about one week.

Single Catheter Treatment

- Surgical implantation of inflatable balloon catheter
- Patient is imaged and the balloon inflated at each treatment
- Device remains in place for the duration of treatment

Brachytherapy





- Radiation source attached only at each treatment session
- Treatment delivered each day for one week

Chemotherapy

- Use of drugs to treat cancers that may have spread beyond the breast
- Systemic treatment – drugs will affect all tissues and organs in the body.
- Treatment will depend on patient age, health, stage of cancer, past or future treatment and other health problems

Uses of Chemotherapy

- Stops the spread of cancer
- Slows the growth of cancer
- Kills cancer cells
- Relieves symptoms of cancer

Method of Chemotherapy

- Delivered through a catheter into a large vein
- Orally as tablets or liquids
- Intramuscular, topically or injected directly to the cancer site
- Regimen – daily, weekly, monthly or depends on patient's response
- Typical treatment 3-6 months

Chemotherapy Regimens

Regimens are tailored for each patient and can vary tremendously

- Neoadjuvant chemotherapy – before surgery
- Adjuvant chemotherapy – given in addition to other treatments

Lower chemotherapy doses are associated with fewer side effects

Side Effects of Chemotherapy

- Irritation of stomach or intestine lining -Nausea and vomiting
- Mouth sores or disturbances in taste
- Decreases appetite
- Diarrhea or constipation
- Numbness in hands and or feet-Tingling or burning sensations
- Skin irritations – redness, itching, peeling or acne
- Dark, brittle or cracked finger and/or toenails
- Infertility or premature menopause
- Birth defects

Hair Loss & Low Blood Cell Count

- Hair loss – generally temporary
- Low blood cell counts (side effects)
  - White – infections
  - Red - anemia, fatigue, dizziness, headaches, irritability, increased heart rate
  - Platelet – easy bruising, longer clotting time, nose/gum bleed, internal bleeding
- May require transfusions

Targeted Treatment

- Targeted treatment determines the exact genetic profile of the altered cancer cells
  - Treatment plan is based on the nature of these cells or subcells.
- Involves addressing each individual's unique biology and disease structure
  - Results in a higher level of treatment efficiency plus more successful outcomes.

Types of Targeted Treatment

- Molecular
- Hormone
- Gene

ER+ Cancers

- More than 75% of breast cancers in the US are estrogen receptor positive (ER+)
- Other cancers
  - Progesterone receptor positive (*PR*+) tumor
  - HER2+
    - Tests positive for the protein called human epidermal growth factor receptor 2
    - Overexpress the *HER2* gene
  - Triple negative
    - Does not contain receptors for estrogen, progesterone or HER2.

HER Receptors

- The HER protein (Human Epidermal Growth Factor Receptor) binds to Human Epidermal Growth Factor, and stimulates cell proliferation
- If HER2 is over-expressed it causes cancer cells to reproduce uncontrollably
  - About 25% of the population have this overactive gene and do not respond to treatment with tamoxifen or other antiestrogen drugs

Targeted Treatment

- Molecular treatment is the earliest attempt at targeted treatment in cancer therapy
- Using the drug Tamoxifen
  - Called Selective Estrogen Receptor Modulators (SERMs)
- Binds to estrogen receptors
  - Blocks estrogen in breast tissue
  - Mimic the effects of estrogen in bone & uterus

Drug Effects

•Antagonist - Used to counteract the effects of certain drugs

•Agonist - A drug that readily combines with a receptor (organ) to enhances the bodies natural response to stimulation

Tamoxifen

Tamoxifen (Nolvadex®)

Anti-estrogen drug

- Prevents estrogen from latching onto tumor cell receptors
- Shrinks or stops the recurrence of breast cancer
- Lowers the risks of breast cancer recurrence in postmenopausal women
- Similar drugs on the market

Risks of Tamoxifen

Minor Risks

- Mild depression
- Tiredness
- Dizziness
- Weight gain
- Skin rashes
- Headaches
- Vision problems

Major Risks:

- Uterine cancer
- Endometrial cancer
- Pulmonary embolism
- Stroke
- Deep vein thrombosis/blood clots
- Increased menopausal symptoms

Tamoxifen should not be taken longer than 5-years

Raloxifene

- Raloxifene (Evista)
- Now used to prevent osteoporosis
- Can reduce risk of invasive breast cancer – sold as Evista
- Not as effective as Tamoxifen on some earlier forms of cancer
- Less side effects than Tamoxifen

Source: National Cancer Institute

Adverse Effects

- Hot flashes
- Increased sweating
- Joint aches
- Leg cramps

Other serious effects:

- Severe allergic reactions
- Blood clots or Stroke

Other Antiestrogen Drugs

- Fulvestrant (Faslodex®)
  - Estrogen antagonist
  - Unlike other SERMs, has no estrogen agonist effects.
  - It is a pure antiestrogen
- When fulvestrant binds to the estrogen receptor, the receptor is targeted for destruction

Adverse Effects

More common

- Bloating or swelling of the face, arms, hands, lower legs, or feet
- Rapid weight gain
- Tingling of the hands or feet
- Unusual weight gain or loss
- Wheezing

Less common

- Difficult or labored breathing
- Shortness of breath
- Tightness in the chest

Hormone Therapy

- Hormone therapy (also called hormonal therapy, hormone treatment, or endocrine therapy)
- Slows or stops the growth of hormone-sensitive tumors by blocking the body's ability to produce hormones or by interfering with hormone action.
- Tumors that are hormone-insensitive do not respond to hormone therapy.

Aromatase Inhibitors

ER+ Treatment

- Used in postmenopausal women
- Drugs used to block activity of enzyme aromatase
  - Body uses it to make estrogen in ovaries
- Drugs
  - Exemestane (Aromasin®)
  - Anastrozole (Arimidex®)
  - Letrozole (Femara®)

Exemestane

- Exemestane (Aromasin)- an oral steroidal aromatase inhibitor associated with fewer adverse effects than tamoxifen.
- Lowers the blood levels of estrogen by attaching to the aromatase enzyme and permanently deactivating it.
- Recommendations:
  - 2 years of tamoxifen followed by 2 to 3 years of exemestane

Adverse Effects

- New or unusual bone pain
- Vision problems
- Swelling in your hands or feet
- Shortness of breath, even with mild exertion
- Chest pain
- Sudden numbness or weakness
- Sudden headache
- Confusion
- Problems with vision, speech, or balance.

Anastrozole

- Anastrozole (Arimidex) lowers estrogen levels in postmenopausal women
  - Used to reduce the recurrence of breast cancer.
- Trials with anastrozole show that patients with hormone receptor positive breast cancer were 65% less likely to have a relapse or a new tumor than women on tamoxifen.

Adverse Effects

- Blurred vision
- Chest pain or discomfort
- Dizziness/ headache
- Nervousness
- Pounding in the ears
- Shortness of breath
- Slow or fast heartbeat
- Swelling of the feet or lower legs

Less Common Effects

- Pain in legs, feet, arm, back, jaw
- Sore throat, cough or hoarseness
- Difficult or painful urination
- Fever or chills/ unusual tiredness or weakness
- Increased blood pressure
- Nausea/ sweating
- Vaginal bleeding (unexpected and heavy)

Letrozole

- Letrozole (Femara®)
  - Non-steroidal aromatase inhibitor
- Side effects
  - Hot flashes, hair loss, joint/bone/muscle pain, tiredness, nausea, diarrhea, dizziness, trouble sleeping, drowsiness, weight gain, weakness, headache, constipation
- Often given after the 5 year treatment with tamoxifen

Herceptin

- Trastuzumab (Herceptin) effective therapy for HER2/neu aggressive cancers
- One year of treatment typical
- Minor adverse effects of trastuzumab
  - Fever, chills, weakness, nausea, vomiting, cough, diarrhea, and headache
- A major adverse effect of trastuzumab
  - Possible damage to the heart muscle

Lapatinib

- Lapatinib (Tykerb)
  - Effective in the treatment of *HER2* aggressive cancers and cancers that are both *HER2* and ER+
  - New study used lapatinib and trastuzumab (Herceptin) for 2 weeks to shrink cancer

Severe Side effect

- May cause liver damage

Other Side Effects

- Nausea/vomiting/heartburn
- Sores on the lips, mouth, or throat
- Loss of appetite
- Red, painful, numb, or tingling hands and feet
- Dry skin
- Pain in the arms, legs, or back
- Difficulty falling asleep or staying asleep

Gene Therapy

- Genes are made up of the chemical DNA
  - Can show inherited mutations that predisposed a woman to cancer
  - Testing of cells from the cancer can look for mutations that drive the tumor's growth

Uses of Gene Therapy

- Inserts specific genes into cells to restore missing function or give new function
  - E.g. Replacing the tumor suppressor genes
    - To prevent cancer from developing, or stopping oncogenes or other genes important to cancer from functioning,
      - Oncogenes are mutated forms of normal genes that cause cells to divide out of control, leading to cancer
  - Stopping other genes important in allowing cancer cells to metastasize

Challenges

- The ability to sequence genes is ahead of the ability to understand what it means
  - The ambiguities abound - doctors sometimes cannot reach a consensus.
  - Results in misinterpretation or over-interpretation

Breast Reconstruction

- Breast reconstruction can be immediate or delayed
- Breast implants are made up of
  - A silicone shell filled with either saline or silicone gel.

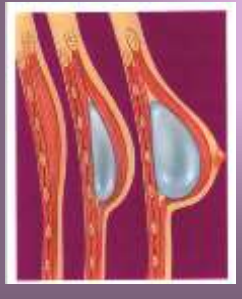
Immediate Reconstruction

- In the one-stage, immediate breast reconstruction
- After mastectomy the surgeon places the implant where the breast tissue was removed to form the breast contour.
- The chest tissues are undamaged by radiation therapy and there is one less surgery needed.

Delayed Reconstruction

- Done some time after surgery
- May be necessary if radiation immediately follows a mastectomy
- Needed if concern about skin damaged by radiation
- Skin is tight and flat

Reconstruction – Tissues Expansion



Breast Reconstruction

Autologous Tissue

- TRAM Flap

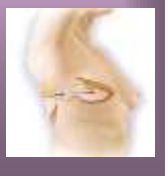
Transverse Rectus Abdominis Myocutaneous flap

- Muscle, fat and skin from abdomen used to create a new breast mound
- Further surgery needed to make nipple & areola
  - Free Flap
    - Tissue removed and breast mount created with micro surgery
  - Pedicle Flap
    - Breast mound tunneled to create new breast

Breast Reconstruction

Autologous Tissue Variations

- DIEP Flap (deep inferior epigastric perforator)
  - fat and skin from abdomen (no muscle)
- SIEP Flap (superficial inferior epigastric perforator flap)
- Latissimus Flap
  - Skin, fat and muscle from the upper back
- Muscle from thighs or buttocks



CC & MLO Tran Flap Imaging

Pain Medication and Pain Management

- Pain receptors are located throughout our bodies in nerve endings, in the skin and mucous membranes.
- Triggered by mechanical, chemical, or thermal stimuli, the pain signal is transmitted through the nerves to the spinal cord and then to the brain.

Cancer Pain

- 30% of all cancer patients experience pain
- 50% of patients are undertreated for cancer pain
- Reports of reluctance to provide analgesics to cancer patients because of concerns about inappropriate use or dependence on opioids

Causes of Cancer Pain

- Blocked blood vessels causing poor circulation
- Bone fractures
- Metastasis to the bone
- Cancer invading the neural structures
- Tumors exerting pressure on a nerve
- Infection
- Inflammation
- Adverse effects from treatments such as chemotherapy or other drugs, radiation therapy, and surgery

Acute/Chronic

- Acute pain may last only a short time and can be the result of surgery or an immediately injury.
- Chronic pain continues for 6 months or more, and depending on the severity of the pain can have life-altering implications for patients, such as diminished activities or dependence on aid for basic functions

Breakthrough Pain

- Breakthrough pain
  - The medication they are taking no longer controls the pain
    - Caused by changes in absorption, metabolism or elimination of the drugs.
- In end-stage cancer, chemotherapy, radiation or surgery can be used to reduce tumor size if the tumors are exerting pressure on a nerve.

Types of Treatment

- Intrathecal anesthetics
  - Pain-killing drugs injected directly into the cerebrospinal fluid
- Nerve blocks
  - Used to kill or deaden the nerve associated with the pain.
- Acupuncture
  - Inserting thin needles to stimulate specific nerves

Thank You