

# Role of bronchoscopy in hemoptysis

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# Cold saline lavage

- First case of endobronchial irrigation with cold saline for hemoptysis reported in 1980<sup>1</sup>
- Lavage with normal saline at 4° C - 50ml aliquots (avg volume of 500 ml, range 300–750 ml) stopped the bleeding in 23 patients with massive hemoptysis obviating the need for emergency thoracotomy<sup>2</sup>

*1) Conlan AA et al; Thorax 1980; 35: 901–904,*

*2) Conlan AA et al J Thorac Cardiovasc Surg 1983; 85:120–124*

# Cold saline lavage

- 1 patient experienced transient sinus bradycardia during the procedure. Only 2 subjects suffered subsequent episodes of massive bleeding
- Also feasible with FOB, but rigid scope has better suction capacity enabling better view

# Topical vasoconstrictive agents

- Effective in mild to moderate hemoptysis following bronchial brushing and biopsy procedures
- Not useful for massive bleeding, the drug gets diluted and washed away<sup>1</sup>
- 13 Of 76 patients in a study evaluating topical hemostatic tamponade therapy responded to vasoconstrictive agents<sup>2</sup>

*1) Cahill BC et al Clin Chest Med 1994;15:147–167,*

*2) Valipour et al CHEST 2005; 127:2113–2118*

# Topical vasoconstrictive agents

- Agent – topical epinephrine (1:20,000)
- High plasma levels following endobronchial application
- Significant CVS effects – hypertension and tachyarrhythmias<sup>1</sup>
- Alternative agents – terlipressin and ornipressin

1) Mazkereth R et al; Crit Care Med 1992; 20: 1582–1587

# Fibrinogen/thrombin

- Endoscopic instillation in 11 patients in whom BAE was not possible<sup>1</sup>
- Cold saline f/b epinephrine, or collapse of the bleeding bronchus through continuous suction, and drying of the airway thereafter fibrinogen-thrombin combination instilled through a catheter within an FOB

• *de Gracia J et al. Respir Med 2003; 97: 790–795*

# Fibrinogen/thrombin

- Immediate cessation in all patients
- Early recurrence – 2 patients, late relapse in 1 patient
- Tsukamoto et al - all 9 patients managed with a fibrinogen-thrombin mixture – immediate control of massive hemoptysis<sup>1</sup>
- Can be used if other modalities not available

• *Tsukamoto et al Chest 1989; 96: 473–476*

# Endobronchial tamponade for massive hemoptysis

- First introduced by Hiebert in 1974
- Necessitates the use of a rigid or flexible bronchoscope



# Endobronchial tamponade for massive hemoptysis

- Occluding the bleeding airway with fogarthy embolectomy catheter
- 4 Fr – segmental bronchi and 14 Fr for main stem bronchi
- Passed through FOB and scope is removed over the catheter
- Alternative – fogarthy catheter passed along the bronchoscope

- Fogarty catheter, 4-Fr (80 long), can be passed through a fiberoptic bronchoscope with a large inner channel ( $\geq 2$  mm)
- Balloon at the distal tip of the catheter is inflated into the bleeding segmental bronchus as a hemostat

- Distal hub of the catheter is cut off to allow the removal of the bronchoscope by sliding it over the Fogarty catheter
- Pin plug used to maintain the cuff pressure

• *Jean-Baptiste et al. Critical Care Medicine 2000; 28: 1642-1647*

# Double-lumen balloon catheter

- 6-Fr (170 cm long), better adapted to the flexible bronchoscope
- Balloon can be inflated by a detachable valve at the proximal end
- Vasoactive drugs - through the second channel
- Facilitates removal of the bronchoscope without modification of catheter - major advantage over the Fogarty catheter

• Freitag L et al *Eur Respir J* 1994; 7: 2033–2037

- Central airways, segmental bronchi and even cavities (under fluoroscopy)
- Acts as a bridge to definitive therapy
- Balloon tamponade was successful in 26/27 patients who lost at least 100 ml of blood
- Deflated - few min 3 times/day to preserve mucosal viability and to check for bleeding recurrence

- *Freitag L et al Eur Respir J 1994; 7: 2033–2037*

# Modified techniques

- Kato et al – Modified bronchoscopic angiographic J guide wire<sup>1</sup>
- PA balloon catheter

- 1) Kato R et al. *Chest* 1996; 109: 842–843

# Lateralization possible not localization

- Unilateral intubation to protect non-bleeding lung from aspiration
- Right-sided bleeding – FOB advanced to the LMB and the left lung is electively intubated over the bronchoscope
- Left side bleeding – tracheal intubation followed by insertion of 14 French 100 cm Fogarthy catheter besides ET tube, guide into LMB bronchoscopically

# Silicone Spigot



- *Dutau H et al. Respiration. 2006; 73: 830-2*



## Topical hemostatic Tamponade therapy – ORC

- ORC – oxidized regenerated cellulose mesh – sterile fabric
- Introduced into the bleeding airway using FOB
- Lobar to sub-segmental bronchi
- Control of hemoptysis - achieved in 56 of 57 (98%) patients, who remained free of hemoptysis for the first 48 h

• *Valipour A et al. Chest 2005; 127:2113–2118*

# Topical hemostatic Tamponade therapy – ORC

- Mild to moderate bleeding (30–100 ml) recurred in 6 subjects (10.5%) 3–6 days after the procedure
- Not suitable for proximal sites of bleeding such as the trachea
- Temporary measure

# Endobronchial Sealing with Biocompatible Glue

- Used in mild hemoptysis
- N-butyl cyanoacrylate - biocompatible adhesive that solidifies on contact with humidity
- Injected into the bleeding airway through catheter via FOB
- 6 patients prolonged mild hemoptysis – bleeding stopped in all patients

• *Bhattacharyya P et al. Chest 2002; 121: 2066–2069*

# Laser Photocoagulation

- First introduced by Dumon et al in 1982
- Nd-YAG laser – effective option endoluminal tumours with symptomatic airway obstruction and/or bleeding
- Photocoagulation of bleeding mucosa, hemostasis
- Photoresection and vaporization of lesion

• *Sakr L et al. Respiration 2010;80:38–58*

# Argon Plasma Coagulation (APC)

- Noncontact electrocoagulation tool
- Argon plasma medium is employed to conduct high-frequency electrical current through a flexible probe
- Blood is a good conductor for the high-frequency current
- Effective dessication of a bleeding bronchus

# Argon Plasma Coagulation (APC)

- Dessication of target surface achieved, it becomes less electrically conductive, thus preventing deeper penetration of the current
- Used for endobronchial lesions
- YAG laser provides deeper tissue penetration (5–10 vs. 2–3 mm)
- APC - allows homogeneous tissue dessication because it continually seeks areas with higher water content

# Argon Plasma Coagulation (APC)

- Morice et al - 31 patients with hemoptysis and 25 patients with both airway obstruction and hemoptysis treated by endobronchial APC therapy
- Hemoptysis stopped in all patients

# Other modalities

- Cryotherapy – inoperable endoluminal malignancies
- Cryotherapy - freezing causes vasoconstriction and development of microthrombi in venules and capillaries,