



## CASE REPORT

# CONTROL OF LIFE THREATENING HEMOPTYSIS UTILIZING ENDOBRONCHIAL TAMPONADE TECHNIQUE

By

*Sayed Oraby*

Pulmonary and Critical Care Department, Erfan Hospital, Jeddah, K.S.A.

Email: orabysayed@gmail.com

*We describe a case of one patient with massive hemoptysis who was treated by endobronchial sealing, with n-butyl cyanoacrylate, of the bleeding subsegment. There was an immediate arrest of bleeding without any recurrence for a mean follow-up period of over 90 days.*

*Endobronchial sealing appears to be an effective method of managing life threatening hemoptysis.*

*Keywords: Endobronchial sealing, fiberoptic bronchoscopy, hemoptysis, n-butyl cyanoacrylate.*

## INTRODUCTION

Hemoptysis is a common clinical problem.<sup>(1)</sup> It is not a separate disease; rather it is a manifestation of multiple pathologic processes. Despite the potentially fatal outcome of hemoptysis, the underlying disease is usually otherwise benign and treatable.<sup>(2-4)</sup> the risk of death is particularly high when hemoptysis is massive, and some investigators<sup>(4-6)</sup> estimate the risk of mortality with untreated massive hemoptysis to be in excess of 75%. Others<sup>(7,8)</sup> have found the risk of death to be lower and have advocated an initially conservative approach, although there may be significant

mortality from subsequent bouts of hemoptysis in these patients. Some of the variation in mortality risk is due to the lack of the common definition of the term massive. However it is defined, that massive hemoptysis represents a significant and immediate risk to these patients. Management of hemoptysis aims to stop the bleeding, replenish the blood loss, and treat the underlying etiology. Homeostasis is often difficult to achieve when the conservative treatment fails. Several bronchoscopic techniques, such as the bronchial tamponade, have been used to arrest bleeding.<sup>(9)</sup>

We have adopted a method of treating hemoptysis by selective placement of a catheter in the bleeding subsegment, with the help of a fiberoptic bronchoscope, and instillation of a sealant, n-butyl cyanoacrylate, a biocompatible glue that has been used successfully in several other hemostatic and sealing procedures.<sup>(10)</sup>

**Case description:** A male patient of 74 years old who used to be heavy smoker, was admitted during April 2006 to the ICU unit in Erfan Hospital on account of recurrent episodes of fresh blood aspirated through his permanent tracheostomy. The patient has had permanent tracheostomy and feeding gastrostomy as therapeutic modalities facing his advanced Parkinson's disease, cerebrovascular stroke with residual right arm monoplegia as well as contraction deformity. The patient had experienced recurrent episodes of respiratory failure necessitating mechanical ventilatory support relevant to repeated pulmonary parenchymal infections of which aspiration etiology was not uncommon. During the latest event of respiratory failure, he was tracheotomized on account of prolonged ventilation and difficult weaning. The patient has been as well bed ridden for the last few years on LTOT and was suffering mild hypertension, IHD, and mildly affected left ventricular functions with EF of 40%.

Few hours post admission he developed massive attack of hemoptysis that led him to acute on top of chronic respiratory failure and mechanical ventilation was instituted. Initial evaluation disclosed normal coagulation profile, stable hepatorenal functions and mild anemia. There was no doubt about possible tuberculosis from initial CXR and sputum examination for acid fast bacilli was negative. Fiberoptic bronchoscopy (Olympus IT 60 Olympus TOKIO Japan) effectuated upon initial evaluation failed to reveal the source of bleeding yet, it was evident that blood was coming from the left side. CT scan of the chest revealed no etiologic evidence of such large volume (500-750 ml) hemoptysis. Repeated bronchoscopy following an attack of hemoptysis accurately delineated the

source of bleeding to be originating from subsegment of left B9. A 5F Fogarty catheter was successfully inserted in the bleeding bronchus with instantaneous cessation of bleeding. The patient was forwarded to invasive radiology suite for bronchial artery embolization.

Bronchial artery embolization was effectuated on both sides as deemed justified for the invasive radiologist. However few hours later the patient again developed two episodes of even more severe hemoptysis. We tried to redo embolization of bronchial arteries yet this time catheterization of bronchial track failed. We were then left with the option of surgery, yet surgery was deemed to be highly mortal given the general status of the patient that was also substantiated by multifactorial cumbersome for tolerance of general anesthesia.

A non conventional solution was clearly needed to overcome such embarrassing problem. Bronchial Tamponade seemed to be a suitable answer. We utilized n-butyl cyanoacrylate. A well known tissue glue used extensively in vascular and gastro intestinal field of medicine. Under local anesthesia the Fogarty catheter was gently removed. We were faced however with a gush of blood that took sometime to control and therefore establish good view of the bleeding bronchus. A balloon tipped catheter was then introduced inside the culprit bronchus and 3 ml of n-butyl cyanoacrylate were injected through the catheter after inflating the balloon. The catheter and the fiberscope were then retrieved using non withdrawal technique 5 seconds post injection to prevent the cyanoacrylate from solidification inside the airway entangling the catheter with it.

The scope was passed again after 2 to 3 min to confirm the absence of bleeding. The culprit bronchus was sealed with the glue that appeared as a shiny white substance on the adjacent bronchial wall. No signs of any active bleeding could be appreciated anymore. Fiberoptic bronchoscopy was repeated 72 hours showing

same results. The patient was then allowed to go back home as he was already weaned off mechanical ventilation. The patient was followed for more than 90 days with no relapse.

## DISCUSSION

Hemoptysis poses serious problems, especially when the conservative treatment fails. In such circumstances the problem is managed with several bronchoscopic (both rigid and fiberoptic) and nonbronchoscopic interventions.

Cold saline lavage with 50-mL aliquots of iced saline at 4°C (total of 500 mL) showed good results when instilled through a rigid bronchoscope in 23 patients; recurrence of hemoptysis was observed in two cases.<sup>(11-12)</sup> Although this approach might be useful in mild-to-moderate hemoptysis, it is insufficient for massive active bleeding where the agent is diluted and flushed away.

Wedging of the bleeding segment with the flexible bronchoscope tip is effective in controlling bleeding after transbronchial lung biopsy.<sup>(13)</sup> Local administration of adrenaline solution (1:20,000), thrombin (Warner Lambert; New York, NY), fibrinogen-thrombin (Green Cross; Tokyo, Japan), and fibrin precursors have been attempted in a small number of cases.<sup>(14,15)</sup> The later entailed the use of complicated equipments not available in most centers.

The ND-Yag laser used bronchoscopically can effectively stop bleeding from endobronchial pathology and can also allow more definite therapy at the same setting.<sup>(16,17)</sup> Balloon tamponading of the bleeding bronchial segment is also helpful, with variable success rates.<sup>(18,19)</sup> Bronchoscopy-guided topical hemostatic tamponade therapy for the management of life-threatening hemoptysis was recently reported on 76 patients with high success rate.<sup>(20)</sup>

Bronchial artery embolization effectively stops bleeding from a bronchial arterial source, although failure and complications occur despite technical

and instrumental excellence.<sup>(4,21,22)</sup> There is also occasional difficulty in cannulating the vessel, and complications, including vessel perforation, intimal tears, and postbronchial artery occlusion sequences, are reported.<sup>(4,23)</sup> Though rare, problems secondary to inadvertent ectopic embolism are also seen. Superselective bronchial catheterization may avert such complications to a great extent.<sup>(24)</sup>

Radiation therapy may be helpful in patients who have aspergilloma with hemoptysis.<sup>(25)</sup> Surgical resection is sometimes the only plausible solution in some situations, but there have been reports of significant mortality and morbidity.<sup>(27-28)</sup> Surgery is currently recommended when the facilities for bronchial artery embolization are not available or deemed technically impossible or unsuccessful; when the bleeding is so massive that any delay in arranging the embolization is very risky; and when the underlying cause is unlikely to be controlled by embolization, as in a case of suspected rupture of pulmonary artery or a mycetoma with profuse collateral arterial supply.<sup>(9)</sup>

Endobronchial tamponade was tried scarcely in the literature; in 2002 Parthasarathi Bhattacharyya et al<sup>(29)</sup> reported the utilization of N-butyl cyanoacrylate sprayed endobronchially in 6 cases of intractable hemoptysis. The procedure succeeded in controlling such life-threatening situation. In 2005, Valipour et al<sup>(20)</sup> described controlling massive hemoptysis using hemostatic oxidized regenerated cellulose (ORC) mesh via both rigid and fiberoptic bronchoscope in 76 patients with high success rate. The later necessitated availability of material and expertise to conduct a rather cumbersome procedure during the rush to save a bleeding patient.

The primary aim in such situation of massive hemoptysis is to prevent spillage of blood to nonaffected, functionally intact alveolar areas of the lung. This was accomplished in our patient using a Fogarty Catheter.<sup>(7)</sup> Removal of the bronchoscope over the Fogarty, however, was

difficult because the valve is part of the device. In an uncontrolled trial, Freitag et al<sup>(30)</sup> have tested a double-lumen bronchus-blocking catheter with superior handling qualities to the Fogarty. Twenty-six of the 27 patients with hemoptysis were successfully treated using that device. The authors, however, reported one death in a patient who pulled out the catheter himself and a few complications such as balloon dislocations and poststenotic pneumonia. Temporary bleeding control can also be achieved by using endoscopic instillation of a fibrinogen-thrombin solution. The relapse rate with this technique, however, is relatively high.<sup>(31)</sup> and the technique is only a temporary solution.

We have adopted sealing of the bleeding segment or subsegment with n-butyl cyanoacrylate. It is a biocompatible adhesive that solidifies quickly on exposure to humidity with antibacterial effects.<sup>(29)</sup> Cyanoacrylate glues are already in use in different procedures in deep tissues with high degrees of success and safety.<sup>(32,33)</sup> They have been used to prevent postoperative air leak from the bronchial stump after lung resectional surgery.<sup>(33,34)</sup> The cyanoacrylate glues have prothrombotic properties such as increased platelet aggregation and possible enhancement of local thromboxane production.<sup>(35,36)</sup>

Although cyanoacrylates are significantly safe, they are volatile and chemically active materials reported to cause eczema, rhinitis, and asthma in occupational exposure.<sup>(37)</sup> Occupational contact dermatitis has also been reported.<sup>(38)</sup> There is also a chance of spillage of the glue more proximally on the bronchial tree or even at the tip of the endoscope. In using cyanoacrylate for endobronchial sealing for hemoptysis in our patient, we have not found any significant side effects. Moreover, the glue was expectorated gradually over the next few days.

In conclusion, it appears that endobronchial sealing with n-butyl cyanoacrylate glue is a simple, less invasive, and safe procedure to control hemoptysis. Future studies shall focus on new

indications, such as persistent bronchopleural fistula in an inoperable patient.

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