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</table>
## Chapter 1: Care of the Surgical Patient

### Assessment of Operative Risk
- Over 70
- Overall Physical status
- Elective v/s Emergency
- Physiologic Extent of Age Procedure
- Number of Associated Illnesses

### Preparation of Patient for Surgery
- Psychological frank but optimistic discussion, enumerate risks and complications
- Physiologic preparation: anemia, dehydration, electrolyte imbalances

### Pre-op Risk Factors Associated with Cardiac Complications
- MI prior 6 months
- Significant Aortic Stenosis
- Chronic Renal Failure
- PaO2 less than 60.
- PaCO2 greater than 50
- Patient bedridden from non-cardiac causes

### Risk Factors for Pulmonary Complications
- Thoracic and Upper abdominal surgery
- Anesthesia time greater than 3 hours
- Poor pre-op nutrition
- History of COPD
- Obesity

### Postop Fever
- A common occurrence postop major surgery in 50% of patients
- Greater than 80% of cases not caused by infection

### Notes:
### Complications to Avoid
- DVT/PE
- Acute Renal Failure
- Wound Infections
- Respiratory: Atelectasis/ Pneumonitis
- Wound Infection

### Physiology of Surgical Patient
- Stress Response, Neuroendocrine
- Fluid Shifts
- Pain
- Pulmonary Changes
- Coagulation Problems

### Stress Responsible
- Counter – Regulatory Hormones: Catecholamine's, GH, Glucagon, Cortisol
- Insulin
- Vasopressin, AD

### Cell – Derived Mediators
- Macrophage or monocyte: Lysozyme, PG, Leukotriene's, Lipoprotein Lipase, elastase, IL1, TNF, Interferon alpha, beta complement Plasminogen activator, Collagenase, Arginase Angiogenesis factor

### Neutrophil
- Leukotriene B4, Elastase, Acid Hydrolases Lysozyme, PGE2, Cathepsin G, Collagenase

### Mast Cell
- Histamine, Proteases, Heparin, Eosinophilic Chemotactic factor-anaphylaxis, Neutrophil Chemotactic factor, PGD2, Leukotriene’s C4, D4, E4, PAF, TNFArginase Angiogenesis factor

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**Notes:**

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**Stress Response**

- Insensible Losses: Sweat, via the lungs.
- Sensible Losses: Diarrhea, vomiting, NG, Foley
- Third spacing a sign of inflammation if several days after surgery
- Poor man’s Central Monitor: HR, BP, U/O

**Fluid Shifts**

- Leaky Capillary Membranes
- Third Spacing
- Insensible Losses
- Sensible Losses
- Electrolyte and Metabolic Disturbances with Various Losses
- SB Diarrhea, Colonic Diarrhea

**Nutritional Considerations**

- o Starvation
- o Gluconeogenesis
- o Catabolism
- o Ketosis
- o Insulin Resistance

**Nutrition**

- Intervention if > 10% Body WT. Loss Over 6 Months
- If the Gut Works use it
- Benefits of Enteral Nutrition Over Parenteral
- Enterohepatic Circulation and Liver Regeneration
- Lysozyme, PGE2, Cathepsin G, Collagenase

**Notes:**
**Anabolism /Catabolism**

- During Stress and Inflammation
- Protein Catabolism
- During Convalescence, Anabolism will Contribute to Rebuild up of Muscle

**Physiology of Surgical Patient**

- Consequences of Having Pain

**Pulmonary Changes**

- Atelectasis, Loss of Volume
- Pneumonia, Aspiration/Nosocomial, Bacterial Translocation

**Coagulation**

- Consumption, Dilutional
- HIT
- Drug induced Antibiotics

**Notes:**

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Chapter 2: Care of the Angiography Patient

Anatomy

- Inguinal Ligament
- Retroperitoneum
- Femoral Artery
- SFA
- DFA or Profunda
- Genicular Branches to Popliteal
- Tibioperoneal Trunk
- ATA, PTA, Peroneal

Angios or Heart Caths

- Micropuncture v/s Regular
- Radiographic Anatomic Landmark: The Femoral Head
- Standard Sheath Diam. 6 FR for Routine Heart Cath. and Angios
- AAA Endovascular 24 FR Sheath and 16 FR
- Some Interventions with 7 or 8 FR

Different Sealing Agents

- None Standard Sheath Pull
- MYNX
- Boomerang
- Angioseal
- Proglide
- Starclose
- When do You Get with Each Device
- Some Interventions with 7 or 8 FR

Notes:
Determining Factors

- Hypertension
- Anticoagulants
- Scar
- Patient Body Habitus
- Caliber of Vessel
- Level Access

Potential Complications

- Hematoma/False Aneurysm
- Retroperitoneal Hematoma
- Fistula AV Listen for a Bruit
- Embolization Compare Pre and Post
- Dissection
- Unstable Intimal Flap at Risk of Thrombosis
- Infection

Management of Complications

- U/S Guided Injection with Thrombin to False Aneurysm
- Covered Stent to AVF
- Covered Stent to High Stick and Bleeding
- Stent Dissection
- Stent Intimal Flap
- Value of IVUS

Value of a Good Assessment

- Start with a Good Assessment of Risks
- Understand the Procedure
- Be Aware of BP, any Heparin Effect on Board, ASA, Plavix
- Always Think of Murphy’s Law
- Renal Impairment is Associated with Platelet Dysfunction

Notes:
## The Care of the Surgical Patient

- Surgical Clearance, Comorbidities
- Preparations of the Patient
- Choice of Antibiotics
- Choice of Pre-op Hydration
- Bowel Prep.
- Skin Prep.
- Type and Hold
- Entereg for Bowel Surgery
- Plavix Pre-Angiography

## Comorbidities

- Diabetes: Check Hgb A1C, F.S.
- Cardiac: CHF, Cardiomyopathy, Pacer Defib., Risk of MI
- Pulmonary: COPD, Interstitial Lung Disease
- ESRD: Dialysis Patients, Non Dialysis Patients
- Obesity: Wounds DVT

## Preparation of Patient

- CXR, EKG, CBC, BMP
- Who Should Have a Stress Test
- Simple Bedside Assessment
- Bowel Prep.
- Hydration LR or NS
- DVT Prophylaxis
- Pulmonary Toilet
- When do we Stop Heparin Pre-op
- Skin Prep.
- Obesity: Wounds DVT

## Notes:

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## Choice of Pre-op. Antibiotics
- ANCEF, Most commonly Used
- Vancomycin for Implants like Joints, Pacers, Artificial Implants
- Invanz for Bowel Cases

## Pulmonary Toilet
- Incentive Spirometry
- Chest PT
- Cough and Deep Breathing
- Breathing Treatments

## Heparin
- Half Life is 1.5 Hrs.
- After 2X Half Life Drug is Out of System
- Lovenox Half Life is 12 Hrs.

## Skin Prep.
- Clip Don’t Shave
- Prep. with Hibiclens, Soap
- Reduce Bacterial Count

## Bowel Surg.
- Bowel Prep.
- Skin Prep.
- Entereg
- Hydration at Least 2 L Pre-op
- Invanz
- Type and Hold

## Who do we Type and Hold
- Hgb Below 10
- Type of Surgery
- Typically Transfuse if Hgb is Below 8.5 and Patient is Symptomatic, i.e. Tachycardia, Hypoxemia, Hypotension
- Typically One Unit Per Gram of Hgb Under 8.5

### Notes:
## Prep. Of Angiography Patients
- Hibiclens to Groins
- Hydrate at Least from Night Before
- If Cr is Greater than 1.2 then Biicarb Drip 3 AMPS in a Liter of Sterile Water at 80-100 ML/H
- Mucomyst 600 mg for 4 Doses
- Benephit Catheter with Fenoldopam Drip
- All Patients get Plavix for Angios

## Comorbidities Diabetes
- If Sugars are Elevated Increased Risk of Infection Due to Glycosylation of Proteins and Immunoglobulin’s
- Insulin is a Trophic Hormone Promotes Weight Gain and Water Retention Plus Fat Deposition
- Expect Sugar Levels to be High During Stress and Preoperatively

## Comorbidities Cardiac
- Patients with Defibrillators Usually Have EF Below 30%
- Risk of CHF
- Bedside Assessment: History, Leg Edema, Jugular Venous Distention, Rales on Auscultation
- Diabetics Have Silent Ischemia

## Comorbidities Pulmonary
- Monitor Pulse OX for Hypoxemia
- Beware of CO2 Retention for it can Cause Hypertension and Narcolepsy
- Increased Risk of Pneumonia
- Most of These Patients Have Been on Steroids and Heal Poorly

### Notes:

__________________________

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### Dialysis Patients
- Life Expectancy on Dialysis is Limited
- Platelet Dysfunction
- Poor Healing
- These Patients Don’t Tolerate High Rates of IV Fluids
- Most have Severe CA

### Obesity
- An Epidemic in our Community
- Increased Risk of Wound Infection
- Increased Risk of DVT
- Increased Risk of Diabetes
- Fat Necrosis in Incisions Lead to Wound Infection

**Notes:**
## Chapter 3: Fluids and Electrolytes

### Fluids
- TBW = 60% Total Lean Body Weight
- INTRAC WATER = 60% TBW
- EXTRAC WATER = 40% TBW, 32% Interstitial AND 8% Intravascular
- INTRAC = Na 10 Meq, K 140 Meq
- EXTRAC = Na 140, K 4

### Minimal Obligatory Water Intake
- Ingested Water 500 ML
- Water in Food 500 ML
- Water from Oxidation 300 ML

### Minimal Obligatory Water Output
- Urine 500 ML
- Skin 500 ML
- Respiratory Tract 400 ML
- Stool 200 ML
- Sensible and Insensible Losses in the Surgical Patient
- NG, Fistulae, Drains
- Third Spacing, Interstitial Edema

### Hyponatremia
- Excess Free Water
- Impaired Renal Excretion of Free Water
- Siadh, Adrenal Insufficiency, Hypothyroidism
- In Severe States, Cerebral Edema, Seizures

### Hypernatremia
- Renal Water Losses: D.I., Osmotic Diuresis, Hyperglycemia
- G.I. Losses: Diarrhea, Vomiting
- Insensible Losses: Sweating, Burns
- Administration on NaBicarb or NaCl
- Neurologic Impairment

### Notes:
- Minimal Obligatory Water Intake
- Hyponatremia
- Hypernatremia
### Factors Influencing K

- Catecholamines (K Entry to C)
- Extrac PH (Acidosis, K Loss)
- Plasma Osmolality (Hyperosm, K Movement Out of Cell)
- K Atpase Activity ( Maintains Intrac K)

### Hypokalemia

- GI Losses
- Increased Urinary Losses
- Increased entry into Cell
- Decreased Intake
- SX: Muscle Weakness Paralysis, Arrhythmias

### Hyperkalemia

- Renal Failure
- Acidosis
- Betablockade
- DIG Overdose
- Insulin Deficiency

### Calcium Homeostasis

- 50% Ionized, 40% Protein Bound, 10% Complexed to P
- Bone > 99%
- Intestinal Excretion (98% Reabsorbed)

### P. Homeostasis

- 90% in Bone
- HYPOP: Hyperpart, DKA, RTA, HYBOK, HYPOMg, Alkalosis, Decreased Intake
- HYPREP: Renal Failure, Hypoparat, Cell Injury, Crush

### Notes:
**Magnesium**
- Low in Alcoholics, Renal Excretion
- Diuretics, Hypercalcemia, GI Losses, Intestinal Bypass, Malabsorption, Diarrhea
- Hyper in Renal Insufficiency

**Acid Base Balance**
- Acidosis Below 7.40
- Alkalosis Above 7.40
- Normal PCO₂=40
- Respiratory Alkalosis Below 40
- Respiratory Acidosis Above 40
- You Can Never Overcompensate
- The PH Usually Dictates the Primary Component

**Main Electrolytes in GI Fluid Loses**
- Stomach: H+, Na+, K+, CL-
- SB: Na+, K+, HCO₃-
- Colon: CL-
- Bile: Na+, K+, HCO₃-

**Nutritional Intervention**
- 10% WT Loss Past 6 Months Immediate Otherwise Wait 5 days NPO
- To Reduce Gluconeogenesis
- Prevent Excessive Protein Losses N Balance: P/(6.25-(UUN+3))
- Target 22 KCA:/KG in Most PTS Except Trauma and Burns
- 1 gm/Kg of Protein
- 1 gm/Kg of Fat
- Remainder in CHO

**Notes:**

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**Indirect Calorimetry**

- Measurement of O2 Consumption and CO2 Production
- Caloric Needs Allows a Prediction of Work of Breathing and Potential for Patient to be Extubated

**Nutrition**

- Use the Gut When it Works
- Do Not Feed the Gut if on Pressors or Patient is Hypotensive
- Ileus is Not a Contraindication to Low Rate Enteral Feeds
- Elemental Formulae Vivonex Rich in Glutamine
- Arginine Important in Immune Response
- Structured Lipids Where Omega 2 Fas are Mounted on MCT for Early Gut Absorption

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**Notes:**
Chapter 5: Surgical Critical Care

Goal of Critical Care

- Assuring Adequate O2 Delivery to Every Cell
- Monitoring and Adjusting Therapy Accordingly
- Metabolic Support and Nutritional Support

Hemodynamic Monitoring

- What is a Poor Man's Swan
- CVP
- PAP
- HR, BP, U/O
- Oximetric Swan and MVO2
- Art Line

Hemodynamics

- What is C.O., C.I.
- S.V.
- Preload EDV
- CVP Reflects RVEDP
- PCWP Reflects LVEDP (V Compliance is Unchanged)
- Afterload
- SVR Responsible for LV Afterload
- PVR Affects RV and Also LV
- Contractility
- O2 Demand, Content and Delivery
- Arterial Lactate
- How do you Increase Preload

Metabolic and Nutritional Support

- Acid Base Balance
- Fluid and Electrolytes
- Nutritional Delivery

Notes:
| Per-op. Fluid Shifts          |  > Third Spacing, Interstitial Edema  
|                              |  > Plasma Oncotic Pressure  
|                              |  > Inflammatory Phase/Convalescence Phase  
|                              |  > Cytokine Release  |
| Low Urine Output             |  > List Three Causes that Contribute to it  
|                              |  > Hypovolemic Shock  
|                              |  > Cardiogenic Shock  
|                              |  > Renal Insufficiency  |
| Shock                        |  > Inadequate Organ Perfusion and Tissue Oxygenation  
|                              |  > Most Injured Patients are in Hypovolemic Shock  
|                              |  > Isolated Brain Injuries Do Not Cause Shock  
|                              |  > Spinal Shock  |
| Cardiac Physiology           |  > CO=SV X HR  
|                              |  > SV is Dependent on Preload, Contractility and Afterload  
|                              |  > Preload= Volume Status  
|                              |  > Contractility Staling's Law  |
| Recognition of Shock         |  > Tachycardia  
|                              |  > Cutaneous Vasoconstriction  
|                              |  > Narrow Pulse Pressure  
|                              |  > Compensatory Mechanisms  |

Notes:
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<th>Classes of Hemorrhage</th>
<th>Trauma Evaluation Primary Survey</th>
<th>Main Electrolytes in GI Fluid Loses</th>
<th>Volume Resuscitation</th>
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<tr>
<td>Class I Loss of up to 15% Blood Volume (750 ml)</td>
<td>Airway C-Spine</td>
<td>Stomach: H+, Na+, K+, CL-</td>
<td>3:1 Rule 2L Crystalloid</td>
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<tr>
<td>Class II 15-30% (750-1500)</td>
<td>Breathing</td>
<td>SB: Na+, K+, HCO3-</td>
<td>20 ml/kg in Children</td>
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<tr>
<td>Class III 30-40% (1500-2000)</td>
<td>Circulation</td>
<td>Colon: CL-</td>
<td>Class III and IV Blood 1:1 and Crystalloid 3:1</td>
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<tr>
<td>Class IV More than 40% (&gt; 2000)</td>
<td>Disability</td>
<td>Bile: Na+, K+, HCO3-</td>
<td>Warm Fluids</td>
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<td>Exposure</td>
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<td>2 Large Bore IVS, Central Introducer</td>
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</table>

**Notes:**

- 3:1 Rule 2L Crystalloid
- 20 ml/kg in Children
- Class III and IV Blood 1:1 and Crystalloid 3:1
- Warm Fluids
- 2 Large Bore IVS, Central Introducer
Chapter 6: Wound Care Center

Wound Care Experience

- Locally 14 Years of Diabetic Foot Work
- Venous Ulcer MGT.
- Decubitus Care with Flaps
- First to Introduce in the Region Novel Therapies: Apligaf, Dermagraft
- Wound Vac., Topical O2 Therapy
- Venous Ulcer MGT.
- Resource to Hospital W.C. Nurse
- Successfully Managing Wound Care Program at Subacute Facility
- Integral Part of my Vascular Practice

Normal Wound Healing

- Phases
  - Hemostasis – Minutes
  - Inflammation - Days
  - Proliferation - Weeks
  - Remodeling - Years

Normal Wound Healing

- Cellular Activity
  - Chemotactic Migration - Inflammation
  - Mitosis - Inflammation
  - Angiogenesis - Proliferation
  - Synthesis - Proliferation
  - Proteolytic Turnover of ECM - Remodeling

Notes:
Clinical Management

Assessment
- Does this Patient Have the Ability to Heal?
- Consider the Overall Goals of Care
- Etiology of Wound
- Factors that Contribute to Impaired Healing

Biochemical Differences

Healing Wound
- Cell Mitosis
- Pro-Inflammatory Cytokines
- MMP’s
- Growth Factors
- Cells Capable of Rapid Response

Chronic Ulcers
- Mitogenic Activity
- Pro-Inflammatory Cytokines
- MMP’s
- Varied Levels of Growth Factors
- Senescent Cells

Debridement

Methods
- Surgical
- Mechanical
- Autolytic
- Enzymatic

Topical Oxygen Research Project: My Local Experience 2005-2006

Arterial and Neuropathic Non Healing Ulcers-174 Patients
- Gangrene- 60 Patients
- Venous Stasis
- Ulcers – 56 Patients
- The Care of These Patients Generated Angiograms Vascular Interventions Including Bypasses, Skin Grafts and Other Innovative Therapies

Qualifications of a Director

Dedication to the Field of W.C.
- Experience
- Leadership Skills
- Lecturer in the Field
- Research (Topical O2)
- Innovative Therapies (Tissue Substitutes, lap.linton)
Diabetic foot infection debrided then grafted

Diabetic foot infection debrided then grafted-Post

Diabetic foot infection debrided then grafted-Post
Chapter 7: *Cancer Screening Symposium*

**Screening**
- Methods of Screening
- Preventive Medicine, Have you Had a Physical Lately
- Inquire About your Family History, Value of Genetic Testing
- Value of Genetic Testing
- X-Rays, Endoscopy

**Screening for Skin Cancer**
- Exam, Screening
- Incidence Has Increased
- Avoid Excessive Sun/Tanning Booth Exposure
- Increased Risk in Fair Skin
- Big Hats V/S Caps

**Screening for Lung Cancer**
- Smoking
- Secondary Smoking
- No Good Cheap Screening Tool
- Cat scan Not Chest X-Ray
- Discovered Late
- Highest Incidence

**Screening for Colon Cancer**
- Hereditary Non Polyposis C.C.
- Adenomatous Polyposis Coli Gene
- Colonoscopy
- Occult Blood in Stools
- Anemia, Change in Caliber of Stools and Pattern
- CEA

**Notes:**
### Screening for Stomach Cancer
- Incidence has Dropped 75% Since 1930’s Shift From Distal to Proximal
- 10th Most Leading CA in the US
- H. Pylori, Intestinal Metaplasia and Atrphic Gastritis, Pernicious Anemia
- HNPCC
- Risks: High Salt Diet, Smoked Foods, Low Fruit and Fresh Vegetables
- Miners, Metal Workers and Rubber Workers
- Endoscopy

### Screening for Esophageal Cancer
- 1% of Newly Diagnosed CA/YR
- 7x More Common in Men
- Risk Factors: Alcohol, Smoking and Gastroesophageal Reflux
- Barrett’s Esophagus 125x Pop Risk
- Patients Present Late
- Endoscopy

### Screening for SB Cancer
- Rare Usually Late Presentation
- Chronic ABD Pain
- CEA
- Capsule Endoscopy, Sbseries

### Screening for Thyroid Cancer
- Physical Exam
- Thyroid U/S
- HX of Radiation Exposure
- Usually Slow Growing
- Capsule Endoscopy, Sbseries

### Notes:

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<table>
<thead>
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<th>Cancer Type</th>
<th>Screening Tests</th>
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| **Screening for Lymphoma/Leukemia** | > Enlarged Lymph Nodes by Exam  
> Weakness, Night Sweats  
> Blood Test, Bone Marrow  
> No Good Screening Tools |
| **Screening for Brain Cancer** | > Cat Scan  
> Severe Headaches, Seizures |
| **Screening for Liver Cancer, GB and Pancreas** | > BG Polyps Increase the Risk Discovered on U/S  
> Chronic Alcohol, Pancreatitis  
> Hepatitis  
> Cat Scan U/S  
> Tumor Markers (Blood Work) |
| **Screening for Breast Cancer** | > Mammography, P.E., U/S, MRI  
> Genetic Testing: BRAC 1,2  
> Prevention with Medications in Patients with Precancerous Lesions |
| **Screening for Prostate Cancer** | > PSA Testing  
> Rectal Exam  
> Prostate U/S and BX  
> Precancerous Lesions |
| **Screening for Ovarian Cancer** | > o CA125  
> o BRCA  
> o U/S Cat Scan  
> o Physical |

**Notes:**

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<table>
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<tr>
<th>Screening for Cervical Cancer</th>
<th>o Pap Smear</th>
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<td>Screening for Uterine Cancer</td>
<td>Pap Smear</td>
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<td>Endometrial BX</td>
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<td>PE, U/S</td>
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<td>Screening for Bladder/</td>
<td>Urine Test and Work Up for Hematuria</td>
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<td>Kidney Cancer</td>
<td>Cystoscopy</td>
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<td></td>
<td>Cat Scan</td>
</tr>
</tbody>
</table>

**Squamous cell CA-Arm**
Squamous cell CA-Arm

Squamous cell CA-Arm Post Resection

Metastatic Melanoma to liver
# Cutaneous Neoplasms

## Most common tumors diagnosed with 1.4 million cases per year
- Most common are basal cell and squamous cell
- Melanoma accounts for 4% of cases but 75% of deaths related to skin cancer
- 1:5 Incidence of skin cancer
- Melanoma 1:41 men and 1:61 women

## Risk Factors
- Fair complexion, blue and green eyes
- Blonde and red hair, freckling
- Uv light, sun tanning booths
- Peeling and blistering sunburns
- Melanoma higher closer to equator
- Actinic keratosis
- Xeroderma pigmentosa
- Family history of melanoma 10-15%
- Mc1r mutation
- Cdkn2a/p16/mc1r mutation
- Atypical nevi, dysplastic nevi
- Multiple nevi adults 100, children 50

## FAMM
- Familial atypical multiple mole melanoma syndrome
- Autosomal dominant
- 10 Year risk 10.7% vs 0.6%

## Xeroderma Pigmentosa
- RARE RECESSIVE DISORDER
- INABILITY TO REPAIR OF DNA DAMAGED BY UV LIGHT
- 10 Year risk 10.7% vs 0.6%

## Notes:
### Congenital Melanocytic Nevi

1-6 % of children born with CMN  
Classified by size  
Small less than 1.5 cm  
Medium 1.5-20  
Giant > 20 cm

### NCM

- Neurocutaneous melanocytosis  
- Leptomeningeal tumors  
- Neurologic manifestations in the first 2 years of life

### Clinical DX

- Abcd rule  
- Asymmetry, irregular border, color, diameter (> 6 mm)  
- Nodular melanoma may not exhibit the abcd rule

### Melanoma Histology

- LMM lentigo maligna 10-15%  
- SSM superficial spreading  
- NM nodular melanoma  
- Alm acral lentiginous

### LMM

- 10-15% invasive LMM  
- Lm is in situ

### SSM

- 70% of melanomas  
- Arise in preexisting nevus  
- Variation in color, border, surface

### NM

- 70% of melanomas  
- Arise in preexisting nevus  
- Variation in color, border, surface

### Notes:

- NCM: Clinical DX  
- LMM: 10-15% invasive LMM  
- SSM: 70% of melanomas  
- NM: 70% of melanomas
### ALM
- Hands, feet, subungual (big toe, thumb)
- 2-8% of melanomas in whites
- 35-60% in people of color

### Staging
- Breslow, depth thickness in mm
- Tnm
- Stage 0 in situ
- Stage I local disease
- Stage II local disease
- Stage III regional nodal or satellite mets
- Stage IV distant mets

### Other Prognostic Factors
- Ulceration: poorer prognosis
- Tumor microstaging
- Nodal status
- Distant mets

### Treatment
- Biopsy excisional down to SC fat 1-2 mm margin for small lesions
- No wide excision initially in order to allow SLN biopsy
- Do not shave, we need to assess depth
- Second excision margins 0.5-2 cm

### Lymph Node Dissection
- Nodal basin dissection if SLN pos
- Can be curative after complete lymphadenectomy
- Depth 1-3 mm require SLN
- Depth above 3 mm need CLND and adjuvant
- Depth below 1 mm usually no SLN

### Notes:

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<table>
<thead>
<tr>
<th><strong>Adjuvant Therapy</strong></th>
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<tbody>
<tr>
<td>&gt; Interferon alpha2b improvement in survival by 24% over 5 years</td>
<td></td>
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<tr>
<td>&gt; Isolated limb perfusion</td>
<td></td>
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<tr>
<td>&gt; Radiation rx high morbidity after clnd</td>
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<tr>
<td>&gt; Immunotherapy il-2</td>
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<tr>
<td>&gt; Chemotherapy limited dtic dacarbazine</td>
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<table>
<thead>
<tr>
<th><strong>Basal Cell CA</strong></th>
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<tr>
<td>&gt; Most common</td>
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<tr>
<td>&gt; Slow destructive local invasion</td>
<td></td>
</tr>
<tr>
<td>&gt; Rarely mets</td>
<td></td>
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<tr>
<td>&gt; Recurr</td>
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<table>
<thead>
<tr>
<th><strong>Squamous Cell</strong></th>
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<tbody>
<tr>
<td>&gt; Second most common</td>
<td></td>
</tr>
<tr>
<td>&gt; Can deeply invade and mets to regional nodes</td>
<td></td>
</tr>
<tr>
<td>&gt; Precursor lesions actinic keratosis Bowen disease(in situ)</td>
<td></td>
</tr>
<tr>
<td>&gt; Radiation therapy</td>
<td></td>
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<table>
<thead>
<tr>
<th><strong>Merkel Cell</strong></th>
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<tbody>
<tr>
<td>&gt; Mcc higher mortality than melanoma</td>
<td></td>
</tr>
<tr>
<td>&gt; Cutaneous neuroendocrine ca</td>
<td></td>
</tr>
<tr>
<td>&gt; Uv and immunosuppression</td>
<td></td>
</tr>
<tr>
<td>&gt; Red purple or sc nodule mistaken for a cyst</td>
<td></td>
</tr>
<tr>
<td>&gt; Mets to nodes, lung brain, bone liver</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
Sarcoma of upper ext.

Sarcoma of the Thigh

Melanoma tatoed for sentinel node biopsy then excised with STSG

Melanoma tatoed for sentinel node biopsy then excised with STSG2
Chapter 8: Breast Diseases

**Benign**
- Fibrocystic alteration
- Simple cyst
- Complex cyst
- Fibroadenoma
- Lipoma, fibrolipoma
- Ductal hyperplasia
- Sclerosing adenosis
- Papillomas

**Premalignant**
- Atypical ductal hyperplasia ADH
- LCIS
- Prevention trial use of tamoxifen in ADH and DCIS
- Giant cysts
- Large papillomas

**Malignant**
- Staging TNM
- Size of mass
- Lymph node status
- Inflammatory breast cancer
- Distant metastases
- Receptors: Estrogen, Progesterone, Neu 2
- General Guidelines in therapy
- If breast preservation then radiation therapy to prevent local recurrence
- Systemic chemo for younger patients even if early disease. Treat as Systemic disease.
- Brachytherapy in early disease small tumor neg. nodes needs 8 mm margin between balloon and skin.

**Notes:**
Breast Cancer

Untreated Breast
### Endocrine Organs

- Pituitary
- Thyroid
- Parathyroid
- Adrenals
- Pancreas

### Adrenals

- Atypical ductal hyperplasia ADH
- LCIS
- Prevention trial use of tamoxifen in ADH and DCIS
- Giant cysts
- Large papillomas

### Adrenal Cancer

- 1% Of Adrenal Tumors Rare
- Median Age 40-50
- 60-80% Functioning
- Suspect In Glands Over 6 Cm

### Adrenal Cushings

- Htn, Obesity, Rashes, Hirsutism
- Acth-Dependent Tumors 80% Bilateral Hyperplasia Secondary To Pituitary Adenoma (Elevated Plasma Acth)
- Acth Independent Primary Adrenal Adenoma Or Hyperplasia
- Ectopic Acth Small Cell
- Unilateral Adenoma, Bilateral Hyperplasia

### Notes:
| **Pheochromocytoma** | Extradrenal Counterpart Paraganglioma  
| | Men2 Ret Gene Mutation, Vhl Gene, Neurofibromatosis Type1  
| | Secrete Epi , Norepi, Dopamine  
| | Curable Form Of Htn In 0.1-1%  

| **Adrenals** | Fna Is Rarely Indicated And Not Capable Of Distinguishing Benign From Malignant  
| | The Decision To Remove Is Based On Size Of Lesion Its Functionality And Imaging Characteristics  

| **Thyroid** | 5% Of Nodules Are Malignant  
| | Nodular Thyroid Prevalence Is 15%  
| | Fnab  
| | Hypothyroidism  
| | Hyperthyroidism  
| | Decision For Surgery  

| **Thyroid Cancer** | Papillary 80%  
| | Follicular 10%  
| | Hurtle Cell Ca 3%  
| | Medullary Ca Of Thyroid 7%  
| | Patients Are Asymptomatic And Present With Nodules  
| | Anaplastic Thyroid Ca 1-2%  

| **Parathyroids** | Primary Usually An Adenoma , Localization For Radioguided Surgery  
| | Secondary , Tertiary  
| | Symptoms Of Severe Hypercalcemia Treatment Glucocorticoids, Calcitonin  
| | Hypocalcemia  

**Notes:**
Chapter 9: The Pancreas

The Pancreas

- Acute Pancreatitis
- Chronic Pancreatitis
- Pancreas Divisum
- Pancreatic CA
- MEN
- Metabolic and Exocrine Role

Acute Pancreatitis

- 85% Mild with Edema of Gland, rare necrosis
- Treat with IVF, bowel rest and analgesics
- 15% Severe, Circulatory shock with Multiple Organ Dysfunction
- These patients can develop ARDS, DIC, GI bleeds, Pancreatic necrosis with pseudocyst formation and risk of Abscesses
- Associated with splenic vein thrombosis, colonic ischemia
- The lack of adequate Resuscitation over the first 24 h will lead to Exacerbation of the Pancreatitis and worsening of the patient.
- Alcoholism and Biliary Disease account for 80%
- ERCP 2-5%
- Hyperlipidemia
- Medications: Diuretics, Steroids, Sulfonamide, Tetracycline, Estrogen, antiAIDS meds
- Trauma
- CABG, Hyperparathyroidism
- Pancreas Divisum
- Pancreatic CA (over age 50 with no hx of ETOH / Gall stones should Investigate

Notes:
Basic Principals in RX

- Determination of Etiology
- Physiologic Assessment of Severity (Ranson’s sign, APACHE II)
- Fluid Resuscitation with Isotonic Solution (LR, NS)
- Goal is to Optimize Cardiac Output, Replenish Intravascular space and avoid Tissue Hypoperfusion
- Third Spacing is a result of large capillary leaks which results in Interstitial Edema (Michelin Tire)
- Support the Patient Metabolically, consider TPN
- Mechanical Ventilation
- Prevention of Infection
- Management of sterile Necrosis

How to Assess Severity

- Ranson’s 11 signs Predictors of Survival (Apply first 48 hrs)
- 1-2 Rans signs less than 1% mortality
- 3-4 Rans signs 15% mort
- 5-6.........................40% mort
- >7 Ranson’s signs Fatal

Apache Scores

- Ranson’s 11 signs Predictors of Survival (Apply first 48 hrs)
- 1-2 Rans signs less than 1% mortality
- 3-4 Rans signs 15% mort
- 5-6.........................40% mort
- >7 Ranson’s signs Fatal

Notes:
## Anatomic Assessment

- Anatomic Indices of Severity
- The Role Of Dynamic CT of the Pancreas
- This will Identify Patients with Necrosis and at risk of Infection
- Patients with Ranson’s >2 or Apache >7 would benefit from a Dynamic CT (Rapid Bolus of Contrast with 1 mm cuts)
- Looking for Necrosis, fluid, degree of fat streaking and saponification of tissue, air bubbles in fluid suggesting abscess
- Looking for Vascular Thromboses, SMV, Splenic vein, mesentery of the Transverse colon.
- Fluid collections are seen in 30-50% of patients.

## Therapeutic Approach

- Acute Pancreatitis should Be Managed in Collaboration with a Surgeon on Board.
- The First 24 h are very crucial
- Expect a positive fluid balance in the first 2-3 days for up to 10L/d
- NO LASIX
- May Need VENT support
- NG in severe Pancreatitis, +/- in mild to moderate
- TPN in severe Pancreatitis
- Jejunal enteral feeding rather than gastric
- May feed via the stomach if NO FEVER, NL WBC, NON TENDER ABDOMEN
- Debate pros and cons of ERCP in Biliary Pancreatitis cases

## Notes:
Therapy

- Infection of Pancreatic tissue does not occur without Necrosis
- Antibiotic Prophylaxis in Patients with Necrosis (35% E.Coli)
- Imipenim has high penetration in pancreatic tissue, trials have supported its use.
- Manage Non Infected Necrosis Conservatively
- OPERATIVE Therapy: Timing of Debridement
  - Surgical Necrosectomy, Open Packing, submit tissue for Quantitative Cultures

Pancreas Divisum

- Dorsal and Ventral Ducts are both present But Do NOT Communicate
- Ventral Duct serves the Head of the pancreas and the Uncinate process by way of duct of Wirsung into Major papilla
- Dorsal duct serves the body and tail and drains via the duct of Santorini via the Accessory papilla.
- There are variations to the anatomy

Clinical Significance

- Most patients are Asymptomatic
- Some Patients have recurrent pancreatitis and pancreatic pain
- Women 3:1 Epigastric pain radiating to back, postprandial
- Initially sporadic then becoming constant
- Most attacks are mild
- Small ducts tend to stricture
- ERCP
- Surgery

Notes:

1. Pancreas Divisum
2. Clinical Significance
### Pancreatic Pseudocyst
- Commonly cause abdominal pain
- Result from an episode of severe pancreatitis
- 25% spontaneously resolve
- Patients with Chronic Pseudocysts or Asymptomatic can be safely observed
- Complications: Bleeding, Rupture, Increase in Size
- Operation of Choice is Internal drainage
- Some patients require Distal Pancreatectomy

### Chronic Pancreatitis
- Result of recurrent episodes of pancreatitis
- Commonly associated with strictures resulting in Ductal Dilation
- Treat conservatively with exocrine replacement and analgesics
- Celiac Nerve Blocks
- Failure of conservative RX results in Surgery
- Puestow Procedure if duct is dilated
- Pancreatic resection if duct is normal in size

### Periampullary Cancer
- Patients present with jaundice, weight loss and abdominal pain
- Surgery is avoided if Metastatic disease is found or vascular encasement
- Palliative therapy to relieve biliary and duodenal obstruction
- 5 year survival after surgery: Pancreatic 10-25%, Distal bile duct 15-40%, Ampullary 25-55%, Duodenal Adenocarcinoma 30-60%
- Pancreatic resection if duct is normal in size

### Unusual Pancreatic Tumors
- Cystic Neoplasms of the Pancreas: Serous Cystadenoma, Mucinous Adenoma or Carcinoma
- Pancreatic Islet Cell Tumors, Glucagonomas, Insulinomas, VIPOMAs, Somatostatinomas, PTH-Rpoma, ACTHoma, GRFoma
- Tumors are difficult to localize
Pancreaticoduodenectomy Whipple Procedure

Surgical Bed Post Whipple
Metastatic Thyroid Cancer in the Neck

Necrotic Pancreas

Necrotic pancreas Excised
Recurrent Thyroid Cancer in the Neck

Thyroid Mass
## Chapter 10: *The Esophagus*

<table>
<thead>
<tr>
<th><strong>Motility Disorders</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Upper third of esophagus: neurogenic, myogenic disorders</td>
</tr>
<tr>
<td>➢ Neurogenic: cva, als, parkinson’s</td>
</tr>
<tr>
<td>➢ Myogenic: muscular dystrophy, myesthenia</td>
</tr>
<tr>
<td>➢ No surgical rx for this category, consider peg</td>
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</tbody>
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<table>
<thead>
<tr>
<th><strong>Disorders of Prox. 1/3</strong></th>
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<tbody>
<tr>
<td>➢ Zenker’s diverticulae: idiopathic</td>
</tr>
<tr>
<td>➢ Prior neck radiation, surgery or injury to rln(affects relaxation phase of cricopharyngeus)</td>
</tr>
<tr>
<td>➢ Caustic burns</td>
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<table>
<thead>
<tr>
<th><strong>Disorders of Distal 2/3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Smooth muscle lower 2/3 v/s upper 1/3 skeletal</td>
</tr>
<tr>
<td>➢ Achalasia, despasm, hypertensive les (normal peristalsis in remainder of esophagus contrary to achalasia)</td>
</tr>
<tr>
<td>➢ Gerd, scleroderma, diabetes</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th><strong>Esophageal Diverticula</strong></th>
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<tbody>
<tr>
<td>➢ Partial wrap to prevent reflux post myotomy(you go thru ge junction) 90-95%</td>
</tr>
</tbody>
</table>

### Notes:
Achalasia

- Nutcracker esophagus, bird’s beak, endoscopy, manometry (les nl or htn. Aperistalsis in esophagus and failure of relaxation in les.
- In nutcracker you can have pain and elevated pressures
- Esophagus becomes a reservoir
- Botox in les 50%, dilation with balloon 70-80% (2% perforation)
- Surgical heller myotomy w or w/o a fundoplication
- Partial wrap to prevent reflux post myotomy (you go thru ge junction) 90-95%

Zenker’s

- Cric 60 mm hg resting, failure to relax
- Incoordination, regurg, aspiration, hoarseness.
- Surgery
- Cricopharyngeal myotomy resect if large tics, if small pexy the tic

Epiphrenic Diverticulae

- Gerd
- Chronic aspiration, foul odor breath
- Assoc with hypertonic les
- Lt thoracotomy exposure lower esophagus
- Myotomy, resect and fundoplication
- Tics, if small pexy the tic

Notes:
Esophageal Trauma

- Mostly iatrogenic
- Cervical and GE junction most common
- Spont Boorhave’s
- Blunt, penetrating
- Sc Air
- Pleural effusion Lt
- Resuscitate patient
- Identify site of perf, scope
- Correct the
- Underlying pathology along with perf
- Jejunostomy tube
- Chemical burns mostly affect lower esophagus, evaluate for stricture and dilate, steroids, antibiotics

Cancer

- Squamous cell 1/3 and dropping
- Alcohol, tobacco, achalasia
- Adeno lower 1/3 reduced with wine cons assoc with reflux
- Endoscopic U/S, endo, pet
- Staging Tnm T1 submucosa, T4 mediastinum
- Most present advanced St3
- Screening for Barrett’s
- Multimodality but surgery is the main Rx? Role of neoadjuvant Rx
- Survival nodal status neg 30-50%
- Survival node pos less 30%
- Surgery with 5 cm margins celiac node dissection as part of procedure
- Ivor Lewis lap and rt thoracotomy (1-2% leak anastomosis in the chest)
- Transhiatal esophagectomy (stomach to neck) ideal for early GE junction ca

Notes:
<table>
<thead>
<tr>
<th><strong>Postesophagectomy</strong></th>
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<tbody>
<tr>
<td>Conduit Stomach, Colon, Jejunum</td>
<td></td>
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<tr>
<td>Cost Of Long Term Medical Rx</td>
<td></td>
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<tr>
<td>Sx Recurr Once You Stop Medicine</td>
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<tr>
<td>2-3 Cm Intraabd Esop, Close The Hiatus And A Wrap</td>
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<tr>
<td>Collis Gastroplasty To Lengthen The Esophagus</td>
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<tr>
<td>Barrett’s Replacement Of Sq By Columnar 5-6 Cm Up</td>
<td></td>
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<tr>
<td>Adenoca 12,000 New Cases A Year</td>
<td></td>
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<tr>
<td>Medical Studies No Regression Of Columnar</td>
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<tr>
<td>Surgery Nissen, Toupe, Belsey</td>
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**Notes:**

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Diaphragm
Chapter 11: The Stomach

The Stomach

- Parietal Cells In The Fundus And Body Make Acid And If
- Chief Cells Produce The Digestive Enzymes (Pepsinogen Group Of Enz)
- Antrum Neuroendocrine G Cells That Make Gastrin
- Other Ne Cells That Produce Peptides Like Somatostatin, Subst P, Glucagon

Ulcus

- Acid Central Role
- Hpylori Assoc With Du 95%, As Well As Gastric Ze Syndrome
- Mucosal Barrier (Mucus, Bicarbonate Epith Cells) Affected By Blood Supply, Role Of Pg
- 1/5 Pts On Nsaids Will Develop Ulcer (Decreased Pg Affecting Mucosal Barrier)
- Hpylori Will Increase Gastrin Production And Acid. Toxin Damages Epith Layer, Produces Ammonia Which Damages Mucus And Stimulate Gastrin
- Du Most Common In Bulb 90%
- Bile Reflux Gastritis
- Ulcers Distal To The Papilla Think Ze
- Endoscopy Gold Standard
- Serum Gastrin > 300 Ze
- Secretin Infusion Test Raises Gastrin In Ze
- Hpylori Test By Bx And Urease. F/U Can Be Done With The Breath Urea Test, Ab Test Not As Sensitive Since Pts Remain Pos. Even After Rx
- H2 Blockers Also Dec Basal Acid Secretion (75% Healed At 4 Weeks)

Notes:
Ulcer (Continued)

- PPI and treatment for H. pylori: Antacids and carafate stimulate PG release, bicarb and coating the mucosa.
- 10% of pts perforate almost all pts are operated on. (Careful selection of pts) Graham patch.
- Gastric outlet obstruction: PPI, antibiotics, decompression, nutrition, gastric reduction surgery.
- Bleeding most commonly stops spontaneously, endo, surgery.
- Acid lowering procedures: V+A, highly selective vagotomy, V+P.
- Intractable ulcer rare.
- Postgastrectomy syndromes.
- Pancreas divisum.
- Pancreatic Ca (over age 50 with no Hx of Etoh / gall stones should investigate).

Gastric Ulcers

- Type IV: 10% defect in mucosal barrier, no association with acid, GE junction.
- Type I: Incisura, low acid.
- Type II and III: Lesser Curv, prepyloric like du.
- Ulcers on the greater curv R/O Ca.
- If they don’t heal in 3 months operate.
- Bleed from multiple areas.
- Key to Rx is prevention.

Stress Gastritis

Notes:

- Stress gastritis.

- Ulcers on the greater curvature are at risk for cancer if not healed in 3 months.
- Key to Rx is prevention.
Gastric CA

- Men 60
- Trend Towards Prox
- H Pylori Assoc With Distal 1/3
- Mucosal Alterations Intestinal Metaplasia, Diet
- Atrophic Gastritis
- 15% Of Gastric Polyps Are Adenomas And Increase The Risk
- Hypertrophic Gastritis Menetrier
- Intestinal Type And Diffuse Type
- Poorly Diff In Prox Stomach Us
- Intestinal Japan
- Staging R/O Liver Mets, Laparoscopy
- Tnm
- Primary Treatment Is Resection With Lymphadenectomy
- No Clear Advantage To Adjuvant Rx
- 5% Lymphomas 50-60
- Carcinoid
- Stromal Tumors

Notes:
Radical Total gastrectomy

Gastrectomy note
ulcerated tumor

Gastrectomy for CA
## Chapter 12: Small Bowel

### Small Bowel Headings
- Obstruction
- Ischemia
- Short Gut
- Fistulae
- Crohn’s
- Neoplasms
- Diverticulae

### Obstruction
- Mechanical V/S Functional
- Simple V/S Strangulated
- Complete V/S Incomplete
- Proximal V/S Distal
- Open V/S Closed

### SBO Causes
- Adhesions
- Herniae
- Neoplasm
- Gallstone Ileus
- Intussusception
- Crohn’s
- Radiation Enteritis

### SBO Imagining
- Pain Films
- Contrast Studies, Gastrograffin
- Ct Scans

### Notes:
<table>
<thead>
<tr>
<th><strong>SBO Presentation</strong></th>
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<tbody>
<tr>
<td>Pain</td>
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<tr>
<td>Vomiting</td>
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<tr>
<td>Obstipation</td>
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<tr>
<td>Distension</td>
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<tr>
<td>Fever</td>
</tr>
<tr>
<td>Tachycardia</td>
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<tr>
<td>Leukocytosis</td>
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<tr>
<td>Tenderness</td>
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<tr>
<th><strong>SBO Management</strong></th>
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<tbody>
<tr>
<td>Npo</td>
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<tr>
<td>Ng Decompression, Nasoenteric</td>
</tr>
<tr>
<td>Iv Fluids</td>
</tr>
<tr>
<td>I/O</td>
</tr>
<tr>
<td>Surgical Exploration</td>
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<table>
<thead>
<tr>
<th><strong>Acute SB Ischemia</strong></th>
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<tbody>
<tr>
<td>Peak Incidence 40-60</td>
</tr>
<tr>
<td>M&gt;F</td>
</tr>
<tr>
<td>Arterial &gt;50% Embolic</td>
</tr>
<tr>
<td>Non Occlusive</td>
</tr>
<tr>
<td>Venous</td>
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<table>
<thead>
<tr>
<th><strong>SB Ischemia Eval</strong></th>
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<tbody>
<tr>
<td>Sudden Onset Abd Pain. Abd Exam May Be Benign</td>
</tr>
<tr>
<td>Gut Evacuation</td>
</tr>
<tr>
<td>Tenderness Distension Late</td>
</tr>
<tr>
<td>Leukocytosis (Hemoconcentration)</td>
</tr>
<tr>
<td>Hyperamylasemia, Lactic Acidosis</td>
</tr>
<tr>
<td>Thumbprinting, Air In Portal Vein</td>
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**Notes:**

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<table>
<thead>
<tr>
<th>SB Ischemia MGT Occlusive Disease</th>
<th>SB Ischemia MGT Non Occlusive</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Early Angio</td>
<td>▶ No Proximal Lesion</td>
</tr>
<tr>
<td>▶ Heparin</td>
<td>▶ Multiple Segmental Narrowing</td>
</tr>
<tr>
<td>▶ Resuscitation</td>
<td>▶ Minimal Distal Perfusion</td>
</tr>
<tr>
<td>▶ Exploration: Embolectomy, Revascularization, Resection</td>
<td>▶ Intraarterial Vasodilators</td>
</tr>
<tr>
<td>▶ Mortality 50-90%</td>
<td>▶ Iv Glucagon</td>
</tr>
<tr>
<td></td>
<td>▶ Correct Hemodynamics Afterload Reducers Inotropes</td>
</tr>
<tr>
<td></td>
<td>▶ Mortality 80-100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SB Ischemia Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ F&gt;M</td>
</tr>
<tr>
<td>▶ Postrandial Pain</td>
</tr>
<tr>
<td>▶ Anorexia, Weight Loss</td>
</tr>
<tr>
<td>▶ Angiography</td>
</tr>
<tr>
<td>▶ At Least Two Vessel Disease</td>
</tr>
<tr>
<td>▶ Revascularization</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>SB Ischemia Venous</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Subacute</td>
</tr>
<tr>
<td>▶ Acute</td>
</tr>
<tr>
<td>▶ Associated With: Portal Htn</td>
</tr>
<tr>
<td>▶ Venous Phase Of Angio</td>
</tr>
<tr>
<td>▶ Anticoagulation</td>
</tr>
</tbody>
</table>

**Notes:**
**Short Bowel Syndrome**

- Ischemia, Trauma, Crohn’s
- Diarrhea
- Fluid And Electrolyte Imbalance
- Malnutrition
- Motility Inhibitors
- Elemental, Tpn

**SB Fistulae**

- Postop
- Granulomatous :2% From Crohn’s
- Malnutrition
- 20% Mortality
- Skin Breakown, Abscesses

**SB Fistula**

- Enterocutaneous
- Enteroenteric
- Enterovesical
- Enterovaginal
- High Output/ Low
- Proximal/Distal

**SB Fistulae MGT**

- Charcoal Confirms
- Fistulogram
- Control Fistula, Octreotide
- Tpn, Electrolytes
- 30% Close
- Surgery

**Crohn’s**

- Peak Age Onset 15-30
- Familial, No Distinct Pattern Of Inheritance
- Chronic Granulomatous Inflammation

**Notes:**
**Crohn’s Manifestations**
- Pain Diarrhea
- Weight Loss
- 55% Both Large And Small Bowel, 30% Only Sb, 15% Only Colon
- Perianal Disease Most Common With Colonic
- Associated With Arthritis, Uveitis, Hepatitis, Erythema Nodosum

**Crohn’s Pathology**
- Transmural
- Fat Wrapping
- Segmental
- Foreshortened Mesentery
- Narrowed Lumen
- Linear Ulcers/Coblestone Mucosa

**Crohn’s MGT**
- Endoscopy, Capsule
- Antidiarrheal, Cholestyramine
- Steroids, Asacol
- Azt, 6Mp, Remicaid
- Surgery Reserved For Complications

**Crohn’s Complications**
- Strictures, Fistulae, Abscesses
- Perforation
- Toxic Megacolon 6%
- Carcinoma Increased Incidence In Small And Large Bowel

**Crohn’s Surgery**
- Stricturoplasty
- Limited Resection
- Perianal Disease: Medical Mgt And Conservative Therapy

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**Notes:**

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### SB Neoplasms

- Uncommon
- Non Specific Early Sx
- Obstruction
- Occult Bleeding
- Sbft
- Capsule Endo

### Benign Neoplasms

- Adenomas 20% Duodenal, 50% Ileal
- Leiomyomas
- Lipomas Common In Ileum Can Lead To Intussusception
- Fibromas, Hamartomas, Hemangiomas
- Excision

### Malignant Neoplasms

- Adenocarcinoma 30-50% Most Common In Duodenum 50% In The Ampulla
- Carcinoid 30% Multiple, 30% Metastatic Ileum Most Common After Appendix
- Lymphoma 10-15% Ileum Most Common
- Sarcoma 10-20%
- Poor Px
- Periampullary 30-40% 5 Year
- Leiomyosarcomas 30-40% 5 Year
- Lymphomas 10-50% 5 Year Survival
- Others 20% 5 Year
- Sarcoma 10-20%

### Notes:

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### Carcinoids
- 50-60% 5Yr Survival
- Urine 5Hiaa May Be Normal
- Desmoplastic Reaction In The Mesentery
- Associated With Non Carcinoid Tumors
- Carcinoid Syndrome 5-10%Metastatic, Treat With Octreotide Or Resection If Doable
- Tumor Can Produce Serotonin, Bradykinin, Substance P, Pg E F, Histamine, Dopamine

### Duodenal Diverticula
- 60-75% Periampullary
- Most Asymptomatic
- May Cause Pancreatitis
- May Bleed Perforate
- Surgery Reserved For Complications

### SB Diverticula Jejunoileal
- Can Bleed, Get Inflammed, Obstruct
- Mesenteric Border
- Can Lead To Malabsorption
- Less Common
- Large Bowel

### Meckel’s Diverticula
- 2M:1F
- 2%Pop
- Can Bleed,Perforate, Cause Pancreatitis
- Most Asymptomatic

---

**Notes:**

- Duodenal Diverticula
- Meckel’s Diverticula
- SB Diverticula Jejunoileal
Laparoscopic Preperitoneal Inguinal Hernia Repair

**Bowel Obstruction**

**SB Intussusception**

Laparoscopic Preperitoneal view of a direct Inguinal Hernia
Necrotic small bowel in a giant strangulated hernia note redundant skin

Small bowel diverticulae

SB capsule stuck in a stricture

SB Crohn's
Intussusception appendix into cecum

SB Crohn's disease

Strangulated hernia

Post repair and resection
Liver Anatomy

- Gallbladder marks the division between lobes
- Left lobe medial (IV), lateral (II+III)
- Right lobe (V, VI, VII, VIII)
- Caudate (I)
- Three main hepatic veins
- Hepatic arteries, 20% SMA origin usually right hep, left hep artery originates from left gastric
- Portal vein (50% of O2 to liver and 70% of blood flow).

Imaging

- IOUS of liver >99% sens in detecting liver masses compared to 89% CT, 88% preop US and 82% angio.
- Portal imaging transhepatically or transjugular. In the past splenoprtogram via the spleen.
- Angiograms celiac and mesenteric angio.

Liver Abscesses and Cysts

- Most are drained percutaneously under CT guidance
- Liver cysts simple
- Hydatid disease of the liver
- Polycystic disease of the liver (Inherited)
- Cystadenomas and cystadenocarcinoma are rare neoplasms comprise less than 5% of cysts. Present with abdominal pain, nearly 80% are F

Notes:
### Liver Tumors Benign

<table>
<thead>
<tr>
<th>Hemangioma</th>
<th>Focal nodular hyperplasia</th>
<th>Adenomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bile duct adenomas frequently found incidentally about 1 cm in size</td>
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<table>
<thead>
<tr>
<th>FNH</th>
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<tbody>
<tr>
<td>F&gt;M</td>
</tr>
<tr>
<td>Mean age 34</td>
</tr>
<tr>
<td>Usually &lt;5cm, can be multiple in 20%</td>
</tr>
<tr>
<td>No malignant potential</td>
</tr>
<tr>
<td>Rare symptoms</td>
</tr>
<tr>
<td>No risk of rupture</td>
</tr>
<tr>
<td>Possible enlargement with pregnancy</td>
</tr>
</tbody>
</table>

### Malignant Neoplasms

<table>
<thead>
<tr>
<th>Hemangioendotheliomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can cause abdominal pain</td>
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</table>

<table>
<thead>
<tr>
<th>Adenomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>F&gt;M</td>
</tr>
<tr>
<td>Mean age 40</td>
</tr>
<tr>
<td>Malignant potential 10%</td>
</tr>
<tr>
<td>Very common symptoms: pain or obstruction</td>
</tr>
<tr>
<td>Potential for rupture is common</td>
</tr>
<tr>
<td>Frequently multiple</td>
</tr>
<tr>
<td>On BCP</td>
</tr>
</tbody>
</table>

### Notes:

- FNH
- Malignant Neoplasms
- Adenomas
<table>
<thead>
<tr>
<th>Malignant Tumors</th>
<th>Primary</th>
<th>Metastatic</th>
</tr>
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<tbody>
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<table>
<thead>
<tr>
<th>Primary Liver CA</th>
<th>Most pts have severe liver disease</th>
<th>Hep b and c</th>
<th>Alphafetoprotein</th>
<th>Surgical resection</th>
<th>Transhepatic artery chemoembolization</th>
<th>Alcohol injection</th>
<th>Transplantation</th>
</tr>
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<table>
<thead>
<tr>
<th>Metastatic</th>
<th>Colorectal most common</th>
<th>Gastric can be considered for resection</th>
<th>Esophageal and pancreatic no role for surgery</th>
<th>Resection</th>
<th>Cryosurgery</th>
<th>RF</th>
</tr>
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</tbody>
</table>

**Notes:**

- Primary Liver CA
- Metastatic

- Most pts have severe liver disease
- Hep b and c
- Alphafetoprotein
- Surgical resection
- Transhepatic artery chemoembolization
- Alcohol injection
- Transplantation

- Colorectal most common
- Gastric can be considered for resection
- Esophageal and pancreatic no role for surgery
- Resection
- Cryosurgery
- RF
Liver Retracted

CT Hemangioma of Liver

Hemangioma Liver
Liver Cyst Hiatal Hernia
Liver Cyst Hiatal Hernia
### Chapter 14: The Colon

#### Anatomy and Physiology
- Vascular SMA, IMA, Internal Iliac
- Function Of Each Segment

#### Colitis
- Infectious
- Inflammatory
- Spastic
- Non specific
- Diverticulosis/itis
- Ischemic>>stricture
- Ibd

#### G.I. Bleeding
- Avm In Colon Most Prevalent In Rt Colon
- Hemorrhoidal
- Diverticular
- Ulcerations /Ibd
- Tumors

#### Rectal Benign Pathology
- Hemorrhoidal disease
- Perianal abscess
- Fistula in ano
- Anal fissures
- Anal condylomas>>> squamous cell ca
- Rectal prolapse

#### Volvulus Colon
- Rt Colon
- Sigmoid

### Notes:
### Colon Cancer
- Etiology
- Behavior Clinical Presentation
- Staging
- Surgery For
- Patterns Of Metastatic Disease

### Rectal Cancer
- V/S Colon CA

### Anal Cancer
- Treatment

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**Notes:**

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Volvulus Colon Strangulated in a diaphragmatic hernia. Thoracoabdominal approach

Rectal CA s/p modified pelvic excetration with liver resection for met
Applecore lesion colon

Cecal CA causing intussusception

Carcinomatosis

Colonic ischemia
Foreign Body in Rectum

Giant benign ovarian cyst

Eschemic Colon
Omental caking by cancer

Eschemic Colon
Chapter 15: *Lung Cancer Surgery*

**Patient Selection**
- The primary treatment with best results for most patients is surgery.
- Unfortunately not all comers are candidates
- Metastatic disease at diagnosis
- Comorbid problems

**Lung Cancer**
- The most common cancer we encounter
- Most frequently discovered late
- Screening tools
- The best prevention is to minimize risk factors

**Patient Workup**
- Preop staging to rule out distant disease
- Ct, pet scans, pft’s, cardiac stress test
- Mediastinoscopy, thoracoscopy
- Thoracotomy

**Mediastinoscopy**
- Insertion of a scope in a plane created over the trachea and sampling lymph nodes
- Positive mediastinal nodes for cancer render patients ineligible for surgical resection

**Thoracotomy**
- Patient positioning
- Resection of a segment of rib
- Lobar anatomy for lobectomy
- Pneumonectomy
- Resection of lymph nodes that drain the lobe to better stage and final consideration for adjuvant therapy

**Notes:**
## Chapter 16: Abdominal Compartment Syndrome

### Etiology

- A rise in intraabdominal pressure irrespective of cause beyond a certain pressure affecting multiple organ systems and creating a vicious cycle.

### Risk Factors for the ACS

- Trauma
- Burns
- Liver tx
- Massive ascites, bowel obstruction
- Sepsis, any condition associated with a lot of third spacing

### Normal Pressure

- Normal intraabdominal pressure is 0 to 5 mm hg
- Mild rise 10-15
- 15-25 You start observing it
- Surgical decompression over 25

### Physiologic Consequences of ACS

- Cardiovascular
- Pulmonary
- Gastrontestinal
- Renal
- Hepatic
- CNS

---

**Notes:**

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<table>
<thead>
<tr>
<th><strong>Cardiovascular</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased c.O. Direct compression of the heart by diaphragm and decreased venous return</td>
</tr>
<tr>
<td>Peripheral edema due to increased hydrostatic press in les</td>
</tr>
<tr>
<td>Elevated central venous pressures</td>
</tr>
<tr>
<td>Reduced contactility and compliance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Gut</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The gut is most sensitive to acs</td>
</tr>
<tr>
<td>Decreased sma and celiac perfusion with pressure of 40 mmhg (animal studies)</td>
</tr>
<tr>
<td>Intestinal mucosal perfusion is reduced with pressure of 20 (animal and human studies)</td>
</tr>
<tr>
<td>Mesenteric perfusion decreased with as low as 10 mmhg p (animal studies)</td>
</tr>
<tr>
<td>The effect is greatest in patients with hemorrhage and hypovolemia</td>
</tr>
<tr>
<td>Vicious cycle with decreased mesenteric venous return and edema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Gut and Hepatic</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of the mucosal barrier and bacterial translocation with p as low as 10</td>
</tr>
<tr>
<td>The liver is unable to clear lactic acid despite adequate volume repletion and with a normal c.O.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Effects on Pulmonary System</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased pulmonary compliance</td>
</tr>
<tr>
<td>Transmission of pressure across the pleura</td>
</tr>
<tr>
<td>Hypoventilation, hypoxemia, hypercarbia</td>
</tr>
<tr>
<td>Increased insp pressures</td>
</tr>
<tr>
<td>Decreased venous return</td>
</tr>
<tr>
<td>Decreased cardiac output</td>
</tr>
<tr>
<td>End organ hypoperfusion</td>
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</tbody>
</table>

**Notes:**

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**Effects Continued**

- Decreased intraabdominal organ perfusion due to increased interstitial pressure and increased outflow pressure along with decreased cardiac output.
- Rv pressure rise increased afterload.
- Oliguria and renal insufficiency
- Splanchnic ischemia
- Decreased liver metabolism
- Bacterial translocation
- Decreased perfusion to abd wall causing delay in wound healing.
- Rise in intracranial pressure due to high venous pressures and decreased venous return

**Renal**

- Oliguria 15 mmhg
- Anuria 30 mmhg
- Renal vein compression
- Renal artery vasoconstriction
- Renin, aldosterone and adh, are inc. By twofold reversed by decompression

**Abdominal Decompression**

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**Notes:**

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Chapter 16: Carotid Stenting

Carotid Stenting
Patient Selection

- Cardiac and pulmonary comorbidities
- Local anatomic risk factors: prior cea, radiation, radical neck dissection, high bifurcation lesions and those inferior to the clavicle

Indications for Carotid Stenting

- Same as indications for cea
- Asymptomatic/symptomatic stenosis
- Severe copd, home o2,fev1<20%
- Contralateral vocal cord paralysis
- Severe cardiac disease, chf patients requiring pta, cabg
- Renal failure patients, cr>3 or on dialysis

Limitations of Carotid Stenting

- No femoral access
- Unfavorable arch anatomy
- Severe tortuosity cca, ica
- Severely calcified stenoses not dilatable
- Lesions containing fresh thrombus
- Extensive stenoses>2cm
- Contrast related issues, renal, life threatening contrast reactions
- Preload dependent states, severe aortic valvular stenosis

Notes:
**Carotid Stenting Procedure**

- Done under local anesthesia
- Cerebral angiogram
- Sheath in the cca
- Cerebral protection device 0.14
- Angioplasty
- Stent deployment
- Post dilation
- Recovery of protection device

**Notes:**

• Percutaneous Femoral Arterial Access and Guide Catheter Placed
• Embolic Protection Device Positioning
• Pre-Dilation of Diseased Area
• Stent Delivery and Deployment
• Post-Dilation
• System Removal
• Embolic Protection
# Chapter 16: Dialysis

## Access Evaluation

### Types of Access Grafts
- Arteriovenous graft:
  - Loop in forearm brachio basilic, cephalic, median anticubital vein
  - Loop in arm brachiobasilic, axillary, cephalic
  - Loop in groin femorosaphenous, femorofemoral
  - Loop infraclavicular subclavian to subclavian
  - Straight radiocephalic, anticubital vein

### Primary Fistula
- Brescia-cemino radiocephalic in snuff box
- Transposition cephalic, basilic in arm or forearm

### When Can You Use Access
- Grafts typically in 3-4 weeks
- Some grafts allow immediate use flexine vectra
- Fistulæ you allow maturation it may take 6 weeks -?

## Notes:

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### Where do Stenosis Develop

- Grafts usually at venous anastomoses
- Graft fatigue from repeated access in same spot
- Central venous level from neointimal hyperplasia at brachiocephalic or subclavian level
- Svc stenosis from catheters usually
- At valve sites in fistulae
- At central level

### Non Invasive Criteria Venous

- Vein > 2.5-3 Mm luminal diameter
- No segmental stenosis
- Continuity with deep system w/o a central stenosis (no pacer or port)
- No occlusion

### Non Invasive Criteria Arterial

- Art lumen >2 mm
- Patent palmar arch
- Non obliterative calcification

### Surveillance

- Adequate selection of anatomical site with good mapping
- Duplex 6 weeks post creation before use
- Then surveillance every 6 months
- Reduce the cost of thrombosis
- Evaluate for steal
- Evaluate for venous hypertension

### How do you that Fistula Open

- Audible bruit
- Palpable thrill
- Ultrasound that shows flow
- Always check for a steal by history and exam

---

**Notes:**
Chapter 16: Minimally Invasive Vascular Interventions

Introduction

- Historical background what we did in 1993
- First angioplast at somc 1993
- First thrombolytic therapy 1993
- First stent at somc 1995
- The evolution of devices

Venous Disease

- Insufficiency, dvt, pe
- Superficial venous insufficiency
- Perforator venous insufficiency
- Deep venous insufficiency
- Deep venous thrombosis

Superficial Venous INS.

- Venous reflux at sfj and gsv
- Venous reflux at lsv
- Therapies: ablation with laser or rf
- Therapies: sclerotherapy

Notes:
<table>
<thead>
<tr>
<th>Section</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perforator INS.</td>
<td>U/s guided sclerotherapy to heal ulcers</td>
</tr>
<tr>
<td></td>
<td>U/s guided laser ablation</td>
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<tr>
<td></td>
<td>Seps</td>
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<tr>
<td></td>
<td>Linton</td>
</tr>
<tr>
<td>Venous Ulcer RX</td>
<td>Valves transplant</td>
</tr>
<tr>
<td></td>
<td>Competent valve interposition grafting</td>
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<tr>
<td></td>
<td>Percutaneous valve under research</td>
</tr>
<tr>
<td>Deep Venous INS.</td>
<td>First case 1993 at somc</td>
</tr>
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<td>Adopted by ascp 2008</td>
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<tr>
<td></td>
<td>Pharmacomechanical therapy</td>
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<tr>
<td>Thrombolytic Therapy</td>
<td>Thrombolytic therapy : proximal to sfj</td>
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<tr>
<td></td>
<td>May thurner syndrome</td>
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<tr>
<td></td>
<td>Submassive pe</td>
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<tr>
<td></td>
<td>Massive pe</td>
</tr>
<tr>
<td>Strategies in DVT/PE</td>
<td>The Role of Mechanical Devices in Enhancing Therapy for Extensive</td>
</tr>
<tr>
<td></td>
<td>Deep Vein Thrombosis of the Caval-iliofemoral and Upper Extremity Veins</td>
</tr>
<tr>
<td></td>
<td>Thomas Khoury MD, Hannah Mckeever DO, Graham Purdy BS, Godwin Dogbey PhD, Presented at SCVS, Miami Beach FL 2013</td>
</tr>
</tbody>
</table>

Notes:
## May Thurner synd.

- May Thurner
- MTS Stented
- IVUS May Thurner
- IVUS Image of M.T.S
- IVUS M.T
- May Thurner Leg
- Phlegmasia Cerulea Dolens
- Prone position
- Post Completion
- Thrombosed Vena Cava

## Post Therapy

- Access Thrombosed Pop Vein
- Post Pharmacomechanical
- Venous Access
- Mechanical Thrombolysis
- Clots
- Thrombus Extraction
- SVC Thrombus (port)
- Post Stent

## Methods

- Significant pulmonary emboli
- Hypoxemia
- Right Ventricular Strain
- Hemodynamic Compromise

## Introduction

- Retrospective review, with emphasis on long-term studies
- Massive and Sub-massive PE

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### Notes:

- Left sided dvt are more common
- Blood type non-o
- Dvt starts proximally due to extrinsic compression

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<table>
<thead>
<tr>
<th>Results : Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>51 Patients treated with Thrombolytic Therapy</td>
</tr>
<tr>
<td>7 received Urokinase</td>
</tr>
<tr>
<td>Drip ranges between 100,000-200,000 units/hour</td>
</tr>
<tr>
<td>44 received TPA</td>
</tr>
<tr>
<td>Drip ranges between 0.5-2.0 mg/hour</td>
</tr>
<tr>
<td>12 Patients treated with Adjunctive Mechanical Therapy</td>
</tr>
<tr>
<td>3 out of 12 were treated with the AngioJet Device</td>
</tr>
<tr>
<td>9 out of 12 were treated with EKOS (intracavitary ultrasound)</td>
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<thead>
<tr>
<th>Methods</th>
</tr>
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<tbody>
<tr>
<td>Complications</td>
</tr>
<tr>
<td>Excessive Bleeding (2/51)</td>
</tr>
<tr>
<td>Infection (0/51)</td>
</tr>
<tr>
<td>Other/Unrelated (1 Death)</td>
</tr>
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<table>
<thead>
<tr>
<th>Massive PE</th>
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<tbody>
<tr>
<td>Troponin, bnp</td>
</tr>
<tr>
<td>Echocardiogram</td>
</tr>
<tr>
<td>Need for thrombolysis or clot extraction</td>
</tr>
<tr>
<td>Minimally invasive techniques</td>
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<table>
<thead>
<tr>
<th>Submassive PE</th>
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<tbody>
<tr>
<td>Major segmental without hemodynamic changes</td>
</tr>
<tr>
<td>Recommend thrombolysis</td>
</tr>
<tr>
<td>Reduction in pa pressures</td>
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<thead>
<tr>
<th>Results : Short-Term</th>
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<tbody>
<tr>
<td>Short-Term Results for TPA</td>
</tr>
<tr>
<td>Complete Lysis – 18/44</td>
</tr>
<tr>
<td>Partial Lysis – 26/44</td>
</tr>
<tr>
<td>Short-Results for Urokinase</td>
</tr>
<tr>
<td>Complete Lysis – 2/7</td>
</tr>
<tr>
<td>Partial Lysis – 5/7</td>
</tr>
</tbody>
</table>

Notes:
### Results: Therapy

**Renal**

- Oliguria 15 mmhg
- Anuria 30 mmhg
- Renal vein compression
- Renal artery vasoconstriction
- Renin, aldosterone and adh, are inc. By twofold reversed by decompression

**Vena cava filter**

- 37 out of 51 patients received a Inferior Vena Cava Filter
- 13 Greenfield
- 12 TrapEaze
- 10 Tulip
- 2 Option
- 3 Previous Greenfield

**PAD**

- Symptoms confused with arthritis and sciatica
- Easy test to determine claudicants
- Who needs interventions
- Techniques available

### Notes:

- Renal
- PAD
## Techniques

- Angioplasty: 4 types, which one
- Stent: last resort
- Atherectomy: 3 types
- Re-entry devices in CTO

## Special Devices

- Embolic Protection Devices in Carotid Stents and Atherectomy of Lower Exts
- Re-entry Devices: Allow us to Access the True Lumen and to Cross Long Segments of Total Occlusions.

### Notes:

- PAD Is Largely Undiagnosed
- Excise Instead of Displace
- Catheter Atherectomy MI

### Techniques

- Plaque Extracted
- Remote Endarterectomy
- Remote Endarterectomy

### Special Devices

- Pioneer Re-entry
- Pioneer Re-Entry
- Occluded FemPop vein graft
- Occluded Graft
- Post Intervention
- Post Intervention

- Embolic protection devices
- Occluded aorta and Bifur
- Reconstruction of Bifur
- Aortic plaque with stent
- Thrombosed Aorta
- Post Lysis
### Carotid Artery Disease

- CEA with patch angioplasty
- Carotid stenting
- How do we choose
- Embolic protection devices

### Carotid Artery Interventions

- Precutaneous Femoral Arterial Access and Guide Catheter Placed
- Embolic Protection Device Positioning
- Pre-dilatation of Diseased Area
- Plaque Hemorrhage

### Aortic Aneurysm

- Stent Delivery and Deployment
- CCA stenosis
- Post Stent CCA
- Critical Carotid Stenosis
- Post Stent
- Carotid Endarterectomy
- Carotid Plaque

### Notes:

- Endovascular repairs
- Percutaneous
- Fenestrated grafts and ability to treat juxta and suprarenal aneurysms

### AAA

- How do we screen
- Htn, hernia, family hx
- Think of connective tissue disease
Abdominal Ultrasound

- Safe, non-invasive
- Widely available
- Rapid
- Inexpensive
- Accurate (> 90%)

Treatment: Options for Repair
Open Surgical Repair of AAA

Case Highlights

- Anatomy
  - 6.3 cm Aneurysm
  - 38mm Proximal Neck
  - Challenging Access
- Devices Used
  - 28mm/60mm long AFX Main Body.
  - 40mm Thoracic graft Extension with fixation
  - 6mm Viabond to Internal iliac Lt
  - 9mm Fluency to External iliac Lt

Plan
Graft to Preserve Bifur
End

Notes:
SOMC AAA experience (personal)

- EVAR since 2003
- Over 100 cases with average 20 per year
- One case 30 day mortality
- 2 cases secondary interventions one limb occlusion, one endoleak limb separation corrected percutaneously
- Largest treated was 10 cm
- 95% totally Percutaneous over the past 5 years.

Renovascular Disease

- Is There Value In Stenting Every Stenosis
- Who Do You Treat
- Fly By Renal Intervention?
- 95% totally Percutaneous over the past 5 years.

Renal Artery Interventions

- You Need A Good Reason to do it
- Bilateral Disease
- HTN poorly controlled
- End Organ Salvage

Renal Preservation

- Reducing the risk of contrast nephropathy
- Mucomyst, bicarb drip
- Intrarenal fenoldopam therapy for 2 hrs
- Presented at scvs las vegas nv 2012

Notes:
Topics to be covered

AA Aneurysms

- Aortic aneurysm repair: evar v/s open
- Indications: >5 cm or 2x normal diam
- Periop what to expect
  - Open: fluids, bp, mi, colonic ischemia, emboli, distal ischemia, chf
  - Evar: colonic ischemia, mi, emboli, contrast nephropathy
- Other associated aneurysms: iliac, pop

Cerebrovascular Disease

- Indication: sympt>60%, asympt>70%
- Periop risks: cva, mi, bleeding. Keep bp between 110-140
- Carotid stent: hypotension, bradycardia, contrast nephropathy
- Vertebral disease: visual field defects, dizziness, syncope.
- Subclavian steal: check bp in both arms

Notes:
**Renal Artery Stenosis**
- Htn poorly controlled on multiple meds
- Renal insufficency
- Cause of acute chf
- Treatment is revascularization endovascular or open

**PVD**
- Indications: non healing wounds 6 wks
- Tissue loss, gangrene
- Disabling claudication, claudication.
- Abi
- Doppler signal
- Options in revascularization
- Surgical: vein grafts are usually shallow, ptf deeper to fascia graft sweats
- Expect edema
- Epidural
- Look for change in signal quality, change in the distal open wound

**Dialysis**
- Avf v/s avg
- Auscult for bruit
- Venous htn
- Edema and outflow stenosis
- All veins with dialysis catheters clot
- Declotting with angiojet : release of k, release of hemoglobin
- Alkalinise the urine, mannitol drip
- Cutting balloon for neointimal hyperplasia

**Notes:**

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**DVT PE**
- Proximal dvt iliofemoral
- Indications for thrombolysis
- Phlegmasia cerulea dolens
- Ivc filter
- Mechanical lysis: watch urine color
- Chemical lysis: watch fibrinogen

**Trauma**
- Proximal dvt iliofemoral
- Indications for thrombolysis
- Phlegmasia cerulea dolens
- Ivc filter
- Mechanical lysis: watch urine color
- Chemical lysis: watch fibrinogen

**Notes:**

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Aneurysm Femoral Art

Atherosclerotic plaque retrieved remotely

Avf between aneurysm ata and atv

Ivc clots
Embolic protection device with debris

CEA with shunt

Cather directed atherectomy

Carotid plaque
Long segments of arterial plaque

Ivc filter being snared and retrieved

Large meandering artery refilling SMA

Ivc stenosis post radical nephrectomy
Migrating IVC filter retrieved from hernia sac

Renal Artery Stenosis repaired

POP Artery pseudoaneurysm

Pop artery pseudoaneurysm
plenic ischemic infarcts caused by splenic artery aneurysm

Renal art stenosis

Schwannoma peripheral nerve Upper Ext

pop artery pseudoaneurysm
Svc Syndrome Post Stenting

Arotid Stenosis Stented

Carotid Stenosis Stented

Popliteal Artery Stenosis Atherectomized
May Thurner Syndrome Left Vein

Duplicate IVC

Fasciotomy Hand

Fasciotomy for compartment syndrome
Bilateral Iliac Conclusions
Leriche Syndrome

Poeliteal Artery
Stenosis atherectomized

SVC syndrome caused by
small cell lung ca

SMA refilling
Healed Fasciotomy after skin graft

Ulcerated carotid artery plaque.

Spleen with giant hemangioma

Splenic Ischemic Infarcts caused by splenic artery aneurysm
Silo bag in abdominal compartment syndrome

Leriche corrected endovascularly

Carotid Plaque
Post Lumbar Sympathectomy

Severe Raynauds

Fasciotomy following snake bite foot (copper head)
## Chapter 18: Arterial Aneurysm Disease: Natural History, Diagnosis and Treatment Options

### Learning Objectives

- The participant should understand the clinical presentation and methods of diagnosing an abdominal aortic aneurysm (AAA)
- The participant should know the differences between open surgical and endovascular repairs of AAA
- The participant should understand the benefits of preventative screening for AAA

### AAA – Working Definition

- Pathologic, focal dilatation of the aorta > 1.5X “normal” diameter
- Normal aortic diameter: 20-mm (range, 14-30 mm) (M > F)
- Increases with age

### Pathology

- Types
  - Infrarenal (> 90%): 15-20 mm non-dilated aorta below renal arteries
  - Juxtarenal
  - Suprarenal
  - Thoracoabdominal
- 20% incidence of concomitant iliac aneurysms (common > internal iliac)

### Notes:

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### Demographics
- Prevalence: 5-7% in > 65 years old
- 2000 US Census: 2.7 million Americans
- 15,000 deaths from aneurysm rupture per year
- 10th leading cause of death in US

### Americans with AAA are Under-Diagnosed & Under Treated
- The prevalence of AAA is 4.5% in men and 1.0% in women (data from SAVE screenings)
- 1,152,294 Americans living with AAA
- 15% are diagnosed
- 6% are treated

### Risk Factors of AAA
- Age: > 65 years
- Gender: M > F (4:1)
- Family history (1° male relatives): 20%
- Smoking: > 10 pack-years
- Peripheral aneurysms
- Femoral, popliteal, thoracic
- Hypertension
- Absence of diabetes
- Race: Caucasian > African-American

### Associated Aneurysms
- 25% Iliac arteries
- 5% suprarenal component
- 12% TAAA

### Clinical Presentation
- 25% Iliac arteries
- 5% suprarenal component
- 12% TAAA

### Notes:

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Clinical Presentation (continued)

- Most patients asymptomatic
- Usually incidental finding on CT, MRI, or ultrasound during work-up for chronic back pain or kidney stones
- Back-flank-abdominal pain + known AAA or pulsatile mass π “asymptomatic AAA”, surgical emergency
- Physical examination
- Sensitivity & specificity ~20-90%
- Determination of size of AAA is not accurate
- Screening modality of choice: ultrasound
- Symptomatic AAA
- AAA can be intact or ruptured
- Unusual, severe, unremitting back or abdominal pain
- Referred testicular pain (frequently misdiagnosed as a hernia or torsion)
- Tender aneurysm on palpation
- Symptoms = impending rupture
- Urgent surgical consultation
- Ruptured AAA
  - Surgical emergency
  - Most contained (retroperitoneal hematoma)
  - Free ruptures uniformly fatal
  - May be hemodynamically stable or unstable
- Immediate imaging
  - Ultrasound or CT
  - Goals
  - Establish diagnosis
  - Anatomic eligibility for endovascular repair
  - Anatomic abnormalities, e.g. horseshoe kidney, retroaortic renal vein

Notes:
<table>
<thead>
<tr>
<th><strong>Abdominal Ultrasound</strong></th>
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<tbody>
<tr>
<td>Safe, non-invasive</td>
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<tr>
<td>Widely available</td>
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<tr>
<td>Rapid</td>
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<tr>
<td>Inexpensive</td>
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<tr>
<td>Accurate (&gt; 90%)</td>
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<table>
<thead>
<tr>
<th><strong>CT Scan</strong></th>
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<tr>
<td>Gold standard: Timed-bolus, intravenous contrast-enhanced, thin-cut, spiral technique</td>
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<tr>
<td>Advantages</td>
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<tr>
<td>Rapid (16 / 64 multi-row detector arrays, 15-30 sec, single breath-hold)</td>
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<tr>
<td>&lt; 1-mm spatial resolution, 3-D reconstructions</td>
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<tr>
<td>Usually operator-independent</td>
<td></td>
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<tr>
<td>Accurate: sizing, anatomy (dimensional / conformational)</td>
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<tr>
<td>Disadvantages</td>
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<tr>
<td>Radiation</td>
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<tr>
<td>Contrast nephropathy</td>
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<tr>
<th><strong>Conventional Angiography</strong></th>
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<tr>
<td>Minimal role in current management of AAA</td>
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<tr>
<td>Invasive, increased complications</td>
<td></td>
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<tr>
<td>Relative indications</td>
<td></td>
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<tr>
<td>- CT-3D reconstructions unavailable</td>
<td></td>
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<tr>
<td>- Severe iliac occlusive disease</td>
<td></td>
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<tr>
<td>- Suspected renal or mesenteric occlusive disease</td>
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<tr>
<td>- Unusual renovascular anatomy (e.g., horseshoe kidney)</td>
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<tr>
<td>Size cannot be measured</td>
<td></td>
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<tr>
<td>REMEMBER: an angiogram is a lumenogram</td>
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<tr>
<td>Size with IVUS</td>
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**Notes:**
**Natural History**

- Natural history of AAA: To EXPAND and RUPTURE
  - > 80% of small aneurysms grow
  - Pattern of growth is unpredictable and staccato (i.e., stop-and-go)
  - Past growth does NOT predict future growth
- 50% die from other causes (mostly cardiovascular)
- 50% die from aneurysm rupture

**Risk of Rupture**

- Laplace’s Law
  - Wall tension = radius x pressure
  - Rupture = wall tension > strength of aortic wall
  - Diameter is greatest predictor of rupture risk
  - Wall-to-wall, transverse or AP
  - Independent of length
- Estimated risk of rupture (per year)
  - 4.0-5.4 cm 0.6%
  - 5.5-6.4 cm 10%
  - 6.5-6.9 cm 19%
  - 7.0-7.9 cm 35%
  - ≥ 8.0 cm 51%
- Estimated rate of expansion (per year)
  - < 4 cm 0.2-0.4 cm
  - 4-5 cm 0.2-0.5 cm
  - > 5 cm 0.3-0.7 cm
- Incidence of ruptured AAA
  - 35.5 / 100,000 in > 65 years old
  - 3:1 male: female (vs. 4:1 for intact AAA)
  - 11-12% of all AAA repaired in US
- Overall mortality 71-77% (out-of-hospital + in-hospital)
- Surgical mortality 48% (meta-analysis of all reported literature between 1955-1998)

**Notes:**

- Natural History
- Risk of Rupture
### Pathophysiology of Ruptured AAA Repair

#### Immediate natural history of ruptured AAA
- 56 patients over 8 years with UNREPAIRED ruptured AA
  - > 85% survived over 2 hour
  - Median survival 10 hours
  - MOST PATIENTS HAVE TIME FOR CT

#### Goals
- To relieve symptoms
- To prevent aneurysm rupture
- To prevent death from aneurysm rupture

#### Repair of asymptomatic, intact AAA is a PROPHYLACTIC procedure

### Time is the Essence...?

### Indications for Treatment

#### Repair of asymptomatic, intact AAA is a PROPHYLACTIC procedure

### Treatment of AAA: Level I Evidence

- 1136 patients, 4.0-5.4 cm AAA
- < 2% females (vs. 17% in UK Study)
- Surveillance: 567, Surgery: 569
- Operative mortality: 2.7%
- Rupture rate: 0.6% per year
- Survival: surveillance 79% vs. surgery 75% (p=NS)

### Notes:

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Current Recommendations for AAA Management

- Size (CT diameter)
  - Men: 5.5 cm, Women: 4.5-5.0 cm
  - “High-risk”: 6.5 cm
- Strong family history of AAA and/or rupture
- Signs (tenderness) and/or symptoms
- Life-expectancy > 2 years
- Absence of medical contraindications (“high-risk”)
- Q6 month surveillance for AAA < 5.5 cm is safe and equivalent to early intervention at 4.0-5.5 cm

The “High – Risk” Patient

- Natural history of “high risk” patients with UNREPAIRED > 5.5-cm AAA
  - 23-29% aneurysm-related death in 2-5 yrs
  - 35-55% aneurysm-related death in 10 yrs

Open Surgical Repair of AAA

- First open surgical AAA repair in 1951 by Dubost
- Complications: 60%
- Risk factors for M&M
  - Renal insufficiency (Cr > 1.8)
  - CHF
  - CAD
  - COPD
  - Age per decade
  - Female gender
  - Surgeon volume / Hospital volume / Vascular surgical training

Notes:
Endovascular AAA Repair

- First endovascular AAA repair in 1991 by Parodi.
- Mortality
  - Elective: 1-2%
  - Ruptured: 15-20%
- Complications
  - 20-30%
- Secondary interventions
  - 10-15%
- Life-long follow up

- Tools of the Trade
- Currently Available Devices
- Delivery Systems
- Device Type
- Endovascular AAA Repair

- Devices and Delivery Systems
  - Picture
  - AAA Stent
  - Picture

- Lifeline Registry of EVAR
  - Long – Term Outcome
  - Results of EVAR at 5 years
    - Freedom from rupture 99%
    - Freedom from AAA death 98%
    - Freedom from open repair 96%
    - Overall survival 66%

- Lifeline Registry of EVAR conclusions*
  - EVAR is a safe, effective, and durable treatment of selected patients with AAA
  - Results of EVAR are favorable even in elderly, higher-risk patients who may not be appropriate candidates for surgery

Notes:
Natural history after EVAR is unpredictable
Life-long
Absolutely critical to overall EVAR treatment strategy
No surveillance = Unrepaired AAA
Suspected noncompliance = Contraindication to EVAR
NO EXCEPTIONS
History and physical exam
  • New onset back / abdominal pain, claudication, hypertension
Imaging
  • Cross-sectional: CT vs. ultrasound vs. MRI
  • AAA size: Compare “apples to apples”
  • Axial diameter vs. orthogonal (centerline) diameter
  • Use first postop scan as reference
  • Endoleak
Abdominal x-ray
  • Device integrity and conformation
Optional: 3-D reconstruction, volumetric analysis

**Surveillance Schedule**

**Surveillance Imaging**

Gold Standard: CT Angiogram
Triple-phase scan (300 images)
  • Series 1: non-contrast, 10 mm cuts (45 images)
  • Series 2: timed-bolus, intravenous contrast-enhanced, 2-3 mm cut (210 images)
  • Series 3: delayed, 10 mm cuts (45 images)

**Notes:**
EVAR Trial 1

- N=543 EVAR vs. N=539 open
  - Age > 60 years (mean 74 years)
  - AAA > 5.5-cm (mean 6.2-cm)
  - Physiologically and anatomically fit for either ** If unfit for open repair, EVAR 2 offered **
- 94% compliance
- Variety of devices used
  - 51% Cook Zenith
  - 33% Medtronic Talent
  - 7% Gore Excluder
- Mortality: EVAR vs. Open repair
  - 209 deaths at 4 years
  - 68 from cardiovascular disorders
  - 53 from aneurysm-related causes
  - 4% vs. 7%, p=0.04
- Complications: EVAR vs. Open repair
  - 41% vs. 9%, p < 0.001
  - 20% vs. 6% re-intervention
- Cost: EVAR vs. Open repair
  - £ 13,257 vs. £ 9,946
- No difference in Health-Related Quality of Life (HRQL)

DREAM Trial

- N=178 open vs. N=173 EVAR
  - AAA > 5cm
- 97% protocol compliance
  - 92% of patients underwent repair within 3 months of randomization
- Mean follow-up was 21 and 22 months
- 2 year survival: 89.6% open vs. 89.7% EVAR (p=0.86)
- Aneurysm-related mortality: 5.7% open vs. 2.1% EVAR (p=0.05)

Notes:
### DREAM Trial (continued)

- **“Severe” event-free survival**: 80.6% open vs. 83.1% EVAR (p=0.39)
- **Re-intervention after EVAR**: 3-fold higher in first 9 months (vs. open) p=0.03

### Endo vs. Open

**Pros**
- Well-established (> 50 yrs)
- Durable results
- Widely available
- Almost all anatomically eligible

**Cons**
- Maximally-invasive
- “High-risk” patients
- Higher morbidity & mortality
- Slower recovery
- 10-12% risk of late complications

### TEVAR vs. EVAR

- Approach is same as EVAR
- Device sizes cover up to 46 mm vs. 36 mm EVAR
- 2 cm neck lesser curvature TA vs. 1.2 cm neck infrarenal AA
- Risk of paraplegia with TEVAR

### TEVAR Indications

- TAA > 5 cm
- Penetrating Ulcer
- Acute Dissection
- Trauma

### Notes:

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Preventative Screening

- AAA Screening
  - Meta-analysis of 4 randomized prospective trials
  - Over 124,000 patients
  - 45% reduction in AAA-related deaths
- Goal
  - Early detection
  - Timely repair

Necessary Conditions

- Disease should have sufficient prevalence and public health impact
- Superior over current (“reactive”) care
- Cost-effective
- Low-risk
- Diagnostic tool
  - Accurate
  - Easy to use
  - Widely available
  - ULTRASOUND

SAAAVE ACT

- SAAAVE = Screening Abdominal Aortic Aneurysms Very Efficiently
- Signed into law by President Bush on February 8, 2006
- Effective January 1, 2007
- Provides coverage for one-time AAA screening to qualified Medicare beneficiaries
- Who qualifies?
  - Men age > 65 years who smoked over 100 cigarettes during lifetime
  - Women with family history of AAA

Notes:
• *EPICS I Study*

**SOMC AAA Experience**

- EVAR since 2003
- 70 cases with 20 in the last year
- One case 30 day mortality
- 2 cases secondary interventions one limb occlusion, one endoleak limb separation corrected percutaneously
- Largest treated was 10 cm

**Notes:**

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Three-Step Procedure

1. After delivering the catheter to the proximal end of the target lesion, pull back the thumb switch to “on” position.
2. Advance the cutter through the length of the lesion, collecting tissue in the nosecone.
3. Push the thumb switch forward, and either torque the catheter to treat additional areas, or retract the catheter.

Magnified View Of Carbide Blade

Luminal Gain With Minimal Barotrauma

1. Cutter is opposed to the plaque wall mechanically without any balloon dilatation.
2. Avoids creating barotrauma associated with intimal hyperplasia and restenosis.
3. Designed to result in less smooth muscle cell proliferation and less negative remodeling.
4. Helps minimize patient ischemia.

Notes:
• **Luminal Gain Analysis**
• **SilverHawk Benefits**
• **Case Study 1: Common Femoral/Profunda + SFA**
• **Total Tissue Collected: 252 mg**

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**Case Study 1: Results**

- Procedure: 3 insertions/14 passes

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**Case Study 4: Results**

- Right SFA: 2 passes with SilverHawk MS catheter = 10% residual stenosis
- Right AT: 4 passes with SilverHawk ES catheter = 15% residual stenosis
- Right PT: 3 passes with SilverHawk ES catheter = 10% residual stenosis
- Good distal flow, runoff to right heel

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**Case Study 7: Limb Salvage Case**

- TALON Outcomes Data
- Total Patients/Total Lesions Treated:
- Patients with Critical Limb Ischemia:
- 6-Month Single Lesion TLR Rate:
- Average Fem-Pop Lesion Length:
- Multiple Lesions Treated:
- Overall 6-Month TLR Rate:

---

**Notes:**
“Real World” SFA Disease - CIS

Complications
- MI
- Emergent Surgery
- Embolization
- Stroke
- Perforations
- Thrombosis

Results
- Procedural Success 131/133 (98.4%)
- ABI pre (0.61 ± 0.12) post (0.79 ± 0.11)
- 64 lesions are out 6 months
- 9.6% Restenosis (Duplex and/or Angiographic)

Conclusions
- Very difficult & long SFA lesion set
- No complications & very low restenosis based on angiographic follow-up

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Then and Now

Stent Fracture in the SFA

Follow-up angiograms were performed on 93 patients with SFA stents, (261 femoral stents evaluated)
- Stent fractures detected in 37.2%
- Mean follow-up period of 10.7 months
- Primary patency at 12 months was significantly lower for patients with stent fractures (41%) vs. patients with non-stent fractures (84%)
- Conclusion: “There is considerable risk of stent fractures after long segment femoral artery stenting, which is associated with a higher in-stent restenosis and reclusion rate.” (J AM Coll Cardiol 2005; 45:312-5)

Notes:

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Complications

- AV FISTULA
- PERFORATION
- ANEURYSM FORMATION
- EMBOLIZATION
- THROMBOSIS

Notes:
Open Aortic Aneurysm repair with tube graft
The cost for treating venous disease is significant. It is estimated that more than $1 billion are spent each year for CVI treatment. Also, 2,000,000 workdays are lost per year due to venous wounds.

Anatomy & Physiology
a) Anatomy and Physiology of the venous system
b) DVT Facts
c) Thrombus development in the venous system
d) DVT risk factors and symptoms

Consequences of DVT
a) Venous hypertension
b) Pulmonary Embolism
c) Post Thrombotic Syndrome

Treatment Modalities
a) Anticoagulation
b) Pharmaco-mechanical thrombolysis catheter

Notes:
**Artery vs. Veins Anatomy**

- Av Fistula
- Perforation
- Aneurysm Formation
- Embolization
- Thrombosis

**Deep Veins**

- Just below the knee, the four anterior and posterior tibial veins join with the two personal veins to become the single large popliteal vein.
- Then extend into the Femoral Vein and then Iliac

**Venous Anatomy A&;P**

- The peripheral venous system functions both as a reservoir to hold extra blood and returned unoxgenated blood to the Heart and Lungs.
- The correct functioning of the venous system depends on a complex series of valves and pumps.
- The entire cardiac output volume of 5 to 10 L/min is received into end-capillary venules for eventual delivery back to the heart and lungs.
- A large part of this volume passes into the peripheral venous system of the extremities,
- Where it is received against a reverse pressure gradient, then is passed (mostly) uphill against gravity.

**Notes:**
### The Calf Muscle Pump

- Passage of blood upward from the feet against gravity depends on a complex array of valves and pumps.

### DVT: Epidemiology

- 2 million per year with DVT Diagnosis
  - 30-50% with concurrent PE
  - 10% will be fatal within the first hour
  - 90% with Iliofemoral DVT will develop symptoms of post-thrombotic syndrome
- 50% of DVT have PE while 70% of PE have DVT

### DVT: Treatment

- Principles of Therapy
- Relief of acute symptoms
- Prevention of thrombus propagation, pulmonary embolization and recurrence
- Prevent future development of venous insufficiency and post-thrombotic syndrome

### DVT: Risk Factors

- Age >40 years
- Cancer
- Obesity
- Previous or family history of DVT/PE
- Recent surgery
- Paralysis or immobility
- Contraceptives/Hormone replacement therapy
- Pregnancy
- Serious illness: CHF, MI, sepsis
- Coagulation disorders

### Notes:
### DVT: Clinical Presentation

- Calf pain/tenderness
- Swelling
- Color, rubor
- Cyanosis or pallor
- Superficial venous dilatation
- Loss of pulses in severe DVT

### DVT: Pathophysiology

- Virchow triad:
  - Endothelial injury
  - Trauma / surgery
- Stasis of blood flow
  - Immobility, CHF, obesity, air travel
- Hypercoagulability
  - OCP’s, HRT, hypercoagulable state
- Loss of pulses in severe DVT

### DVT: Diagnosis

- History and Physical
- Compression venous ultrasound
- CT Venogram
- MR Venogram
- Loss of pulses in severe DVT

### Notes:

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### Thrombosis of the Left Lower Extremity Veins

- Due to compression of the left iliac vein by the overlying right common iliac artery
- Women in their 2nd–4th decades
- Chronic compression results in fibrotic spurs or bands which require percutaneous or surgical treatment

### MAY THURNER OR COCKETT SYNDROME

- **Sub-acute Clot Removed**
- **Chronic Clot Removed**

### 10 Days Post Hip Surgery

- LT IlioFemoral DVT

### 12 mg Tpa and Trellis

- Thrombus
- Chronic is white
- Acute is dark

### Picture 16 Hrs Post Therapy

- Post Trellis
- On heparin
- No Bleeding
- Acute is dark

### Symptomatic DVT and Flow

- Extracted Clots

### Notes:

- May Thurner or Cockett Syndrome
- Sub-acute Clot Removed
- Chronic Clot Removed
- 10 days post hip surgery
- 12 mg Tpa and Trellis
- Picture 16 hrs post therapy
- Symptomatic DVT and Flow
- Extracted Clots

- Thrombus
- Chronic is white
- Acute is dark

- Post Trellis
- On heparin
- No Bleeding
- Acute is dark
<table>
<thead>
<tr>
<th>Deep Vein Obstruction</th>
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<tbody>
<tr>
<td>&gt; Partial obstruction of the deep veins may have little effect on venous outflow, but severe obstruction of the deep veins produces secondary muscle pump failure. In this case the muscle pump produces an appropriately high outflow pressure with each contraction, but the volume of venous blood pumped out of the calf is reduced because of the reduced diameter of the outflow tract.</td>
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<th>Thrombosed IVC and Filter</th>
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<td>&gt; The goals of successful management of deep vein thrombosis (DVT) include relief of acute symptoms with restoration of venous patency, prevention of clot propagation and subsequent pulmonary embolism, and maintenance of venous valvular function.</td>
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<tr>
<th>DVT</th>
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<tbody>
<tr>
<td>&gt; Phlegmasia Alba dolens</td>
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<tr>
<td>• Thrombosis involves deep system but spares collateral veins resulting in significant edema, pain, blanching without cyanosis</td>
</tr>
<tr>
<td>&gt; Phlegmasia Cerulea dolens</td>
</tr>
<tr>
<td>• Severe form with near total occlusion including deep and superficial systems resulting in edema, pain and cyanosis</td>
</tr>
<tr>
<td>• 1-3% of DVTs</td>
</tr>
<tr>
<td>• Limb and life threatening</td>
</tr>
<tr>
<td>• Mortality: 20-40%</td>
</tr>
<tr>
<td>• Amputation: 20-50%</td>
</tr>
</tbody>
</table>

**Notes:**
Deep Vein Thrombosis

> 95% of patients treated with anticoagulation alone had ambulatory venous hypertension at 5 years
> 90% had symptoms of chronic venous insufficiency
> Only 24% of iliofemoral veins will be patent at 1 year with standard anticoagulation

Iliofemoral DVT

> Left untreated, a deep vein thrombosis (DVT) can break off and travel in the circulation, getting trapped in the lung, where it blocks the oxygen supply, causing heart failure.
> It is estimated that each year more than 600,000 patients suffer a pulmonary embolism.
> PE causes or contributes to up to 200,000 deaths annually in the United States.
> One in every 100 patients who develop DVT die due to pulmonary embolism.
> A majority of pulmonary embolism are caused by DVT.
> If pulmonary embolism can be diagnosed and appropriate therapy started, the mortality can be reduced from approximately 30 percent to less than ten percent.

Pulmonary Embolism

Notes:

- Deep Vein Thrombosis
- Iliofemoral DVT
- Pulmonary Embolism
### Postthrombotic Syndrome

**Pathophysiology:**
- DVT and the process of vein recanalization creates... valvular insufficiency
- Chronic obstruction and valvular incompetence causes... reflux of blood resulting in venous congestion/HTN
- Venous congestion/HTN leads to... edema, tissue hypoxia, ulceration

**Signs and Symptoms**
- Pain
- Edema
- Hyperpigmentation
- Ulceration

**Ambulatory venous hypertension**
- Residual venous obstruction
- Valvular incompetence
- If spontaneous lysis occurs within 2-3 months, patients are likely to preserve valvular function

**Incidence:**
- 2/3rds will have PTS
- 7-23% will develop severe PTS
- 4-6% will develop ulceration

**Frequency of PTS after symptomatic DVT**
- ~ 20% to 50%

### Notes:

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DVT Treatment

- Prophylaxis
- Anticoagulation
- Thrombolysis
  - Systemic
  - Catheter Directed
- Percutaneous Mechanical Thrombectomy
  - Suction
  - Wall Contact Devices
  - Hydrodynamic Thrombectomy Devices
  - Ultrasound Accelerated
  - Rheolytic Thrombectomy
- Combination
- Power pulse
- Trellis
  - Surgical Ligation

Anticoagulation

- Although this approach may effectively prevent recurrent thrombosis, it often fails to meet the other treatment goals. Recent studies have demonstrated that early clot lysis through the use of catheter-directed thrombolytic therapy and other adjunctive endovascular techniques rapidly restores venous patency; more effectively preserves valvular function, and improves quality of life. When used in conjunction with anticoagulation, these minimally invasive endovascular techniques have the potential to lead to improved long-term outcomes in patients with DVT.

Notes:
If your physician wants to dissolve the clot, he or she may recommend thrombolysis. In this procedure, your vascular surgeon injects clot-dissolving drugs through a catheter directly into the clot. Thrombolysis has a higher risk for bleeding complications and stroke than anticoagulant therapy. However, thrombolysis can also dissolve very large clots. Your vascular surgeon may prefer to use thrombolysis if you have a high risk for pulmonary embolism or, sometimes, if you have DVT in your arm 1.

(Oakbrook Terrace, Ill., and Washington, DC – September 27, 2004) The National Quality Forum (NQF) and the Joint Commission on Accreditation of Healthcare Organizations today announced a joint project to develop and standardize performance measures for the prevention, as well as the care, of deep vein thrombosis (DVT). The project is funded through an unrestricted educational grant from Aventis.

Notes:
DVT is an often-overlooked clinical condition where blood clots form deep inside the leg and create the risk of death when the clots break off and eventually block the circulation in the lungs. DVT affects approximately two million Americans each year; of these, 200,000 die. Almost all hospitalized patients are at risk of DVT, but it is a particular risk following major surgery, serious trauma, certain medical conditions, or prolonged inactivity from any illness. People who are immobile for prolonged periods of time for other reasons, e.g., sitting on an airplane on long flights, are also at risk for DVT.

The NQF will oversee the project and have the lead responsibility for project aspects that relate to development of relevant organizational policies and procedures, care practices, and appropriate improvement interventions. The NQF will subcontract to the Joint Commission for actual creation of the DVT performance measure set, as well as the specification and testing of these measures. The process to be utilized to identify this measure set will rely heavily on the input and guidance of a content-specific expert panel and provide ample opportunity for stakeholder input. The resulting measures will then be subjected to the NQF’s Consensus Development Process which will likely lead to formal endorsement of the measures as national consensus standards.

Notes:
Treatment Recommendations:

- Initial Treatment of acute DVT of the leg
  - Short-term treatment with SC LMWH or IV UFH or SC UFH
  - Initial treatment for at least 5 days
  - Initiation of VKA together with LMWH or UFH on the first day and discontinuing heparin when INR is stable and >2.0

- Systematically Administered thrombolysis, Catheter directed thrombolysis and surgical Thrombectomy in the initial treatment of DVT
  - Recommend against routine use of above measures
  - Reserved for limb salvage and risk of limb gangrene

- Vena Caval Interruption
  - Recommend against routine use of DVT in addition to anticoagulation
  - Placement in patients with contraindication for, or a complication of anticoagulation as well as recurrent VTE despite adequate anticoagulation

Notes:
Prevention of Post-Thrombotic Syndrome
• Recommend use of an elastic compression stocking with a pressure of 30-40mmHg during 2 years after a DVT

Ambulation after a DVT
• Recommend ambulation as tolerated. Bed rest may not provide additional protection

Acute Upper extremity DVT
• Treatment similar to Lower extremity DVT
• Surgical Ligation

Anticoagulation vs. systemic thrombolysis
• 45% clearance vs. 4% with Heparin
• Fewer post-thrombotic symptoms with thrombolysis
• Iliofemoral DVT patients not likely to respond to systemic thrombolysis
• Occlusive nature prevents exposure to medication
• Larger thrombus burden
• Risk of bleeding
• Surgical Ligation
## Surgical Treatment
- Surgical Thrombectomy
- Temporary arterio-venous fistula
- Surgical Bypass

## Percutaneous Options
- Catheter Directed Thrombolysis
- Wall Contact Devices
- Hydrodynamic Thrombectomy
- Rheolytic Thrombectomy
- Ultrasound Accelerated Thrombolysis
- Combination Infusion/Isolated Oscillation

## What do we have at SOMC
- Angiojet: Mechanical Rheolytic (10 y)
- Catheter directed: Chemical (15 y)
- Ultrasound: EKOS (3 y)
- Combination: Trellis oscillation + chemical (1y)
- Combination Infusion/Isolated Oscillation

## Catheter Directed Thrombolytic therapy
- CDT vs. Anticoagulation
  - 85-90% success rate for thrombus clearance with 60-80% 1 year patency rate
  - Benefit in restoring venous patency and maintaining valve function
  - Marked decrease in post-thrombotic syndrome and venous insufficiency

## Notes:

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<table>
<thead>
<tr>
<th>Catheter Directed Thrombolysis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Technique:</td>
<td>Catheter positioned within the thrombus with slow or pulsed infusion of thrombolytic agent</td>
</tr>
<tr>
<td>Outcomes:</td>
<td>83% with at least 50% thrombolysis with compete lysis in 31%</td>
</tr>
<tr>
<td>Disadvantages:</td>
<td>Labor and cost intensive</td>
</tr>
<tr>
<td></td>
<td>Less effective for chronic thrombus</td>
</tr>
<tr>
<td></td>
<td>Risk of hemorrhage (major 11% and minor 16%)</td>
</tr>
<tr>
<td></td>
<td>Risk of intracranial bleed (2/287: National Venous Thrombolysis Registry)</td>
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</tbody>
</table>

<table>
<thead>
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<td></td>
<td>Limited systemic thrombolytic agent</td>
</tr>
<tr>
<td>Disadvantages:</td>
<td>Cost</td>
</tr>
<tr>
<td></td>
<td>Limited data</td>
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<table>
<thead>
<tr>
<th>Isolated Pharmaco-mechanical Thrombolysis</th>
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Notes:

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**Trellis 8 Isolated Thrombolysis**

**Pharmaco-Mechanical Thrombolysis**

- The Trellis® - 8 Peripheral Infusion System is an advanced Isolated Thrombolysis catheter with two occluding balloons, drug infusion holes between the balloons, and mechanical drug dispersion capabilities. This pharmaco-mechanical combination enables focused treatment of thrombus within a targeted vessel.

**Ultrasound Accelerated Thrombolysis**

- Endowave (EKOS Corp, WA)
  - Technique:
    - Ultrasound infusion catheter distributes ultrasound waves which modify the shape of fibrin exposing more surface area for thrombolytic agent action
  - Outcomes:
    - 70% complete Lysis (Ekos registry)
    - Infusion times reduced in half (23 hours vs. 53 hours)
    - Reduced major bleeding complications (5.5% vs. 11%)
    - Clears clot behind valves leading to preservation and prevention of PTS
  - Disadvantages:
    - Similar to CDT
    - Cost

**Notes:**

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**DVT: Vena Caval Filters**

- **Absolute**
  - DVT or PE with contraindication to anticoagulation, documented failure of anticoagulation or complications of anticoagulation

- **Relative**
  - DVT or PE with continued risk of VTE despite anticoagulation

- **Prophylactic**
  - No established DVT or PE but with perceived risk of PE is high and efficacy of DVT prophylaxis is limited or poor

- **Other clinical uses: role of the retrievable filter**
  - Prior to catheter directed thrombolysis or mechanical Thrombectomy
  - Particularly with mechanical Thrombectomy devices due to risk of clot displacement and particle remobilization
  - Free-floating IVC or iliac thrombus
  - Limited respiratory or cardiac reserve

**DVT: Decision Algorithm**

- **Clinical Presentation**
  - Acute vs. Chronic
  - Swelling, pain and/or Phlegmasia

- **Level of thrombus**
  - Iliocaval, Iliofemoral, femoral-popliteal, calf

- **Associated co morbidities**
  - Risk of bleeding with anticoagulation, CDT, PMT or isolated Thrombectomy

**Notes:**

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> Acute Iliofemoral DVT of <10 days duration with pain and swelling
> Otherwise active patient with long life expectancy
> May-Thurner or Crockett syndrome
> Phlegmasia Alba and Cerulea Dolens
> Extensive IVC thrombosis
> Large free-floating iliofemoral or IVC thrombus
> Acute or subacute DVT with either clot propagation or persistent symptoms despite anticoagulation
> Acute on Chronic DVT with propagation or persistent symptoms despite anticoagulation

Patient Selection for Percutaneous Thrombolysis/Thrombectomy

Notes:
# Chapter 20: Heparin

## Induced Thrombocytopenia

<table>
<thead>
<tr>
<th><strong>Heparin</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Heparin potentiates the action of AT</td>
</tr>
<tr>
<td>▶ Discovered by McLean in 1916</td>
</tr>
<tr>
<td>▶ Bovine/porcine</td>
</tr>
<tr>
<td>▶ AT and heparin cofactor II</td>
</tr>
<tr>
<td>▶ Does not work on fibrin bound thrombin</td>
</tr>
<tr>
<td>▶ Osteoblast suppression, osteoclast activation</td>
</tr>
<tr>
<td>▶ Increased vasc permeability</td>
</tr>
<tr>
<td>▶ Inhibits vascular smooth muscle proliferation</td>
</tr>
<tr>
<td>▶ Binds to a lot of proteins (fibronecin, vitronectin) GF, GPs</td>
</tr>
<tr>
<td>▶ It is interesting that we don’t see much HIT in dialysis patients</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>H.I.T.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Occurs in 5% of patients receiving heparin for at least 5 days</td>
</tr>
<tr>
<td>▶ Diagnosis is clinical</td>
</tr>
<tr>
<td>▶ 50% drop in baseline platelet count or a drop to below 100,000.</td>
</tr>
<tr>
<td>▶ Need to R/O other causes of platelet drop as in consumption or new large graft implants (AAA)</td>
</tr>
<tr>
<td>▶ HIT</td>
</tr>
<tr>
<td>▶ HITTS (Thrombosis syndrome)</td>
</tr>
<tr>
<td>▶ HIT I non immune</td>
</tr>
<tr>
<td>▶ HIT II immune mediated</td>
</tr>
<tr>
<td>▶ Hypothesis: IgG Ab react with a complex of Heparin and platelet factor 4 forming a complex</td>
</tr>
</tbody>
</table>

### Notes:

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H.I.T. (continued)

- Lab test unfortunately not local takes days
- Once diagnosed stop heparin and switch to Argatroban (Direct Thrombin Inhibitor) better than using Hirudin (antibodies to it can form)
- Don’t start Coumadin until the plat ct is over 100,000
- Argatroban does raise the INR
- Asymptomatic HIT has a 30 day cumulative thrombosis of 50% they should be anticoagulated even if hep. is stopped and plat ct has come up.
- No antidote
- Just therapy use argatroban, early recognition and prevention of complications, graft occlusions arterial thrombosis limb loss.
- Argatroban, stop heparin wait till plat over 100k

Case study

- One week ago patient post back surgery at KDMC was treated for DVT released home on no anticoagulants 6 yrs prior had dvt and ivc filter
- Presented with caval thrombosis and lower extremity edema
- Plat ct 160 on admission
- Lysed tpa and heparin plat dropped below 100 positive HIT argatroban started
- Converted to coumadin after plat over 100k

- IVC
- DVT with Ischemia
- Thrombus of various age
- Thrombus
- Post Lysis

Notes:
## Chapter 20:  *Illofemoral DVT*

### Phlegmasia Cerulea Dolens
- Can lead to limb loss
- Poor surgical results
- Case reports of chemical lysis in pregnancy
- Chemical lysis carries however the potential risk of bleeding
- New approach with mechanical lysis

### Mechanical Thrombolysis
- Pulse jet of heparinised saline to breakdown the clot and suction it out
- Pulse therapy with combination mechanical and chemical lysis.
- Had never been tried in pregnancy

### Current applications of mechanical lysis
- Thrombosed grafts (dialysis, ptfe bypasses)
- DVT when chemical agents are contraindicated/and or in conjunction with
- Peripheral arterial occlusions
- Pulmonary emboli

### Side effects of mechanical rheolytic therapy
- Breakdown of rbc and release of hgb
- Hemoglobinuria (renal, atn )
- Microembolization/macro

### Technique
- Prone position
- Duplex guided percutaneous access into the popliteal vein
- 6Fr sheath
- Over a wire technique
- Multiple passes
- Foley catheter

### Notes:
<table>
<thead>
<tr>
<th><strong>Set up</strong></th>
<th><strong>Blue limb</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access</strong></td>
<td><strong>Phlegmasia</strong></td>
</tr>
<tr>
<td><strong>Phlegmasia with limb ischemia</strong></td>
<td><strong>Immediate post therapy</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Before and after</strong></td>
</tr>
</tbody>
</table>

### Case reports in pregnancy

- 2 Patients in the second trimester and one in the first
- Case 1 failed heparin and readmitted with limb ischemia
- Patient 1 had a therapeutic abortion for anencephalic baby 1 month post therapy
- Patient 1 completed a second pregnancy without dvt
- All limbs were salvaged
- Patient 2 delivered healthy baby no untoward effects on kidneys
- Both patients had negative venous duplex scans 6 months post lysis.
- Both patients had no edema and ambulated without compression stockings.

### Results of therapy

- All limbs were salvaged
- No renal failure
- No venous reflux on 6 month follow studies
- Healthy babies delivered in patients 2 and 3
- Initial results are very encouraging
- Without compression stockings.

### Summary

- Mechanical thrombolysis can be performed safely in pregnancy.
- It seems less risky than chemical lysis in pregnancy.
- Monitoring the color of the urine and avoiding excessive hemoglobinuria to safeguard against renal side effects.
- Without compression stockings.
### Chapter 20: *Thrombolytic Therapy in the Management of Deep Venous Thrombosis*

#### DVT: Risk Factors
- Age >40 years
- Cancer
- Obesity
- Previous or family history of DVT/PE
- Recent surgery
- Paralysis or immobility
- Contraceptives/Hormone replacement therapy
- Pregnancy
- Serious illness: CHF, MI, sepsis
- Coagulation disorders
- New approach with mechanical lysis

#### DVT: Pathophysiology
- Endothelial Injury
  - Trauma / Surgery
- Stasis of Blood Flow
  - Immobility, CHF, Obesity, Air Travel
- Hypercoagulability
  - OCP’s, HRT, Hypercoagulable State

#### Virchow Triad:

**Notes:**

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### Goals of Therapy
- Prevention of long term sequelae of the post thrombotic syndrome (lipodermatosclerosis, ulcers)
- Valve preservation and prevention of chronic ambulatory venous hypertension
- Restoration of flow and limb salvage in Phlegmasia Cerulea Dolens
- Improvement in Cardiodynamics and prevention of pulmonary hypertension in P.E.
- Foley catheter without compression stockings.

### Which Patient to Target?
- P.E. with RV Strain, Saddle Emboli
- Caval Thrombosis
- Iliofemoral Deep Venous Thrombosis
- DVT proximal to the Saphenofmoral Junction

### Technology Evolution
- Continuous Drip with Multisidehole catheter (Mewissen, Katzen, unifuse)
- Mechanical Rheolytic Angiojet System (pulse therapy)
- Intracavitary Ultrasound EKOS catheter (variable frequency)
- Trellis System (mechanical oscillation)

### Advantages of Mechanical Devices
- Reduction in duration of overall lytic therapy
- Less risk of bleeding
- Fewer angios and contrast load
- Are proven to work with subacute and chronic thrombus
- Trellis System (mechanical oscillation)

### Notes:

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### The Trellis® - 8 Peripheral Infusion System

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- **12 mg Tpa and Trellis**
  - Thrombus
  - Chronic is white
  - Acute is dark

### Pharmaco-Mechanical Thrombolysis

#### Picture 16 hrs Post Therapy

- **Post Trellis**
- **On Heparin**
- **No Bleeding**

### Phlegmasia

- **Phlegmasia Alba Dolens**
  - Thrombosis involves deep system but spares collateral veins resulting in significant edema, pain, blanching without cyanosis.

- **Phlegmasia Cerulea Dolens**
  - Severe form with near total occlusion including deep and superficial systems resulting in edema, pain and cyanosis.

- **1-3% of DVTs**
- **Limb and life threatening**
- **Mortality: 20-40%**
- **Amputation: 20-50%**

### Notes:

- Not All Proximal DVT is Created Equal
- May Thurner Syndrome
- Stent with Area of Stenosis
- Angioplasty
- Post Angioplasty
- 10 Days Post Hip Surgery

- Pharmaco-Mechanical Thrombolysis
- Picture 16 hrs Post Therapy
- Phlegmasia Alba Dolens
- Phlegmasia Cerulea Dolens
- 1-3% of DVTs
- Limb and life threatening
- Mortality: 20-40%
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Iliofemoral DVT

- 95% of patients treated with anticoagulation alone had ambulatory venous hypertension at 5 years.
- 90% had symptoms of chronic venous insufficiency.
- Only 24% of iliofemoral veins will be patent at 1 year with standard anticoagulation.

Pulmonary Embolism

- Phlegmasia Post Lysis
- Thrombus Retrieval with 9 Fr. Cath.

- Left untreated, a deep vein thrombosis (DVT) can break off and travel in the circulation, getting trapped in the lung, where it blocks the oxygen supply, causing heart failure.
- It is estimated that each year more than 600,000 patients suffer a pulmonary embolism.
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DVT Treatment

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- Anticoagulation
- Thrombolysis
  - Systemic
  - Catheter Directed
- Percutaneous Mechanical Thrombectomy
  - Suction
  - Wall Contact Devices
  - Hydrodynamic Thrombectomy Devices
  - Ultrasound Accelerated
  - Rheolytic Thrombectomy
- Combination
  - Power pulse
  - Trellis
- Surgical Ligation

What Do We Have at SOMC

- Angiojet: Mechanical Rheolytic (10 y)
- Catheter directed: Chemical (15 y)
- Ultrasound: EKOS (3 y)
- Combination: Trellis oscillation + chemical (1 y)

Catheter Directed Thrombolytic Therapy

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Isolated Pharmaco-Mechanical Thrombolysis

Trellis-8 (Bacchus Vascular, CA)
>
Technique:
• Two occluding balloons, drug infusion holes and a mechanical drug dispersion capability
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Outcomes:
• Mean thrombus removal of 79%
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• Limited systemic thrombolytic agent
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Disadvantages:
• Cost
• Limited data

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Disadvantages:
• Similar to CDT
• Cost

Ultrasound Accelerated Thrombolysis

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<tbody>
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<td>› Need to Limit duration of therapy due to Hemoglobinuria</td>
</tr>
<tr>
<td>› Alkalinise urine</td>
</tr>
<tr>
<td>› Force diuresis</td>
</tr>
<tr>
<td>› I have not used a prophylactic filter except on patients who had embolised prior to procedure.</td>
</tr>
<tr>
<td>› Cannot use safely in PE cases</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks of Trellis</th>
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<tbody>
<tr>
<td>› Need to use a filter high risk of embolization of large particles</td>
</tr>
<tr>
<td>› Need to use a 9 Fr Guiding catheter or a 10 Fr Pronto catheter for large clot retrieval, the latter may be added to the kit in the future</td>
</tr>
<tr>
<td>› No Indication for PE yet, has not been tried</td>
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<table>
<thead>
<tr>
<th>Drawbacks of the EKOS</th>
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</thead>
<tbody>
<tr>
<td>› Cooling port clogs up on occasions</td>
</tr>
<tr>
<td>› Difficult to reuse the catheter due to sterility issues after its removal for angio.</td>
</tr>
<tr>
<td>› Needs on occasions a secondary device in chronic clots that do not respond to lysis (high fibrin content).</td>
</tr>
</tbody>
</table>

**Notes:**

- Cost
- Angiojet Mechanical Lysis
- Post Angiojet and Chemical Lysis
- Caval Thrombosis
- Post Therapy
- Chronic and Acute Thrombus
- Pre and Post Therapy

- Thrombus
- Caval Thrombosis
- Thrombus
- Post Trellis
- Ekos Catheter
- Post Ekos
What Do I Use?

- All three systems and select the one that will give me the shortest duration of therapy.
- A combination of chemical and mechanical
- With EKOS you can drip Tpa at lower doses (from 2 mg per hour to .5 mg).
- With Trellis you can treat without Tpa in very high risk cases, e.g. recent intracranial bleeds.
- They are all safe if properly used.
Introduction

- 10-35% of adults have some form of CVI.
- Venous ulcers affect 4% of adults >65.
- Cost: >1 billion dollars per year.
- Loss of 4.6 million workdays per year.
- The recurrent nature of the disease and the ineffective current treatment modalities underscores the need for further CVI research.

Venous ulceration

- CVI is caused by venous HTN.
- Chronic inflammatory state.
- Primary injury: extravasation of fibrinogen and macroglobulin + RBC into dermis, signaling leukocyte recruitment.
- Increased expression of ICAM1 (adhesion molecule) on endothelial cells.
- Dermal fibrosis.
- TGFβ1 (levels in dermis increase with severity), primary regulator in CVI causes intense dermal fibrosis.
- PDGFR alpha and beta and VEGF are also found in the dermis of CVI patients.
- They regulate leukocyte recruitment, capillary proliferation, and interstitial edema in CVI patients.
- Aberrant phenotypic fibroblast activity, decreased collagen activity.
- Cellular senescence, no ulcer healing.
- Tissue remodeling and matrix deposition are controlled by MMPs.
- MMP1, 2, and TIMP1 are increased in patients with lipodermatosclerosis.
- High MMP2 increases remodeling and delay healing.

Notes:
Varicose vein formation: genetic/environmental

Vein wall fibrosis and loss of valvular competence which lead to venous htn

High pressure on dermal circulation causes extravasation of macromolecules and rbc's enticing an inflammatory injury.

Fibroblast proliferation decreases with disease progression.

Venous ulcer fibroblasts share many similarities to a senescent phenotype, they are not in a senescent state (growth arrested with inability to proliferate)

Valve damage and subsequent incompetence is the result of thrombosis.

Patients who experience rapid recanalization can preserve some valve function and do better clinically.

Patients treated with thrombolysis have fewer post thrombotic symptoms and improved quality of life.

Natural thrombosis recanalization is a slow process.

The monocyte is the important mediator in the process.

Deletion of the gene encoding urokinase type plasminogen activator results in poor monocyte recruitment and poorer results.

Venous ulcer conclusion

Mechanisms in the natural resolution of venous thrombosis

Notes:
### Resolution of venous thrombosis

- The inhibitory phenotype can be reversed by transplanting normal bone marrow.
- Direct injection of monocyte derived macrophages results in a 5 fold reduction in thrombus size and a 4 fold increase in recanalisation.
- IL8, VEGF and MCP1 also enhance thrombus resolution.

### The new anticoagulants

- UFH discovered by McLean in 1916
- 1960’s UFH established as standard of care for VTE
- Immediate onset of action, short t1/2
- Unpredictable due to protein binding to proteins not involved in clotting
- Difficulties in establishing therapeutic levels w/i 12-24 hrs
- Hit 1-3%
- LMWH have greater bioavailability longer t1/2
- More predictable dose response
- Lower incidence of hit
- Survival benefit inpatients with CA
- Warfarin suppresses the body’s natural anticoagulants before achieving a full circulating anticoagulant effect.
- Used for secondary thrombosis prophylaxis
- Long t1/2
- Drug interactions, food interactions
- Factor xa inhibitors, fondaparinux, refinement of the UFH molecule containing the pentasaccharide found in UFH that binds and activates antithrombin which blocks the activation of factor xa
- T1/2 17 hrs
- 1.6% Venographically proven DVT in pts with hip fx after 30 days prophylaxis. Superior results

### Notes:

- —
- —
- —
- —
### The new anticoagulants (continued)

- No hit
- Can be used in treating dvt and pe
- Idraparinux, t1/2 3-4 days currently in trials
- Oral pentasaccharide razaxaban in trials
- Direct thrombin inhibitors dti
- Found in the medicinal leech
- Used in hit
- New oral cpd ximelagatran, absorbed and converted to melagatran
- Low potential for food and drug interactions
- Not bound to plasma proteins
- Can cause rise in lft’s
- Equally effective and superior to coumadin or lmwh
- Dabigatran etexilate another dti is in trials

### Therapeutic goals in treating acute dvt

- Reduction of pe
- Prevention of extension
- Reducing recurrence
- Restoring patency of the occluded vein
- Preserving valvular function
- Reducing cvi

### Anticoagulation alone

- Does not restore patency
- Does not preserve the valve
- Does not prevent cvi

### Post thrombotic synd

- Pts due to severe dvt
- 15-40% Of pts treated develop debilitating sxs w/1 5 yrs
- 95% Have cvi
- 15% Have ulcers
- Pathophysiology is ambulatory venous htn(obstruction,valvular incompetence)

### Notes:
Natural hx of acute dvt treated with anticoagulants

- Meissner demonstrated that some pts lysed their thrombus spontaneously.
- Those who lyse w/i 60 days of treatment had restored patency and a better likelihood of valve preservation.
- Persistent thrombosis of the proximal vein led to distal valvular incompetence.
- This combo leads to ambulatory venous htn.

Catheter Directed Thrombolysis

- Goal is to reestablish patency
- Goal is to preserve the valve
- Goal is to prevent cvi
- Goal is to prevent v htn
- Associated with improved quality of life

Mechanical Thrombolysis

- Angiojet device pulse jet of heparinized saline
- May use combination of chemical and mechanical
- Multiple applications avg, dvt, pe, arterial and venous

- Thrombolysis results
- Molecular markers for vte

Thrombolysis

- Urokiase coming off the market
- Tpa results are comparable and the safety profile is comparable, growing experience
- Tnkase

Notes:
## Introduction

- Cvi is caused by venous htn
- Chronic inflammatory state
- Primary injury: extravasation of fibrinogen and macroglobulin+rbc into dermis, signaling leukocyte recruitment
- Increased expression of icam1(adhesion molecule) on endothelial cells
- Dermal fibrosis
- Tgfb1(levels in dermis increase with severity), primary regulator in cvi causes intense dermal fibrosis

## Venous Ulceration

- Pdgfr alpha and beta and vegf are also found in the dermis of cvi patients.
- They regulate leukocyte recruitment capillary proliferation and interstitial edema in cvi patients.
- Aberrant phenotypic fibroblast activity, decreased collagen activity
- Cellular senescence, no ulcer healing
- Tissue remodeling and matrix deposition are controlled by mmps
- Mmp1,2 and timp1 are increased in patients with lipodermatosclerosis
- High mmp2 increases remodeling and delay healing

## Venous Ulcer Conclusion

- Varicose vein formation: genetic/environmental
- Vein wall fibrosis and loss of valvular competence which lead to venous htn

### Notes:

- Varicose vein formation: genetic/environmental
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### Venous Ulcer

**Conclusion (cont.)**

- High pressure on dermal circulation causes extravasation of macromolecules and rbc's enticing an inflammatory injury.
- Fibroblast proliferation decreases with disease progression.
- Venous ulcer fibroblasts share many similarities to a senescent phenotype, they are not in a senescent state (growth arrested with inability to proliferate).

### Mechanisms in the natural resolution of venous thrombosis

- Valve damage and subsequent incompetence is the result of thrombosis.
- Patients who experience rapid recanalization can preserve some valve function and do better clinically.
- Patients treated with thrombolysis have fewer post-thrombotic symptoms and improved quality of life.
- Natural thrombosis recanalization is a slow process.
- The monocyte is the important mediator in the process.
- Deletion of the gene encoding urokinase type plasminogen activator results in poor monocyte recruitment and poorer results.

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**Notes:**

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### Resolution Of Venous Thrombosis

- The inhibitory phenotype can be reversed by transplanting normal bone marrow.
- Direct injection of monocyte derived macrophages results in a 5 fold reduction in thrombus size and a 4 fold increase in recanalisation.
- IL8, VEGF and MCP1 also enhance thrombus resolution.

### The new anticoagulants

- UFH discovered by McLean in 1916
- 1960’s UFH established as standard of care for VTE
- Immediate onset of action, short t1/2
- Unpredictable due to protein binding to proteins not involved in clotting
- Difficulties in establishing therapeutic levels within 12-24 hrs
- HIT 1-3%

### New anticoagulants

- LMWH have greater bioavailability longer t1/2
- More predictable dose response
- Lower incidence of HIT
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- Warfarin suppresses the body’s natural anticoagulants before achieving a full circulating anticoagulant effect.
- Used for secondary thrombosis prophylaxis
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Phlegmasia Cerulea Dolens

Mixed arterial thrombus old and new
### Introduction
- Retrospective review, with emphasis on long-term studies
- Massive and Sub-massive PE

### Methods
- Significant pulmonary emboli
- Hypoxemia
- Right Ventricular Strain
- Hemodynamic Compromise
- Therapy Evaluation
- Mechanical Fibrinolysis vs Chemical Fibrinolysis
- Adjunct Therapies
- Therapy Duration
- Complications
- Excessive Bleeding (2/51)
- Infection (0/51)
- Other/Unrelated (1 Death)
- Short-term Therapeutic Results
- Complete vs. Partial Lysis
- Long-Term Therapeutic Results
- Recurrence of thromboembolic event

### Notes:
Results: Therapy

- 51 Patients treated with Thrombolytic Therapy
  - 7 received Urokinase
  - Drip ranges between 100,000-200,000 units/hour
  - 44 received TPA
  - Drip ranges between 0.5-2.0 mg/hour
- 12 Patients treated with Adjunctive Mechanical Therapy
  - 3 out of 12 were treated with the AngioJet Device
  - 9 out of 12 were treated with EKOS (intracavitary ultrasound)
- Average Drip Duration
  - Range between 12-24 hours
  - Average TPA drip duration – 24.23 hours with STD of ± 21.68 hours
  - Average Urokinase drip duration – 16.57 hours with STD of ± 4.47 hours
- Average Total Dosage
  - TPA – 43.74 mg with STD of ± 31.42 mg
  - Urokinase – 2,570,000 units with a STD of ± 360,000 units
- 37 out of 51 patients received an Inferior Vena Cava Filter
  - 13 Greenfield
  - 12 TrapEaze
  - 10 Tulip
  - 2 Option
  - 3 Previous Greenfield

Notes:
Results: Short-Term

- Pre- and Post-lytic PA Transduced Pressure
- Initial and Long-Term PAP and RVSP by Echocardiography
- Initial and Long – Term PA Pressures by Echocardiography
- Initial and Long – Term RSVP by Echocardiography

Complications During Procedure

- No Procedural Mortalities
- No deaths at 30 days post therapy
- There were no retroperitoneal hematomas, ICH, stroke or MI

Mortality Complications

- We had 1 death, a patient with massive PE that succumbed shortly after catheter placement and before instituting the TPA drip, at that time cardiopulmonary bypass was not an available option at our hospital.

Bleeding Complications

- Bleeding complications GI bleed (1/51); Airway bleed (1/51)
- Drop in hemoglobin without identified bleeding site (7/51)

Other Complications

- Therapy was discontinued and patient was intubated for 24 hours.

Notes:
Results: Long-Term

- Long-Term Therapeutic Results
- Long-Term Mortality

Discussion

- Limitations of this study
  - Severity of Emboli
  - Limited Long-term results

Conclusion

- Aggressive catheter directed thrombolysis in massive and sub-massive PE is safe.
- Substantial results within 24 hours.
- Rapid improvement in symptoms over a short duration.
- Very low risk of bleeding with 2/51 3.9% With 0% intracranial hemorrhage in the catheter directed modality with 8/51 patients over the age of 80.
- Most of the patients had a reduction in PA pressure post therapy.

Notes: