

CASE REPORT

Bronchoscopic hemostatic tamponade with oxidized regenerated cellulose for major hemoptysis control: two case reports

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Abstract

Hemoptysis is a common and alarming clinical problem. Acute massive hemoptysis is a life threatening condition. Different therapeutic strategies such as surgery, endovascular treatment and/ or bronchoscopy have been applied. We report two cases of patients with severe hemoptysis who were treated by bronchoscopy guided topical hemostatic tamponade therapy with oxidized regenerated cellulose.

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Tamponamento hemostático por broncoscopia com aplicação de celulose oxidada regenerada no controlo de hemoptises graves —a propósito de dois casos clínicos

Resumo

Hemoptises são um problema clínico comum e grave. Nalguns casos, como nas hemoptises maciças, podem causar mortalidade elevada. Para o seu controlo e/ou tratamento têm sido aplicadas diferentes estratégias como a cirurgia, embolização das artérias brônquicas e tratamentos broncoscópicos. Os autores descrevem dois casos clínicos de pacientes com hemoptises graves, cujo controlo foi efectuado por broncoscopia com aplicação de tamponamento hemostático com celulose oxidada regenerada (Surgicell®, Johnson and Johnson's, London).

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Introduction

Hemoptysis is a frequent and alarming clinical problem. It can be caused by different entities: bronchiectasis (26%), chronic bronchitis (23%), acute bronchitis (15%), lung cancer (13%) and others.¹ Nevertheless, in a significant proportion of patients, between 3 and 22% the cause remains undetermined.²

Acute massive hemoptysis is a life-threatening condition, by causing either obstruction of the airway (asphyxiation) or hypovolemic shock, with mortality rates ranging from 23 to 85%.³ Massive hemoptysis is defined based on the volume of blood expectorated, with different criteria adopted by different authors, ranging from 100 ml/24 hours to more than 1000 ml/24 hours,^{4,6} which may justify the disparity concerning mortality rates described in literature.

We describe two cases of severe hemoptysis. They were successfully treated by bronchoscopic hemostatic tamponade with oxidized regenerated cellulose (Surgicell®, Johnson and Johnson's, London).

Case reports

Case 1

Fifty-eight-year-old woman, non smoker, admitted to Hospital with moderate hemoptysis. She reported hemoptoic sputum for three days before admission, without dyspnea, chest pain, fever, malaise or weight loss. She had a history of hysterectomy and hiatus hernia.

On admission, physical examination and routine laboratory studies, including arterial blood gas and chest radiograph were unremarkable. Rigid bronchoscopy (RB) showed active bleeding from the right bronchial tree. A blood clot was observed obstructing the right lower lobe bronchus. After clot removal, significant bleeding was reactivated from the lower segments and instillation of cold saline, aminocaproic acid, epinephrine solution and tamponade with balloon catheter were performed, with bleeding control.

A computed tomographic (CT) scanning of the chest, performed without contrast enhancement, revealed right intermediate bronchus occlusion (possibly a clot?) and areas of consolidation in right lower lobe. Coagulation profile, arterial blood gas, tumor markers and immunology tests were normal.

On the seventh day in hospital, a thoracic CT angioscan revealed pulmonary embolism at subsegmental arteries in right upper lobe, right inferior lobe and some subsegmental arteries in left inferior lobe. These findings were not visible in the previous CT-scan, which was performed without contrast. Anticoagulation with low molecular weight heparin (LMWH) was started. In the first day of anticoagulation the patient had a massive hemoptysis with blood loss about 400 ml, with hypotension and desaturation. Rigid bronchoscopy was performed with massive bleeding occurring at right lower segments. Topical hemostatic tamponade with oxidized regenerated cellulose (ORC) for bleeding control was applied (Figure 1). This procedure was performed as described below in discussion.

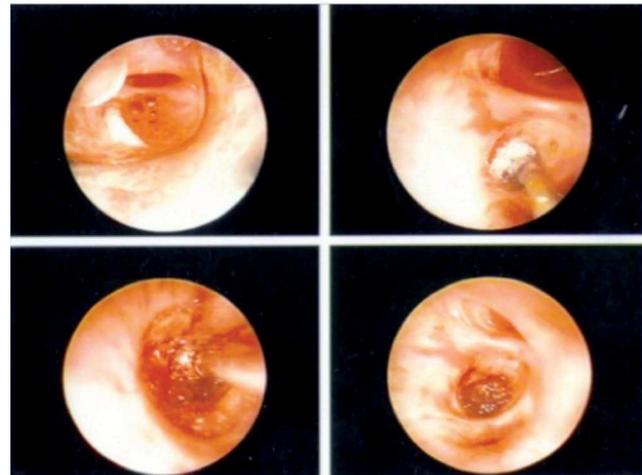


Figure 1 Major bleeding IRL. Effective tamponade with ORC.

She was reevaluated by fiberoptic bronchoscopy (FOB) one week later, which showed absence of active bleeding with a small clot obstructing B6 (upper segment of lower lobe bronchus) that was removed without bleeding. Oxidized regenerated cellulose (ORC) remained in lower lobe bronchus, partially reabsorbed. *One month* later, patient was well under oral anticoagulation. Hemoptysis did not recur. FOB revealed total reabsorption of ORC.

Case 2

Fifty-four-year-old man, former smoker, admitted to our Hospital with severe hemoptysis, without fever, thoracic pain, dyspnea or other complaints. He was previously healthy. Physical examination and routine laboratory studies were unremarkable, except for diminished breath sounds in the lower third of right hemithorax. Chest radiograph showed segmental atelectasis, in right lower lobe. Arterial blood gases revealed hypoxemia (Arterial gases with FiO_2 31%: pH 7,42; pCO_2 36,8 mmHg, pO_2 67,6 mmHg; HCO_3^- 23 mmol/l, satO_2 94%).

FOB showed blood in both bronchial trees, with clots in the right lower lobe and in the main left bronchus, thus RB was performed. During RB severe bleeding occurred, with blood loss of 200 ml. For hemoptysis control, instillation of cold saline and epinephrine solution was performed, followed by topical hemostatic tamponade with oxidized regenerated cellulose (ORC) applied in RLL.

Spiral CT-scanning of chest revealed atelectasis of the medium and right lower lobes without further findings of remark. On the fifth day in hospital, new rigid bronchoscopy was performed, showing a clot, this time in the middle lobe bronchus, which was removed without bleeding. Partially reabsorbed ORC remained in right lower lobe occluding b9 and b10 segments.

A diagnostic and therapeutic right lower lobectomy was performed three weeks later, with the final diagnosis of bronchiectasis.



Figure 2 RB Forceps, optical terminal inserted through RB 8.5 mm.

Discussion

Hemoptysis management is generally undertaken emergently with a primary goal of preventing hypoxemia and lung inundation by protecting the airway using selective intubation when the bleeding side is identified.⁷

Several bronchoscopic techniques have been used to stop bleeding,⁸ like local instillation of cold saline, epinephrine solution and/ or Antidiuretic Hormone derivatives (ornipressin or terlipressin).⁹ These might be useful in mild to moderate hemoptysis, but are insufficient for massive active bleeding. Endobronchial blocking techniques using a Fogarty balloon catheter (or similar ones) enable the physician to occlude the bleeding bronchus on a segmental level, thus providing more lung tissue for gas exchange. Difficulties in positioning the catheter and problems with removal of bronchoscope over the Fogarty might discourage its use in clinical practice.¹⁰

These treatments are preferentially performed using a rigid bronchoscope to insure adequate ventilation, to use rigid ancillary tools, and to efficiently aspirate secretions, blood and/ or clots.

Oxidized regenerated cellulose is a sterile hemostatic agent, broadly used across surgical^{11,12} and nonsurgical specialties.¹³ The material is derived from regenerated cellulose oxidized by nitrous oxide, which converts certain hydroxyl radicals to carboxyl groups and confers an acidic quality to product that provides a bactericidal environment, reducing the incidence of infections.¹⁴⁻¹⁶ It has caustic activity too, so after it has been saturated with blood, it swells into a brownish or black gelatinous mass and it aids in the formation of a clot, serving as a hemostatic adjunct in bleeding control.

The application of ORC for hemoptysis was described by A. Valipour et al.,¹⁰ with the use of fiberoptic bronchoscopy. These authors applied it in 57 patients; the procedure was successfully performed in 98% of patients with an immediate arrest of hemoptysis. They concluded that

ORC use is safe, successful and a practicable technique in massive hemoptysis.

In the cases described in the present article ORC was applied using rigid bronchoscopy with high-frequency and intermittent positive ventilation under general anesthesia. The central airway was cleared of secretions, blood and clots with large bore suction catheter with identification of bleeding site. Washing with cold saline solution followed by instillation of 1:20000 epinephrine solution minimally controlled the bleeding. Afterwards, ORC mesh was cut to the appropriate size (40 mm × 40 mm), grasped with rigid forceps and placed into the bleeding bronchus. Depending on bleeding severity and bronchus diameter 4 to 10 layers of ORC mesh can be placed to provide a tight blockade of the bronchus (Figure 2).

Conclusion

Tamponade hemostatic therapy with ORC is a safe and practicable technique in the management of hemoptysis. In the cases described it was possible to control the bleeding and stabilize patients. In the first case, no other intervention was needed. In the second case the patient was submitted to surgery for diagnosis and definitive treatment. Although being in principle a temporary procedure, this technique appears to be safe and effective in acutely stopping moderate to massive hemoptysis. Using rigid bronchoscopy makes it a more secure, simple and rapid hemostatic procedure, with no need for posterior removal of material, as it is completely absorbable.

References

1. Tsoumakidou M, Chrysofakis G, Tsiligianni I, Maltezas G, Safakas NM, Tzanakis N. A prospective analysis of 184 hemoptysis cases—diagnostic impact of chest X-ray, computed tomography, bronchoscopy. *Respiration*. 2006;73:808-14.
2. Hirshberg B, Biran I, Glazer M, Kramer MR. Hemoptysis: etiology, evaluation, and outcome in a tertiary referral hospital. *Chest*. 1997;112:440-4.
3. Cahill BC, Ingbar DH. Massive hemoptysis: assessment and management. *Clin Chest Med*. 1994;15:147-67.
4. Dweik RA, Stoller JK. Role of bronchoscopy in massive hemoptysis. *Clin Chest Med*. 1999;20:89-105.
5. Brinson GM, Noone PG, Mauro MA, Knowles MR, Yankaskas JR, Sandhu JS, et al. Bronchial artery embolization for the treatment of hemoptysis in patients with cystic fibrosis. *Am J Respir Crit Care Med*. 1998;157:1951-8.
6. Flume PA, Yankaskas JR, Ebeling M, Hulsey T, Clark LL. Massive hemoptysis in cystic fibrosis. *Chest*. 2005;128:729-38.
7. Lordan JL, Gascoigne A, Corris PA. The pulmonary physician in critical care. Illustrative case 7: assessment and management of massive haemoptysis. *Thorax*. 2003;58:814-9.
8. Dweik RA, Stoller JK. Role of bronchoscopy in massive hemoptysis. *Clin Chest Med*. 1999;20:89-105.
9. Tüller C, Tüller D, Tamm M, Brutsche M. Hemodynamic effects of endobronchial application of ornipressin versus terlipressin. *Respiration*. 2004;71:397-401.
10. Valipour A, Kreuzer A, Koller H, Koessler W, Burghuber OC. Bronchoscopy-guided topical hemostatic tamponade therapy for the management of life-threatening hemoptysis. *Chest*. 2005;127:2113-8.

11. Hurwitt ES, Hederson J, Lord GD, Gitlitz GF, Lebendiger A. A new surgical absorbable hemostatic agent. *AMJ Surg.* 1960;100:439-46.
12. Thetter O. Fibrin adhesive and its applications in thoracic surgery. *Thorac Cardiovasc Surg.* 1981;29:290-2.
13. Shinkwin CA, Beasley N, Smo R, Rushton L, Jones NS. Evaluation of Surgicel Nu-knit, Meroceel and Vasolene gauze nasal packs: a randomized trial. *Rhinology.* 1996;34:41-3.
14. Dineen P. The effect of oxidized regenerated cellulose on experimental intravascular infection. *Surgery.* 1977;82:576-9.
15. Dineen P. The effect of oxidized regenerated cellulose on experimental infected splenotomies. *J Surg Res.* 1977;23:114-6.
16. Dineen P. Antibacterial activity of oxidized regenerated cellulose. *Surg Gynecol Obstet.* 1976;142:481-6.