The Journal of Laryngology & Otology (2014), ***128***, *1123–1124*.

doi:10.1017/S0022215114002175

CLINICAL RECORD

Nebulised N-acetylcysteine used in acute tracheostoma obstruction

A PATEL, C THEOKLI

ENT Department, Lewisham Hospital, London, UK

Abstract

Background: Patients with laryngectomy tracheostomas are at risk of developing acute airway obstruction due to mucous crusting. Current management relies on saline nebulisers, followed by suction and manual evacuation to remove the obstruction. This paper describes the first reported case of using N-acetylcysteine nebulisers in addition to saline to adequately soften the mucous plugs in order to facilitate removal.

Case report: A 68-year-old female attended the emergency department with a partial obstruction of her laryngectomy tracheostoma as a result of mucous crusting. Saline nebulisers did not provide adequate softening to allow the obstructing mucous plugs to be removed. N-acetylcysteine nebulisers were used to further soften the mucous plugs which successfully resulted in their removal.

Conclusion: N-acetylcysteine nebulisers can be used to assist in the removal of mucous plugs in saline-resistant cases.

Key words: Laryngectomy; Airway Obstruction; Acetylcysteine; Mucus; Surgical Stomas

Introduction

Patients who undergo laryngectomy for laryngeal carcinoma have a tracheostoma formed. This tracheostoma cannot benefit from the humidifying capabilities of the upper airway. Around a third of these patients find mucous crusting troublesome and they can go on to develop acute airway obstruction.[1] Mucous plugs causing airway difficulty must be evacuated. Saline nebulisers are used to moisten and soften the mucus to assist manual evacuation.

We describe a novel technique to further soften tracheal mucous plugs in cases with limited response to saline nebulisers.

Case report

A 68-year-old female presented to the emergency department with difficulty breathing, of acute onset. Four months previously she had undergone a total laryngectomy with tracheal stoma formation for a tumour–node–metastasis staging $T_{4a}N_2M_0$ post-cricoid laryngeal carcinoma.

On examination, the patient was in respiratory distress, with minimal air transfer through the tracheostoma opening. Bedside endoscopy of the trachea revealed dry mucosa with thick, dry plugs of debris in the proximal airway causing a 60 per cent obstruction. An attempt at removal of these obstructions using Tilley's forceps was hindered by the firm and adhesive nature of the plugs. Saline nebulisers were used in an attempt to soften the mucus; these had a limited effect despite back-to-back use.

An N-acetylcysteine nebuliser was used as a second-line treatment. Repeat endoscopy revealed moist mucous membranes; the mucous plug had become softer and was successfully evacuated. A combination of N-acetylcysteine nebulisers and saline nebulisers were continued overnight. The patient was monitored in the high dependency unit but made a good recovery and was discharged home.

Discussion

Laryngectomy stomas (tracheostomas) are formed following total laryngectomies for laryngeal cancer. The majority of complications associated with laryngectomy stomas are long-term; however, on occasion emergency doctors are required to respond to acute complications.

The most serious complication involves luminal obstruction. Stoma sites are prone to develop crusting. This is not unexpected given the crucial role the upper airways play in helping to warm, filter and humidify inspired air. Patients with laryngectomy stomas are given specific instructions to prevent luminal obstruction. This includes regular examining, cleaning and moisturising of the stoma site. Patients are advised to keep the stoma site covered. Adequate humidity is the key to preventing luminal obstruction. Patient education should begin early and be tailored to each patient, so each individual understands their airway and the importance of maintenance.[2]

There is little literature on acute airway complications in laryngectomy stomas. The majority relates to obstruction as a result of mucous collections in patients using tracheal devices long-term. Jay *et al*. reported that 35 per cent of patients with laryngectomy stomas found crusting to be troublesome.[1] Ganly *et al*. found that approximately 7.1 per cent of patients with laryngectomy stomas suffered from acute airway complications.[3]

The current stepwise management for luminal obstruction involves conservative measures such as suction and oxygen

Accepted for publication 14 March 2014 First published online 2 October 2014

to alleviate respiratory distress. The lumen can be inspected and any obstructions should be manually removed. Hard, crusty debris can be softened using saline nebulisers. The cessation of respiratory distress following clearance of the obstruction is diagnostically useful. Failure of an appropriate respiratory improvement should prompt other potential diagnoses such as a pneumothorax or lower respiratory tract infection.

N-acetylcysteine is the acetylated precursor of the amino acid L-cysteine.[4] It has been used in clinical practice for several decades, principally as a mucolytic in chronic respiratory illnesses as well as in paracetamol overdose. Studies have shown it to be a powerful antioxidant, with a potential use in cancer and heart disease treatment.[5]

The mechanism of action of N-acetylcysteine is principally attributed to its ability to reduce extracellular cystine to cysteine and act as a source of sulfhydryl groups intracellularly. By supplying sulfhydryl groups, N-acetylcysteine stimulates glutathione synthesis and thus promotes liver detoxification. Its effectiveness as a mucolytic is related to its sulfhydryl group, which interacts with the mucoprotein disulphide bonds; this causes the mucus to be broken down and become less viscous.[5] N-acetylcysteine is also reported to act as an expectorant by stimulating ciliary action and therefore clearing mucus from the airways.[6]

N-acetylcysteine is rapidly absorbed into various tissues and quickly deactivated by the liver before being renally excreted. Peak plasma levels are seen at 1 hour; within 12 hours, N-acetylcysteine is undetectable in plasma.[4] It is pharmaceutically available for use intravenously, orally or by inhalation. In this case, we successfully used N-acetylcysteine via a nebuliser.

There have been several studies on the role of N-acetylcysteine as a mucolytic in chronic respiratory conditions, such as chronic obstructive pulmonary disease and cystic fibrosis.[7–9] The effects of its use orally and via a nebuliser have been assessed. Although improved patient outcomes are widely reported in N-acetylcysteine treated groups, no statistically significant differences have been found in terms of lung function, mucociliary clearance curves or sputum viscosity following treatment with N-acetylcysteine as compared with control or placebo groups. More research is required to further investigate the role of nebulised N-acetylcysteine in these conditions.

N-acetylcysteine is generally a safe and well-tolerated drug. The most common side effects are nausea and vomiting. Anaphylactic reactions are rare but have been reported, manifesting as rash, pruritus, angioedema, bronchospasm, tachycardia and hypotension.[6]

- **The most serious complication of laryngectomy stomas is acute airway obstruction**
- **Management currently involves the use of oxygen and suction, with saline nebulisers to assist in manual evacuation of any obstruction**
- **This paper describes a case where N-acetylcysteine nebulisers assisted in softening mucous plugs to aid manual evacuation**

In the presented case, the patient was not actively involved in her stoma care and thus has had recurrent mucous plugs. The case highlights the importance of patient awareness and prevention of complications. N-acetylcysteine nebulisers were successfully used to soften the mucous plug, allowing it to be manually evacuated.

References

1 Jay S, Ruddy J, Cullen RJ. Laryngectomy: the patient's view. *J Laryngol Otol* 1991;**105**:934–8
2 Lewarski J. Long-term care of the patient with a tracheostomy. *Respir Care* 2005;**50**:534–7
3 Ganly I, Patel S, Matsuo J, Singh B, Kraus D, Boyle J *et al*. Postoperative complications of salvage total laryngectomy. *Cancer* 2005;**103**:2073–81
4 Samuni Y, Goldstein S, Dean O, Berk M. The chemistry and biological activities of N-acetylcysteine. *Biochim Biophys Acta* 2013;**1830**:4117–29
5 N-acetylcysteine. *Altern Med Rev* 2000;**5**:467–71
6 Zimet I. Acetylcholine: a drug that is much more than a mucokinetic. *Biomed Pharmacother* 1988;**42**:513–20
7 Nash EF, Stephenson A, Ratjen F, Tullis E. Nebulized and oral thiol derivatives for pulmonary disease in cystic fibrosis. *Cochrane Database Syst Rev* 2009;(**1**):CD007168
8 Millar AB, Parvia D, Agnew JE, Lopez-Vidriero MT, Lauque D, Clarke SW. Effect of oral N-acetylcysteine on mucus clearance. *Br J Dis Chest* 1985;**79**:262–6
9 British Thoracic Society Research Committee. Oral N-acetylcysteine and exacerbation rates in patients with chronic bronchitis and severe airways obstruction. *Thorax* 1985;**40**:832–5

Address for correspondence:
Dr Ankit Patel,
9 Elstree Hill,
Bromley,
Kent BR1 4JE, UK

Fax: 020 8333 333
E-mail: ankitpatel@doctors.org.uk

Dr A Patel takes responsibility for the integrity of the content of the paper
Competing interests: None declared

https://doi.org/10.1017/S0022215114002175 Published online by Cambridge University Press