

MASSIVE HEMOPTYSIS

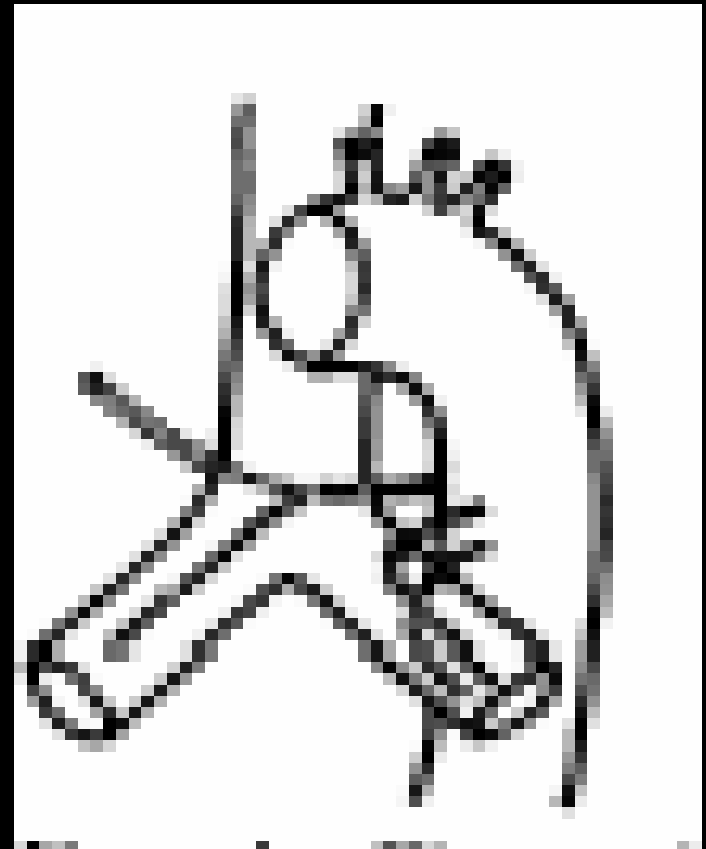
-abdul khaliq

DEFINITION

- >200-600 ml/24 hrs
- Crocco et al. showed that prognosis of medically treated hemoptysis changes drastically when 600 ml of blood is lost in 1 day
- Massive hemoptysis is seen in 1.5 % of all hemoptysis cases

ANATOMY

- Pulmonary circulation- low pressure 15-20mm HG/
5-10 mm HG
- BRONCHIAL CIRCULATION
 - Nutritional source to lung
 - Arise from aorta / intercostal arteries
 - Ant. Spinal artery may arise from the bronchial artery



ANATOMY

- Enter hila - >follow bronchial tree
 - >anastomose freely with each other as plexiform arrangement in peri-bronchial space
- Extensive submucosal plexus in bronchial wall
- Beyond the terminal bronchiole anastomose with precapillary pulm. arterioles and veins
- Arterioles associated with airways are under systemic pressure, they have propensity to bleed when airways are diseased

■ ETIOLOGY

Neoplasm:

- 1) bronchial carcinoma, adenoma
- 2) metastatic lung cancer

Bronchiectasis

Infections:

- 1) mycobacteria, especially tuberculosis
- 2) fungal infections
- 3) lung abscess, necrotizing pneumonia
- 4) paragonimiasis
- 5) hydatid cyst

Vascular:

- 1) pulmonary infarct, embolism
- 2) mitral stenosis
- 3) iatrogenic rupture of pulmonary artery by balloon-tipped catheter
- 4) broncho-arterial fistula
- 5) ruptured thoracic aneurysm
- 6) arteriovenous malformation

Vasculitis:

- 1) Behcet's disease
- 2) Wegener's granulomatosis

Miscellaneous:

anticoagulant therapy, coagulopathies (von Willebrand's disease, hemophilia, thrombocytopenia), Goodpasture's syndrome, trauma, lymphangioliomyomatosis

TUBERCULOSIS

- Active tubercular pneumonitis- bronchiolar erosion
- Rupture of Rasmussen's aneurysm (pulm. art)
- Healed calcified LNE-eroding through bronchial arteries into airway (expectoration of broncholith)
- Scar carcinoma
- Development of bronchiectasis
- Mycetoma formation

BRONCHIECTASIS

- Pathologically it is destruction of the cartilaginous support of bronchial wall and bronchial dilatation owing to parenchymal retraction from alveolar fibrosis
- **ANATOMICAL CHANGES:**
 - **Bronchial artery hypertrophy**
 - **Expansion of peribronchial & sub mucosal bronchiolar arteriolar plexus**
 - **Augmentation of anastomoses with the pulmonary arterial bed**

FUNGAL INFECTION

- Mycetoma
- Fungal pneumonia- invasive fungal infections- common in hematological malignancies- mainly by the Aspergillus
- Blastomycosis & Histoplasmosis

MYCETOMA

Preexisting cavity lesions

- Sarcoidosis,
- Tuberculosis,
- Lung abscess,
- Cavitating carcinoma (squamous carcinoma)
- Lung abscess ,
- Lung infarction,
- Bullous emphysema,
- Bronchiectasis,
- Fibrobullous disease of rheumatoid arthritis & ankylosing spondylitis

MYCETOMA

- Fungal ball- hyphal elements mixed with necrotic cellular debris, fibrin & mucus
- Wall of mycetoma cavity is fibrous containing of highly vascular granulation tissue & chronic inflammatory cells
- The blood vessels lining the cavity are the branches of bronchial artery network

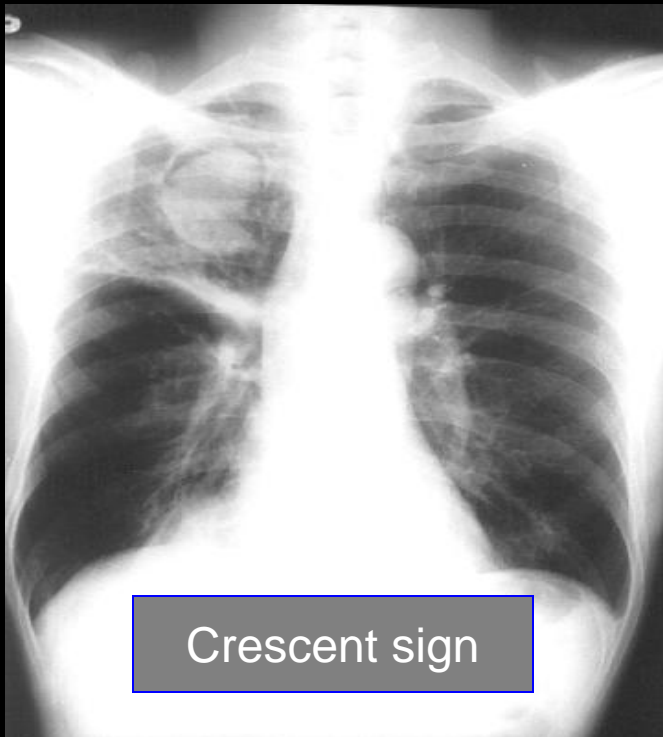
MYCETOMA

- Saprophytic infections
 - *Aspergillus fumigatus* is the commonest organism
 - other species of *aspergillus*
 - *mucor*
- Hemoptysis occur in 50- 90% of patients with mycetoma

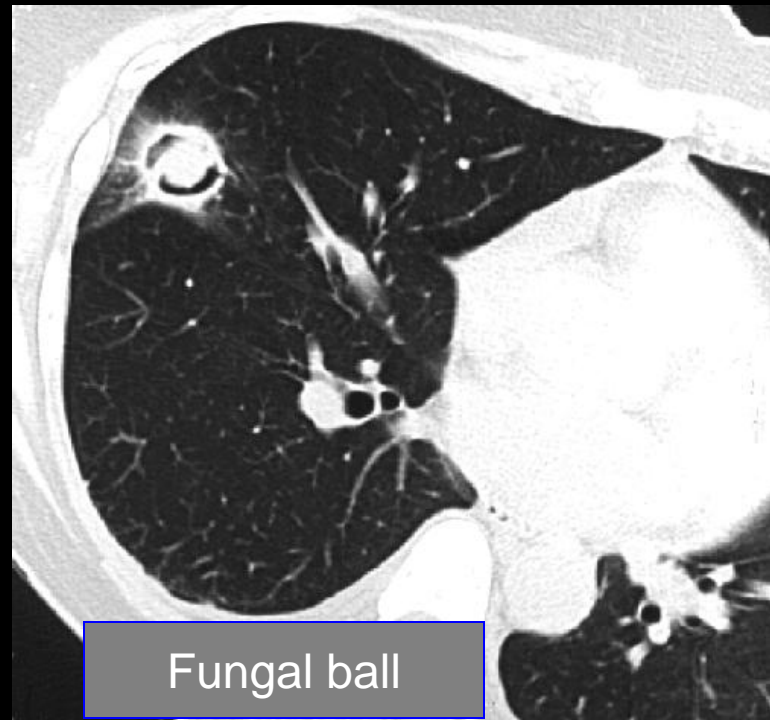
MYCETOMA

- MECHANISMS:
- Mechanical trauma of the vascular granulation tissue by the movement of the fungal ball in the cavity
- Vascular injury from aspergillus associated endotoxin
- Aspergillus related proteolytic activity
- Vascular damage from a type 3 hypersensitivity reaction

Fungal ball



Crescent sign



Fungal ball

LUNG ABSCESS

- 11-15% of primary lung abscess patients
- Massive bleeding in 20- 50 % of bleeders
- Due to necrotizing effect of primary infection and the inflammation that involves pulmonary vasculature

MITRAL STENOSIS

- Before valvotomy and mitral valve replacement-hemoptysis occurred in 20-50% of patients with massive bleed - 9-18%
- M.S -- left atrial pressure – pulmonary veins-pulmonary capillary bed-if pressure exceeded in the rt. atrial pressure- blood flows in the retrograde direction in the bronchial veins through the bronchopulmonary anastomosis
- The sub mucosal bronchial venous plexus dilates

MYCETOMA

- Blood is directed back to the right atrium via azygos and the intercostal veins
- Prominent varices in the submucosa of the bronchial walls are formed
- Hemoptysis is precipitated by URTI , simple coughing, rise in intravascular volume and pressure as in pregnancy

CONG. HEART LESIONS

- Pulmonary hypertension – (pri , sec)
- Eisenmenger's complex
- Blalock- Taussig shunt- sec. pulm. htn.
- Tetralogy of fallot- where the pulmonary outflow tract is atretic

CARCINOMA

- 7-10% of patients with bronchogenic carcinoma- streaky hemoptysis
- Mc Gregor's series: 3% patients with bronchogenic carcinoma has massive , terminal hemoptysis
- Most of them had previous small amounts of bleed but 20% had no such previous episodes

CARCINOMA

- 83% with hemoptysis – squamous carcinoma
 - centrally located
 - 48% cavitate
- Mechanism:
 - necrosis and inflammation of vessels within tumor bed
- Direct tumor invasion of the pulmonary vasculature is rare

BRONCHIAL CARCINOIDS

- Endobronchial location & marked vasculature
- Polypoidal tumor with a stalk
- Stalk- submucous in location-derives blood supply from the bronchial artery system
- Micro: cords or nests of uniform, small cells separated by a rich fibrovascular stroma

BRONCHIAL CARCINOIDS

- Trauma to the delicate tumor vessels
- Vascular invasion by tumor is rare
- Hemoptysis is seen in 45%- 83%
- No bleeding by fiberoptic bronchoscope and small biopsy forceps

METASTASES

- Due to endobronchial lesion
- Breast
- Colon
- Kidney
- Melanoma
- Tumors of the mediastinum particularly esophageal carcinoma-extending directly into tracheobronchial tree

HEMOTOLOGICAL MALIGNANCIES

- Hemoptysis is strongly associated with fungal pneumonia
- 33%-50% of patients with leukemia and occult pulm. hemorrhage has Aspergillus pneumonia
- Mech: fungal invasion of pulmonary vasculature- thrombosis, ischemia
- Granulocyte recovery

HEMOTOLOGICAL MALIGNANCIES

- Idiopathic pulmonary hemorrhage-2-3%
- Cytotoxic agents (cytoxan , cytosine arabinoside)
- Radiation injury
- Viral infections
- Bacteremia
- Sepsis

VASCULAR ANAMOLIES

- PRIMARY
- ACQUIRED:
 - Cirrhosis
 - Mitral stenosis
 - Pulmonary schistosomiasis
 - Metastatic carcinoma

VASCULAR ANAMOLIES

- Primary AVM:
- Multiple in 33-50%
- Bilateral in 8-20%
- 60% are associated with Osler- Weber- Rendu syndrome
- Arterial supply from pulmonary tree
- The wall of veins draining –degenerative changes- varicose-rupture- hemoptysis
- Hemoptysis occurs in 10% of patients but massive bleed is rare

WHAT TO DO WITH H/O HEMOPTYSIS

TABLE 2

Differentiating Features of Hemoptysis and Hematemesis

| <i>Hemoptysis</i> | <i>Hematemesis</i> |
|--|---------------------------------|
| History | |
| Absence of nausea and vomiting | Presence of nausea and vomiting |
| Lung disease | Gastric or hepatic disease |
| Asphyxia possible | Asphyxia unusual |
| Sputum examination | |
| Frothy | Rarely frothy |
| Liquid or clotted appearance | Coffee ground appearance |
| Bright red or pink | Brown to black |
| Laboratory | |
| Alkaline pH | Acidic pH |
| Mixed with macrophages and neutrophils | Mixed with food particles |

Information from references 4, 17, and 18.

LOCALIZATION

- Physical examination
- CXR
- CT chest
- Bronchoscopy
- Arteriography
- RBC scan
- Bronchography

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- Physical examination and chest x-ray were equivocal and not helpful in 55%-60% of patients
 - This poor localization of bleeding reflects the fact that blood may be widely distributed in the lung by coughing

BRONCHOSCOPY

RIGID

- Improved suctioning
- Continuous airway control
- Larger lumen-packing/clearing clots
- Decreased visual range
- General anesthesia

FLEXIBLE

- Performed at bedside
- Access to UL/distal orifices
- Lavage segments of lung methodically
- Can be used with the rigid bronchoscope

BRONCHOSCOPY

- Early bronchoscopy :(48 hrs)
 - Diagnostic yield is higher
 - Likely hood of localizing site is more
 - Accurate localization may direct therapeutic interventioin

COMPUTED TOMOGRAPHY

- CT chest during active bleeding may be misleading because aspirated blood may obscure underlying pathology or incorrectly appear as a parenchymal mass

- **RBC SCAN**

- Tc 99m-sulfur colloid isotope-labeled RBC
- Reserved for the patients in whom bronchoscopy couldn't be performed

- **BRONCHOGRAPHY: replaced by HRCT**

- **OTHER TESTS: according to etiology**

MASSIVE HEMOPTYSIS

ADMIT IN ICU

**STABILIZE AIRWAY
MONITOR OXYGENATION
INTUBATE
BT REQ 6 UNITS
HEMODYNAMIC STABILITY
CORRECT PTI/ PLATELETS
CTVS CONSULTATION**

BLEED STOPPED

**BRONCHOSCOPY+
CT CHEST**

+/-ANGIOGRAPHY

BLEED PERSISTING



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EARLY BRONCHOSCOPY

LOCALIZED

- **TOPICAL THERAPY**
- **BRONCHIAL TAMPONADE**
- **UNI-INTUBATION**

NOT LOCALIZED

- **LUNG ISOLATION**
- **DOUBLE LUMEN TUBE**
- **RIGID BRONCHOSCOPY**
- **ARTERIOGRAPHY +/-**
- **EMBOLIZATION**
- **SURGERY**

EMBOLIZATION VS SURGERY

MANAGEMENT

- BRONCHOSCOPIC MEASURES:
 - BRONCHIAL IRRIGATION
 - VASOCONSTRICTIVE AGENTS
 - TOPICAL COAGULANTS
 - LASERS
- ENDOBRONCHIAL BLOCKADE
 - BALLOON TAMPONADE
 - UNILATERAL LUNG VENTILATION
 - DOUBLE-LUMEN ENDOTRACHEAL TUBES
- EMBOLOTHERPY
- SURGERY

MANAGEMENT

- **BRONCHIAL IRRIGATION:**
 - Colon et al iced saline lavage (4⁰c) arrested bleeding in 23 patients- 2 patients rebled
- **VASOCONSTRICTIVE AGENTS:**
 - Topical epinephrine (1:2000)
 - Intravenous vasopressin

MANAGEMENT

- ELECTROCAUTERY
- ARGON PLASMA COAGULATION
- BRONCHOSCOPIC BRACHYTHERAPY
- TOPICAL COAGULANTS:
 - Tsukamoto et al- 19 pts-
 - 60% hemostasis with topical thrombin
 - 100% - fibrinogen-thrombin solution (re bleeding in 1 pt)

MANAGEMENT

- LASER COAGULATION:
- Nd –YAG laser therapy for endobronchial tumors
- Thermal effects vaporizes the superficial layers and coagulate the deeper layers
- Seal vessels upto 1.5mm in diameter but larger vessels maynot be adequately controlled
- Even highly vascular tumors have a propensity to bleed when subjected to laser therapy

BALLOON TAMPONADE

- 4 Fr 100 cm Fogarthy balloon catheter-
placed by the fiberoptic bronchoscope and
is inflated in the segmental and sub
segmental bronchus
- Inflated for 24-48 hrs
- Advantages:
 - Allows gas exchange
 - Supports patient before embolization or surgery

- Disadvantages:

- Ischemic mucosal injury
- Post obstructive pneumonia

- Saw et al- 6/10 patients effective . No rebleeding for 6wks- 9 months

- Swersky et al- 4/4 pts- effective.
Rebleeding in 2 pts

UNILATERAL LUNG VENTILATION

- Intrapulmonary shunting from the nonventilated lung and V/Q mismatching from the aspirated blood in the ventilated lung may leave an inadequate surface for gas exchange, especially in patients with limited pulmonary reserve
- DOUBLE LUMEN ET TUBES

ARTERIOGRAPHY

- Bronchial artery- 90%
- Pulmonary artery bed-- > 10%
- Non bronchial systemic collaterals-
subclavian, axillary, intercostal, phrenic
arteries

EMBOLIZATION

- 1973 – Remy et al.
- Alternative to surgery in pts with bilateral disease, multiple bleeding sites and borderline pulmonary reserve
- Halted active bleeding and stabilized patients in 84-100%
- Long-term control of bleeding after embolization range from 70%-88% with f/u period of 1- 60 m

CATHETERS

- Cobra type curved catheters are most commonly used
- Simmons- 1
- Headhunter
- Yashoro-type
- Microcather-permits superselective catheterization-less complications

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- Early technical failure-4-13% inability to cannulate the bronchial artery, inability to stabilize the catheter in the vessel
 - Cannulation may be difficult in small bronchial arteries, if arise high in thoracic aorta, mediastinal anatomy is distorted

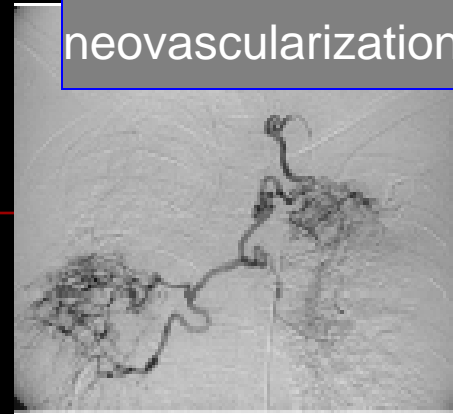
■ ARTERIOGRAPHIC FINDINGS:

- Parenchymal hypervascularity
- Vascular hypertrophy
- Tortuosity
- Capillary stasis
- Bronchopulmonary shunting
- Aneurysm formation
- thrombosis of vessel

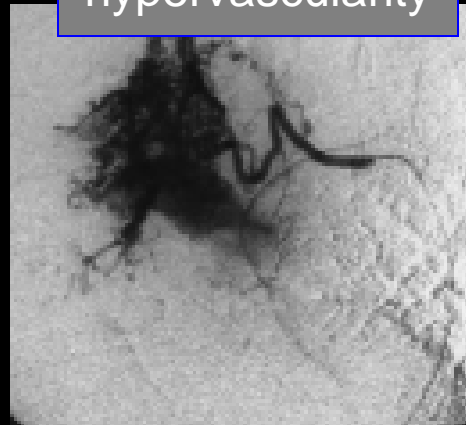
Hypertrophied vessel



neovascularization



hypervascularity



Bronchial leak



Pulm shunting



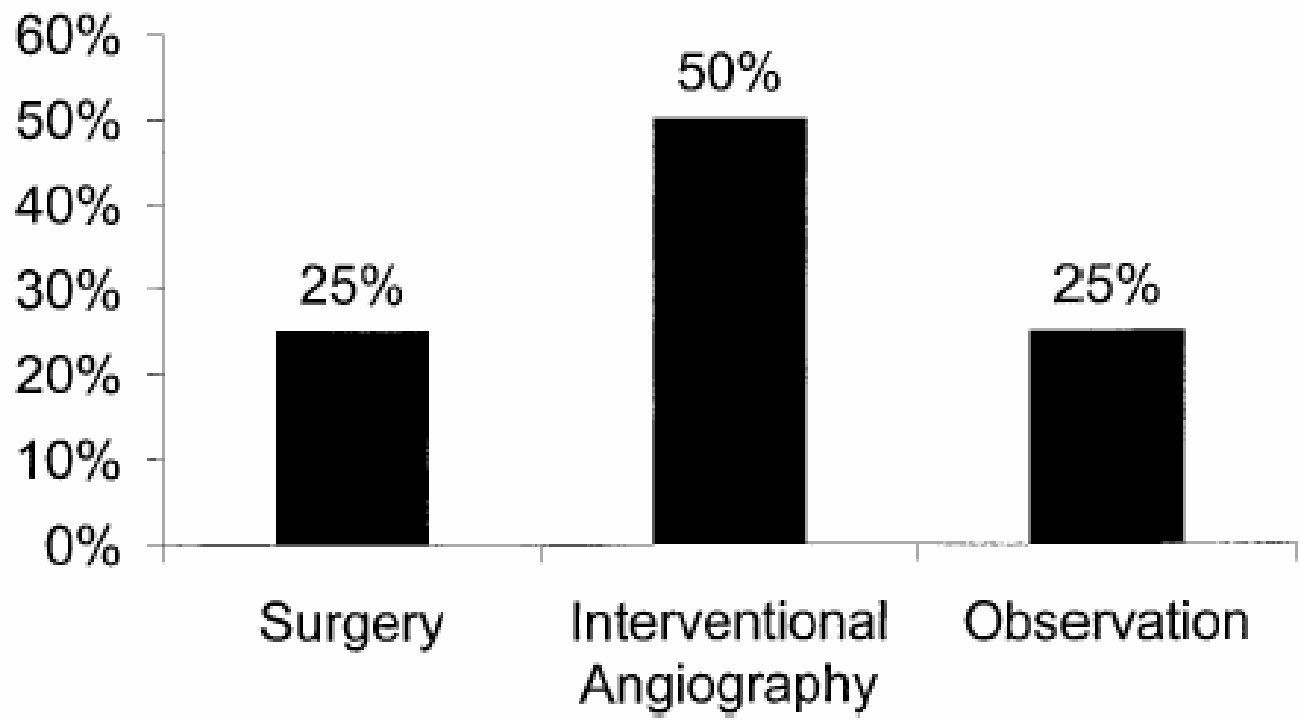
Embolic materials

- Absorbable gelatin sponge
 - Inexpensive, easy to handle, controllable embolic size
 - but resolvable, lack radioopacity
- Poly vinyl alcohol particles (350-500 mic)
- Liquid embolic agents – ischemic necrosis
 - isobutyl-2 cyanoacrylate,
 - absolute alcohol
- Stainless steel platinum coils-
 - occlude more proximal vessels
 - used in pulmonary artery aneurysms
 - preclude repeat embolization if hemoptysis recurs

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- **COMPLICATIONS:**
 - Chest pain-(24-91%)
 - Dysphagia-(0.7-18.2%)
 - Subintimal dissection of aorta or bronchial artery
 - Bronchoesophageal fistula
 - Reflux of embolic material into systemic circulation-necrosis of small bowel,occlusion of anterior tibial artery,seizure
 - Anterior spinal artery (A. of Adamkiewicz) ischemia – 1.4- 6.5%

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- Long term recurrence rates have reported to be 10-52% with a mean follow up period ranging from 1- 46 m
 - Long term success rates are improved by repeat BAE
 - BAE is a palliative procedure that prepares a patient for elective surgery for localized disease or continued antimicrobial therapy

Proportion of Respondents
(n=215)



SURGERY

- Conservative management of massive hemoptysis carries a mortality rate of 50-100%
- Mortality rate for surgery performed for massive hemoptysis- 7.1-18.2%
- However mortality rate increases significantly upto 40% when surgery is undertaken as an emergency procedure

- SURGERY IS PROCEDURE OF CHOICE

- BRONCHIAL ADENOMA
- ASPERGILLOMA RESISTANT TO OTHER TREATMENT
- HYDATID CYST
- THORACIC VASCULAR INJURY

SURGERY- C.I

- Unresectable carcinoma
- Inability to lateralize the bleeding site
- Diffuse disease
 - Multiple AVM
 - Cystic fibrosis
 - Non-localizing bronchiectasis
- Arterial hypoxia
- Co2 retention
- Marginal pulm-reserve
- Dyspnea at rest
- Severe dyspnea at exertion

Emergency surgery

- Age > 50 yrs
- HTN
- Hb% < 10g/dl
- Prior attack of hemoptysis
- Bleeding due to-
 - Fungal ball
 - Necrotising pneumonia
 - TB
 - Lung abscess

-Ayed A Eur J Cardiothorac Surg

COMPLICATIONS

- Morbidity-23-54%
- Post- op BPF-10-14%
- Empyema
- Hemorrhage requiring re-exploration
- Hemothorax
- Resp insufficiency req prolonged ventilation
- Mortality-10-50%
- -Gourin & garzon's study:37% of active bleeding died in comparision with 8% with minimal bleeding

THANKS