##### Management of respiratory symptoms in paediatric palliative care

Finella Craig, The Louis Dundas Centre for Children's Palliative Care, Great Ormond Street Hospital for Children NHS Foundation Trust, London UK.

Ellen M Henderson, The Louis Dundas Centre for Children’s Palliative Care, UCL-Institute of Child Health 30 Guilford Street, London, England.

Myra Bluebond-Langner, The Louis Dundas Centre for Children’s Palliative Care, UCL-Institute of Child Health 30 Guilford Street London, England; Rutgers University, Camden, New Jersey, USA.

All correspondence concerning this article should be addressed to Dr Finella Craig, The Louis Dundas Centre for Children’s Palliative Care, Great Ormond Street Hospital for Children NHS Foundation Trust, Great Ormond Street, London WC1N 3JH.

Tel: +44 20 7829 8678

E-mail: [finella.craig@gosh.nhs.uk](mailto:finella.craig@gosh.nhs.uk)

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**Conflicts of interest**

None

**Abstract**

**Purpose of review:** Respiratory symptoms in children with life limiting and life threatening conditions are common, distressing and have a lasting impact, yet there is a paucity of evidence to guide clinicians in their management. This article makes a series of recommendations for the management of the most frequent and distressing respiratory symptoms encountered in paediatrics (dyspnoea, cough, haemoptysis and retained secretions) with attention to the evidence from research.

**Recent findings:** There are very few paediatric studies exploring any aspect of respiratory symptoms in paediatric palliative care, so much of the evidence base has been drawn from adult studies, few of which have been published in the past 12-18 months.

**Summary:** In the absence of well designed paediatric studies we need to judiciously apply what we can extrapolate from adult studies to each child we are treating; selecting interventions and approaches carefully, adjusting them when there is no evidence of individual benefit

**Key words:**

Dyspnoea

Cough

Secretions

Haemoptysis

Palliative Care

**Introduction:**

Respiratory symptoms are common, distressing and have long-term impact. They occur in 25.6% of children with progressive genetic, metabolic or neurological conditions (1). Parents of children with advanced heart disease report difficulty breathing in the last month of life to be associated with ‘a lot’ or ‘a great deal’ of suffering in 77% of children under 2 years and 62% of those over 2 years (2). The severity of dyspnoea experienced at the end of life by children with cancer is associated with higher levels of long-term parental grief (3). This article addresses the management of the most frequent and distressing respiratory symptoms encountered in paediatrics: dyspnoea, cough, haemoptysis and retained secretions. Whilst an evidence based approach is essential, limited research in paediatric palliative care (4) demands that much of the evidence is extrapolated from adult studies.

**Basic principles of symptom management**

A multi-dimensional approach to management is essential, recognising the interaction of physical, psychological, social and spiritual factors. Investigations and the approach to management must be considered in the context of the likely cause of the symptom (Table 1), the child’s prognosis, goals of care and the burden/benefit of any intervention. When there is a need for further investigations or specific treatment approaches, including those directed at treating the underlying disease or a specific causative factor, symptom management must not be delayed and can be initiated before commencing and alongside active treatments.

**Dyspnoea**

Dyspnoea is one of the most frightening symptoms experienced by children and witnessed by parents. It has been reported to occur in 24% of children in the last 72 hours of life (5) and as the second most commonly occurring symptom after pain (5, 6). In children with cancer, dyspnoea is experienced by 49% of patients in the last 4 weeks of life and considered severe in 29.4% (6).

As dyspnoea is a subjective experience, patient self-report is the only accurate measure - a challenge in a population where many are non-verbal or have not acquired descriptive language. A paediatric dyspnoea scale can aid assessment, but may still be unreliable or difficult to perform some patient groups (7).

**Symptomatic management of dyspnoea**

Simple approaches to dyspnoea management are essential and can commence alongside symptom-directed medication or interventions directed at an underlying cause. Anxiety and dyspnoea each have the potential to exacerbate the other so maintaining a calm environment is crucial. The use of a hand-held fan directed at the face can significantly reduce dyspnoea in adult patients (8) and should be offered to children. Good chest hygiene, with attention to physiotherapy and management of secretions is also important.

Oxygen

Adult studies have failed to show a consistent benefit of oxygen, in some cases even when hypoxia is improved (9). One large multicenter study showed no benefit of oxygen over room air (administered through a similar route as supplemental oxygen), suggesting that the benefit of oxygen administration may only be through providing cool airflow, rather than the oxygen itself (10). However, patients with higher baseline dyspnoea derived more benefit from oxygen than those with lower baseline dyspnoea, with most benefit occurring in the first 48 hours (10). There is weak evidence that oxygen may be beneficial in cardiac dyspnoea and for exercise-induced dyspnoea in adults with kyphoscoliosis (9).

Given the evidence from these studies, it seems rational to offer a trial of airflow prior to considering oxygen. If this proves unsuccessful, oxygen should be offered but discontinued if there is no apparent symptomatic benefit within the first 48 hours. Care should be taken in children with chronic carbon dioxide retention, to avoid suppression of their hypoxic drive.

Opioids

In experimental models, opioids reduce air hunger and the ventilatory response to decreasing oxygen and rising carbon dioxide, as well as reducing anxiety (and potentially anxiety-related escalation of symptoms) (11)*.* The role of opioids in reducing symptomatic dyspnoea in adults has been demonstrated in a number of studies and consequently they are often used as first line drug therapy in children (12-14).

In paediatrics, usual practice (although not evidence based) is to prescribe opioids for dyspnoea at 30-50% of the dose that would be used for pain management (in opioid naieve children). Adult studies have shown that for patients already established on opioids for pain management a 25% increase in their usual breakthrough pain dose is sufficient to relieve dyspnoea and is as effective as a 50% increment (15). It would therefore seem appropriate in opiate naieve children to start with 25% of a standard pain management dose and for those already established on opioids for pain management to increase the breakthrough dose by 25%. For children with chronic dyspnoea, long acting opioids should be considered (16, 17) as establishing a constant background state is likely to be of more benefit than intermittent dosing (16, 17).

Fast acting opioids can be helpful as anxiety can escalate, exacerbating dyspnoea, while waiting for medications to be effective. Intranasal opioids, most typically used in pain management, are minimally invasive, effective and have rapid onset of action. Intranasal diamorphine is widely used in the management of paediatric pain (18) and whilst there are no published studies of its use in paediatric dyspnoea, there are anecdotal reports of its use in clinical practice. Fentanyl has been used for dyspnoea management in adults (19) and there is one neonatal report (a retrospective chart review) that suggests intranasal fentanyl is efficacious in the reduction of laboured breathing (20). There may also be a role for transmucosal fentanyl (21) although emerging evidence does not look promising (22). Currently, however, there remains insufficient evidence of the effectiveness or safety of fentanyl to recommend its use in the management of dyspnoea in either adults or children.

Despite anecdotal reports that nebulised opioids improve dyspnoea, there is no good evidence for their use (23) and, given the potential to cause bronchospasm, we do not recommend their use in children.

Anxiolytics

The close inter-relationship between dyspnoea and anxiety suggests a role for anxiolytics. However, studies in healthy adult subjects, those with advanced cancer and those with COPD have failed to show any statistically significant benefit over placebo (14, 24). In contrast, there is some evidence that midazolam may be more effective than morphine in the management of dyspnoea in adults with cancer (25) and one randomised controlled trial that suggests (but did not demonstrate statistical significance) that a combination of morphine and midazolam may be better than either medication individually (26)*.* The evidence from these 2 studies (25,26), however, is not sufficiently robust to recommend the widespread use of anxiolytics for the management of dyspnoea in children. They may, however, be considered on an individual patient basis, alongside opioids, particularly where anxiety is a significant factor.

Buccal midazolam, used to manage anxiety in dental practice (27), is often prescribed in paediatric palliative care, but there are no studies assessing the benefit in paediatric dyspnoea. Intranasal midazolam may be more acceptable to children than the buccal route (28) but again no studies have assessed its role in dyspnoea.

Diuretics

There is clearly a role for diuretics in children with fluid retention and dyspnoea associated with pulmonary oedema (29, 30) but evidence of benefit in the absence of pulmonary oedema is lacking. Inhaled furosemide has been shown to reduce dyspnoea induced in experimental settings (31) and in patients with COPD (32)*.* Results in adult cancer patients have been conflicting (33, 34)*.* At present, there appears to be insufficient evidence in adult patients, and none in paediatrics, to support a role for nebulised furosemide.

Non-invasive positive pressure ventilation (NIPPV)

NIPPV is often used in the respiratory management of children with chronic hypoventilation secondary to muscle weakness, such as in Duchenne Muscular Dystrophy and Spinal Muscular Atrophy. It’s use has been shown to prolong survival (35), reduce episodes of acute respiratory failure and hospitalisation (36) and reduce symptoms associated with hypercapnic respiratory failure (37, 38). NIPPV may also have a role in the symptomatic management of acute dyspnoea in the palliative care setting, particularly if reversible causes, such as infection, can be addressed (39-42). In adults with end-stage cancer NIPPV is more effective than oxygen in reducing dyspnoea and decreases the doses of morphine required (40). In children with central nervous system disorders and acute respiratory distress, NIPPV has been shown to improve blood gas parameters and reduce hospital stay (41), but studies have not looked specifically at the subjective experience of dyspnoea. As with all interventions, consideration must be given to the likely benefit of NIPPV, both in the long and short term, with goals of care and indications for discontinuing treatment being clear from the outset.

Whilst it is referred to as ‘non-invasive’ by clinicians, in reality NIPPV can be a very invasive procedure for an individual child and family. It is important that NIPPV does not simply prolong the dying process with no improvement, or possible detriment, to the child’s symptom burden and quality of life. Tolerability may be limited by mask discomfort, discomfort from the air pressure, feelings of claustrophobia, poorly managed initial set-up and child or parent anxiety (43).

Specific interventions in malignant disease

In children, primary lung tumours are uncommon and metastatic lung disease (e.g. from osteosarcoma and rhabdomyosarcoma) is unlikely to cause symptomatic dyspnoea unless directly obstructing the airway. Other cancer-related causes of dyspnoea will include pericardial or pleural effusions, pneumothorax and superior vena cava obstruction.

Interventions directed at reducing tumour mass may include palliative chemotherapy, short courses of high dose steroids, such as dexamethasone, and radiotherapy (44)*.* To date, there are no published randomised controlled trials of steroids for dyspnoea management. Drainage of pericardial and pleural effusions should be considered and in the case of recurrent pleural effusion a pleurodesis or insertion of an indwelling catheter may be appropriate (45).

Integrative and supportive therapies

# Psychosocial support alongside other non-pharmacological interventions such as exercise training and breathing control can be beneficial in managing dyspnoea in adults with cancer and COPD (46-48) and self-hypnosis has been shown to be beneficial in children (49, 50)*.* Studies of acupuncture in dyspnoeic adults with COPD and cancer have had mixed results (46). There is some evidence to indicate that adult patients with breathlessness would utilise psychological interventions for anxiety associated with dyspnoea, however, to date few studies have assessed the efficacy of such interventions in either adults or children and few interventional studies are conducted at all during the end of life phase (51).

# Summary of recommendations for symptomatic management of dyspnea

# See Table 2

**Cough**

In the paediatric palliative care setting, cough is most usually due to infection (acute or chronic), aspiration (particularly in children with an impaired swallow), gastrointestinal reflux and, occasionally, malignant disease. An effective cough is dependent on both the tenacity of the mucous and the ability to create an adequate airstream velocity. An inability to create an effective cough can lead to persistent and distressing coughing, which can adversely affect sleep and contribute to symptoms of nausea, pain and dyspnoea.

**Interventions directed at a specific cause**

It is important to address gastro-intestinal reflux, particularly in children with neurological disease, muscle weakness or who have assisted feeding. Reducing feed volumes and/or commencing continuous feeding can be an effective intervention, alongside or in place of antacids and prokinetics.

For children with an impaired swallow, cough secondary to aspiration may be reduced by altering feeding technique or changing from oral to nasogastric (or gastrostomy) feeding. Secretions that accumulate in the oropharynx can be managed with postural drainage, suctioning and physiotherapy, in addition to anti-cholinergic medication. In more extreme cases, intrasalivary gland injection of botulinum toxin may be considered (52), or surgical removal of the submandibular glands.

Treatment of infection and management of bronchospasm is particularly important in children with respiratory disease, such as cystic fibrosis. Inhaled corticosteroids can reduce cough associated with inflammation of the airways and increased mucous production and there is evidence to suggest that some patient groups may benefit from combining these with long acting beta agonists (53).

Where cough is the result of tumour mass affecting the airway, treatments directed at reducing tumour mass should also be considered.

**Symptom-directed management**

Symptomatic management of cough must be addressed alongside any disease-directed interventions.

Opioids

Opioids are likely to be the most effective medication in the palliative management of a persistent dry cough. The antitussive action is distinct from the analgesic effect and thought to be mediated via the central cough receptor. Whilst opioids are more effective than placebo in the management of cough (54, 55), adult studies have not shown any one opioid to be superior (56). Dose information for paediatric patients is lacking and accepted practice is to use 25-50% of the pain dose. For children already receiving opioids for pain we could not find any evidence for or against the addition of a separate opioid or for increasing opioid dose above the dose needed for pain management.

Non-opioids

Evidence for the benefit of non-opioid drugs in the management of cough in palliative care patients is limited or conflicting, even in adult studies (56, 57). A review of over-the-counter (non-prescription) medications for management of acute cough found that published randomised-controlled trials in children showed no benefit of antitussives, antihistamines, antihistamine-decongestants and antitussive/bronchodilator combinations over placebo (58). One paediatric study, however, has shown a benefit of honey preparations over placebo (59). Adult studies suggest that guaifenesin is an effective protussive (55, 58, 60).

One study in adult patients with advanced lung cancer showed that sodium cromoglycate was better than placebo (61) and a task group of the Association for Palliative Medicine of Great Britain and Ireland has recommended a therapeutic trial of sodium chromoglycate prior to commencing opioids (55). Studies in children, however, have not found evidence to support the use of cromones in the management of prolonged, non-specific cough (62), although one single-arm trial in children with chronic cough reported an improvement within 2 weeks of starting therapy.

Inhaled local anaesthetics, such as lidocaine 2% or bupivicaine 0.25% have shown some benefit in adults (63) but the evidence is insufficient to support their use in paediatric patients. Additionally, they can cause bronchospasm and an increased risk of aspiration due to the loss of oropharyngeal sensation.

**Airway clearance**

If the cough is ineffective, the cough reflex will be persistently stimulated. An effective cough requires both adequate cough strength and secretions that are loose enough to be cleared.

Interventions to loosen secretions

Nebulised saline and hypertonic saline are both effective in loosening secretions. Hypertonic saline is superior to lower concentrations, but may be less well tolerated in the paediatric population (64)*.* Muclolytics, such as DNAse are likely to be more effective thanhypertonic saline in improving forced expiratory volume (65).

Interventions to improve cough strength

Good chest physiotherapy is essential for children with increased secretion viscosity and/or an inability to effectively clear their airway, for example due to muscle weakness. This can be facilitated by the use of a mechanical insufflation/exsufflation, which increases peak cough flow, improves secretion clearance and can reduce hospitalisation due to respiratory exacerbations (66-68).

# Summary of recommendations for symptomatic management of cough

# See Table 3

**Haemoptysis (Table 4)**

Haemoptysis in the paediatric palliative care population is most commonly seen in children with haematological malignancy, impaired clotting from other causes (e.g. disseminated intravascular coagulation) and respiratory infection. It can be extremely frightening for the child and parents. Even a small amount of blood-specked sputum can raise fears that a large, more significant bleed, may follow. Endoscopic or surgical management is rarely indicated at end of life, but should be considered in children anticipated to have a longer prognosis.

Preventative management of haemoptysis

Regular platelet transfusions should be considered for children with thrombocytopenia although the burden of frequent hospital attendance may outweigh any potential benefit. Evidence from adult studies suggests a role for antifibrinolytics (e.g. tranexamic acid) in the prevention of bleeding and in reducing platelet transfusions in patients with haematological disorders, although studies are limited (69). There are no available studies in paediatric palliative care, but given the potential benefit (although limited evidence) demonstrated in adult studies, antifibrinolytics should be considered on an individual patient basis.

Acute management of haemoptysis

Evidence from adult studies suggests that tranexamic acid may be of benefit in reducing both the duration and volume of bleeding (70). Catastrophic haemorrhage is relatively rare in children, but when they are at risk parents should be advised of this in advance and management strategies put in place. Dark towels should be available to lessen the visual impact and a fast acting anxiolytic and opioid, such as midazolam and morphine, can be given to manage acute distress and breathlessness, although there is little evidence to support this approach (71, 72).

# Summary of recommendations for symptomatic management of haemoptysis

# See Table 4

**Retained secretions at the end of life**

As consciousness deteriorates and the ability to swallow weakens, secretions accumulate in the upper airway causing noisy breath sounds. Due to a reduced level of awareness, this is not usually distressing for the child but can be considerably distressing for family members (73).

There is currently no evidence to show that any intervention, pharmacological or non-pharmacological, is more effective than placebo in the management of noisy breathing at the end of life (74, 75)*.* However, due to the distress that noisy breathing causes to relatives, it is appropriate to initiate therapeutic interventions, adjusted or discontinued according to response, on an individual patient basis.

Simple measures such as repositioning and postural drainage should be initiated and suctioning, although only of short term benefit, may also be a helpful. Anticholinergic drugs, usually hyoscine hydrobromide or glycopyrronium, may also be used. There is some limited evidence that glycopyrronium may be superior to hysocine hydrobromide in the reduction of noisy breathing (76, 77) but no evidence that there is any difference between atropine, hyoscine hydrobromide or hyoscine butylbromide (78) or between hyoscine hydrobromide and octreotide (79), or that any of these are better than a placebo. Hyoscine hydrobromide can be preferable to children and families as a topical preparation is available, although it does not allow the easy and responsive dose adjustment afforded by glycopyrronium.

# Summary of recommendations for symptomatic management of retained secretions

# See Table 5

## Conclusion

The prevalence of respiratory symptoms in children with life-limiting illness is high but there is very little research dedicated to their management. In the absence of a paediatric evidence base, much practice is based on extrapolation from adult studies, often conducted in specific disease groups (e.g. Chronic obstructive pulmonary disease (COPD) and lung cancer) that bear little resemblance to the medical conditions encountered in the paediatric palliative care population. Whilst conducting research studies with paediatric palliative care patients is challenging (80, 81), there is clearly an urgent need for well‐designed multi-centre paediatric studies with objective outcome measures which demonstrate not only the efficacy of an intervention, but also the impact of the intervention for the child and family’s quality of life. Until such time, the evidence we have from adult studies must be applied wisely to our paediatric patients, treating each child as an individual, selecting our management options carefully and adjusting them where there is no evidence of individual benefit.

**Key points**

* Respiratory symptoms at the end of life are common, distressing and have a lasting impact on parents, yet research into their management is lacking
* Current management is based predominately on adult studies, often in specific disease groups that bear little resemblance to the paediatric population
* Even within adult studies, strong research evidence for the management of common paediatric symptoms (dyspnoea, cough and retained secretions) is lacking and it is difficult to extrapolate this data into recommendations for paediatric practice
* There is an urgent need for well-designed multi-centre paediatric studies to demonstrate the efficacy of commonly used interventions and the impact on the child and family’s quality of life.
* In the absence of a paediatric evidence base, each child must be treated individually, based on best practice derived predominately from adult studies, with treatment tailored according to observed individual benefit.

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Table 1: Causes of respiratory symptoms in paediatric palliative patients

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cause | Dyspnoea | Cough | Haemoptysis | Retained secretions |
| Infection |  |  |  |  |
| Anaemia |  |  |  |  |
| Pain |  |  |  |  |
| Anxiety |  |  |  |  |
| Respiratory muscle weakness |  |  |  |  |
| Cardiac failure |  |  |  |  |
| Pulmonary oedema |  |  |  |  |
| Pleural or pericardial effusion |  |  |  |  |
| Pneumothorax |  |  |  |  |
| Tumour mass |  |  |  |  |
| Superior vena cava obstruction |  |  |  |  |
| Aspiration |  |  |  |  |
| Reflux |  |  |  |  |
| Impaired ability to swallow |  |  |  |  |
| Abnormalities of clotting, eg haematological malignancy |  |  |  |  |

Table 2: Symptomatic management of dyspnoea

|  |  |  |  |
| --- | --- | --- | --- |
| Management strategy | Paediatric study population | Note | Recommendation |
| Hand held fan directed at face | No | Significantly reduces dyspnoea in adult patients (8). | Should be offered to all children with dyspnoea. |
| Oxygen | No | Probably no significant benefit over room air delivered by a similar mechanism, but may be of benefit in those with severe baseline dyspnoea, with most benefit seen in first 48 hours (10). | Airflow should be tried initially. If no benefit, supplemental oxygen can be offered, but discontinue if no symptomatic benefit within 48 hours. |
| Oral, intravenous and subcutaneous opioids | No | Strong evidence of symptomatic benefit (12). | Use as first line pharmacological management. For children not established on opioids start with 25% of the dose recommended for pain management. For those established on opioids for pain, increase the breakthrouh pain dose by 25% (15). For chronic dyspnoea long acting preparations likely to be more beneficial than intermittent dosing (16, 17). |
| Intranasal fentanyl or diamorphine | One small neonatal case note review | Observation of a reduction in laboured breathing after administration of intranasal fentanyl (20). | Insufficient evidence to recommend the use of intranasal fentanyl or diamorphine |
| Transmucosal fentanyl | No | Conflicting evidence of benefit (21, 22). | Insufficient evidence to recommend the use of transmucosal fentanyl |
| Nebulised opioids | No | No proven benefit in adults (23). | Not recommended |
| Anxiolytics | No | Insufficient evidence of benefit (14, 24). | Not recommended as first line therapy for dyspnoea.  Could be tried on an individual patient basis alongside opioids, particularly where anxiety is a significant factor.  Buccal and intranasal midazolam may offer relief of acute anxiety (27, 28) but effect on dyspnoea unknown. |
| Diuretics | Children with congenital cardiac disease | Benefit in dyspnoea associated with cardiac failure and pulmonary oedema (29, 30). No good evidence to support the role of nebulised diuretics(33, 34). | Use if clinically indicated (eg fluid overload and pulmonary oedema). No evidence to support a role for nebulised diuretics |
| NIPPV | Children with neuromuscular disease (35-38)  Children with central nervous system disorders and acute respiratory distress (41) | Evidence of improvement in blood gas parameters in children with acute respiratory failure (41), but no studies specifically looking at symptomatic management of dyspnoea. | Should be considered in the context of goals of care, particularly if a potentially reversible cause of acute dyspnoea is identified. |
| Integrative and supportive therapies | Self-hypnosis in the management of chronic dyspnoea in children (49, 50) | Evidence of benefit of non-pharmacological interventions in adults (46) and that self-hypnosis can be helpful in children (49, 50). | Integrative and supportive therapies should be offered to children. |

Table 3: Symptomatic management of cough

|  |  |  |  |
| --- | --- | --- | --- |
| Management strategy | Paediatric study population | notes | Recommendation |
| Opioids | No | Evidence of benefit (54, 55). No evidence that one opiate is better than another or that adding an additional opioid is helpful for children already using opioids for pain. Dose evidence lacking in children. | Can be used for cough management. In paediatrics, accepted practice is to use 25-50% of the pain dose.  Consider trying non-opioid approaches first, eg honey preparations or sodium cromoglycate |
| Over the counter cough medications | Effect of honey preparations studied in children aged 1-5 years with nocturnal cough and sleep disturbance secondary to upper respiratory tract infection | No benefit of antitussives, antihistamines, antihistamine-decongestants and antitussive/bronchodilator combinations in children with acute cough (58). Guaifenesin may be an effective protussant (56, 60). Evidence for benefit of honey preparations over placebo, although not studied in palliative care patients (59). | Honey preparations should be tried on an individual patient basis, prior to opioids.  Consider guaifenesin preparations if a protussive is required. |
| Sodium cromoglycate | A single-arm open trial in children with chronic cough (62) | In adults with advanced cancer this was more effective than placebo (61) and has been recommended for adults prior to commencing opioids (55). | Based on recommendations for adults, could be tried in children prior to commencing opioids. |
| Inhaled local anaesthetics | No | Evidence of benefit in adult patients (63) | Not recommended due to insufficient evidence in children and risk of bronchoconstriction and aspiration secondary to local anaesthesia |
| Nebulised saline solutions and DNase | Children with cystic fibrosis, but not specifically looking at effect on cough | Saline effective but in adult studies less so than hypertonic saline (64). Mucolytics such as Dnase are more effective than saline (65) | Nebulised saline or DNAse can be tried on an individual patient basis for children with thick secretions and/or insufficient cough strength to remove secretions from airway. |
| Mechanical insufflation/exsufflation | Children with neuromuscular weakness | Mechanical insufflation/exsufflation can increase peak cough flow and improve secretion clearance (66-68) | Mechanical insufflation/exsufflation should be considered as an adjunct to chest physiotherapy in children with insufficient cough strength to remove secretions from airway. |

Table 4: Symptomatic management of haemoptysis

|  |  |  |  |
| --- | --- | --- | --- |
| Management strategy | Paediatric study population | notes | Recommendation |
| Antifibrinolytics to prevent haemoptysis | No | Adult studies suggest a benefit of antifibrinolytics in prevention of bleeding and reducing platelet transfusions, but data too limited to recommend widespread use (69). | Maintain adequate platelet count and correct coagulation abnormalities where clinically appropriate.  Antifibrinolytics should be considered on an individual patient basis |
| Antifibrinolytics to stop haemoptysis | No | Adult studies suggest a role for tranexamic acid in reducing the duration and volume of bleeding (70). | Tranexamic acid should be considered for use in children with active haemoptysis. |
| Symptomatic management | No | No evidence found to suggest symptomatic management with anxiolytics and opioids is effective. | Despite a lack of evidence to support symptomatic management of haemoptysis, individual patients may benefit from management of anxiety and dyspnoea. |

Table 5: Symptomatic management of retained secretions at the end of life

|  |  |  |  |
| --- | --- | --- | --- |
| Management strategy | Paediatric study population | notes | Recommendation |
| Simple interventions | No | No studies looking at the benefit of simple interventions such as suctioning, postural drainage or positioning | Simple measures should be considered prior to drug management. Care should be taken with suctioning to avoid trauma. |
| Anticholinergics | No | No studies comparing anticholinergic to placebo.  Weak evidence that glycopyrronium may be superior to hyoscine hydrobromide (76)  No difference between atropine, hyoscine hydrobromide or hyoscine butylbromide (78) | Although evidence of benefit over placebo is lacking, anticholinergics can be tried on an individual patient basis.  Glycopyrronium may be more effective than other anti-cholinergics. |
| Octreotide | No | No evidence that octreotide is better than placebo or anticholinergics (79) | Although there is no evidence that octreotide is better than any other medcation for management of secretions, it could be tried if anti-cholinergics fail. |