Title: Management of death rattle at end of life.

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Abstract
Noisy breathing or death rattle is a common clinical sign in the final days of life. When it occurs, the level of consciousness is usually low and it is generally assumed that patients are not distressed by it. Despite the assumption that patients are not distressed, death rattle is usually actively treated in palliative care settings through a combination of pharmacological and non-pharmacological measures. Anti-cholinergic or anti–muscarinic medications are the drugs of choice in practice even in the absence of patient distress, despite there being no conclusive evidence to suggest that any drug is superior to placebo. In addition, a recent Cochrane review suggests lack of supporting evidence for the use of anti-cholinergics to treat death rattle (Wee and Hillier 2010). Currently the choice of drug is based on the various properties of the drugs and desired effects. However, treatment is currently based on alleviating the perceived distress of family members rather than aimed specifically at benefiting the patient. Moreover, anti-cholinergic drugs can result in unpleasant side effects such as urinary retention and dry mouth for patients who are probably unable to report symptoms. Recent research calls for prescribers to consider carefully why they are treating death rattle. Moreover, families need to be reassured and have it explained to them that it is unlikely that the patient is distressed and why not.

Key words: death rattle, noisy breathing, palliative care.

Introduction

Death rattle is a common clinical sign in the terminal phase of a wide variety of diseases, including cancer, neurological, circulatory and pulmonary disease. It is a term used to describe the noisy breathing or 'rattle' that is probably produced by the accumulation of oro-pharyngeal and or chest secretions. The terminal phase refers to when death is imminent and life expectancy is limited to a short number of days or hours. It is generally accepted that death rattle is a reliable indicator of impending death (Lichter and Hunt, 1990; Wildiers and Menten, 2002; Kass and Ellershaw, 2003; Wildiers et al, 2009). It is thought unlikely that dying patients are aware of the death rattle given that, by the time it occurs, the level of consciousness is usually low and gag and cough reflexes often absent (Hipp and Letizia, 2009; Wee and Hillier, 2010). However, a recent Cochrane review suggests death rattle is routinely 'treated' with anti-cholinergic drugs across various healthcare settings even in the absence of patient distress and despite the lack of supporting evidence (Wee and Hillier, 2010).

The reported prevalence of death rattle in dying patients in the literature varies from 23-92% and can occur 17 to 57 hours before death (Lichter and Hunt, 1990; Bennett 1996; Ellershaw et al, 1995; Morita et al, 2000; Wildiers and Menten, 2002). According to Lichter and Hunt (1990) death rattle occurs in 25% of dying patients. However, the incidence highlighted by Ellershaw et al, (1995) is much higher at 92%. More recently, a prospective study of 245 hospice patients reported by Morita et al, (2000) found that 44% of dying patients developed death rattle. A similar incidence rate is reported by Bennett et al, (2002) who conclude that the incidence of noisy bronchial secretion in terminally ill cancer patients is 44%.

Aetiology and risk factors for death rattle

Although unproven, it is generally considered likely that death rattle in patients weakened by the dying process is caused by air passing through, and over accumulated secretions in the hypopharynx, trachea or main bronchus in association with the inspiratory and expiratory phases of respiration (Ellershaw et al, 1995; Twycross, 1997; Bennett et al, 2002; Wildiers and Menten, 2002).

In terms of risk factors, for the development of death rattle, in a multicentre prospective, observational study of 310 terminally ill patients, Morita et al (2004) found that patients with primary lung cancer, pneumonia or dysphagia were reported to be significantly more likely to develop noisy bronchial secretions (Morita et al, 2004). Whether the presence of brain metastases contributes significantly to the presence of death rattle is unclear. In this study, the presence of brain metastasis was not significantly associated with the development of death rattle – this was contrary to the findings of a previous study by Morita et al (2000). Morita et al (2004) suggest by way of explanation, that some of the symptoms commonly associated with brain metastasis, such as dysphagia, may contribute to death rattle rather than the brain pathology itself.

In order to explain an aetiology for death rattle, two sub types have been proposed - Wildiers and Menten (2002) describe 'real' and 'pseudo' while Bennett et al (1996) prefer the terminology of 'type 1' and 'type 2'. Type 1 or real death rattle largely refers to the noise that ensues when excessive secretions are produced by the salivary glands and is reported to predict death for 75% of dying patients (Wildiers and Menten, 2002). This type of death rattle is associated with decreased consciousness levels and is typical at end of life. It can often be satisfactorily treated with anti-cholinergic medication through inhibition of salivary secretion (Bennett et al, 1996). Type 2 or pseudo death rattle refers to the presence of mostly bronchial secretions often caused by respiratory pathology like pulmonary infection, aspiration and/or oedema. Type 2 is much more difficult to treat than type 1, and may be persistent and even refractory to standard palliation treatment. It can occur in conscious patients even prior to the terminal phase and, consequently, can lead to severe distress. 10% of all dying patients have refractory secretions (Bennett et al, 2000).

It is important to distinguish between Type 1 (true) death rattle and Type 2 (pseudo) death rattle in order to plan treatment according to likely cause, because the type may influence the most appropriate management. For instance, type 2 may require an antibiotic rather than an anti-cholinergic drug (Morita et al, 2004). However, it is

important to remain cognisant that death rattle may be a combination of type 1 and type 2.

The physiological events surrounding death rattle

The pathophysiology of death rattle is not fully understood and it is generally acknowledged that a greater understanding of the noise that is death rattle is required (Morita et al, 2004; Wee and Hillier, 2010). As outlined above, airway secretions are presumed to cause the sound that is commonly known as death rattle (Wee et al, 2006). In dying patients this is usually due to an inability to clear or expectorate related to reduced consciousness levels (Morita et al, 2004). A useful hypothesis on the pathophysiology of death rattle is proposed by Hipp and Letizia (2009). They propose that the physiological processes under the control of the sympathetic and parasympathetic nervous systems may deviate from normal during the dying process, due to lack of oxygen to the brain. It is thought that this may cause an ongoing release of the neurotransmitter acetylcholine from parasympathetic cholinergic neurons leading to activation of muscarininc receptors within the salivary glands and bronchial mucosa, culminating in the production of excessive secretions. It is also suggested in this hypothesis that dehydration, which often occurs in the dying patient, may increase the viscosity of chest secretions making them more difficult to expectorate. As stated earlier, dysphagia and decreased levels of consciousness may also contribute to the prevalence of chest secretions and the death rattle (Hipp and Letizia, 2009).

It is also believed that the muscarininc receptors, M2 and M3, are particularly involved in respiratory secretions and that a dysfunction of the M2 receptors, e.g., due to a pulmonary infection or inflammation, is likely to lead to increased levels of secretions from the salivary glands and bronchial mucosa (Bennett et al, 2002). This proposed scenario would likely lead to type 2 or pseudo death rattle which may be refractory to treatment.

Management of death rattle

Death rattle is best managed by a combination of pharmacological and non-pharmacological measures (Bennett et al, 2002; Mercadante et al, 2011).

Pharmacological Measures

Salivary glands are innervated by cholinergic nerves therefore oro-pharyngeal and bronchial secretions are produced by a cholinergic mechanism. Anti-cholinergic or anti-muscarinic drugs (such as scopolamine, hyoscine butylbromide (Buscopan), hyoscine hydrobromide (Hyoscine), glycopyrrolate (Robinul) and atropine) (Table 1) can be used to antagonise or block acetylcholine at muscarinic receptors in order to inhibit secretions in the respiratory system, thereby reducing noisy or rattling breathing (Bennett et al, 2002; Morita et al, 2004).

Anti-cholinergic or anti-muscarinic drugs have become the established treatment for death rattle even though there is little evidence to support their use in the dying patient population (Wee and Hillier, 2010). Their use was originally based on their demonstrable effectiveness in anaesthetics for drying secretions. They are used in as many as 73% of patients with death rattle with 79% achieving satisfactory palliation of the rattle and 10% of all patients having refractory secretions (Bennett et al, 2002).

A lack of evidence to support the use of anti-cholinergic drugs for death rattle prompted Bennett et al (2002) to establish a task group to review this practice. They set out but were unable to determine an optimal drug regime for death rattle. They did however, highlight the different characteristics of various anti-cholinergic drugs and recommended that prescribers be aware of these in choosing a drug. They reviewed the evidence surrounding the use of anti-cholinergic drugs and reported evidence to support the use of single doses of anti-cholinergic drugs but none to guide doses for continuous subcutaneous infusions. They established that the intravenous route had a faster onset of action than the intramuscular route, but a shorter duration. Their review also concluded that low doses of anti-muscarinics will readily inhibit salivary secretion but bronchial secretions are inhibited only if higher doses of drugs are used (Bennett et al, 2002). Given that response rates to anti-cholinergic drugs were higher when combined with non-pharmacological treatments like suctioning and positioning, Bennett et al (2002) recommended a combination of measures and pointed out the importance of effective communication with the patient's family.

Non-pharmacological measures

Non-pharmacological measures to manage death rattle include careful positioning and re-positioning, suctioning and restricting artificial hydration. The onset of the death rattle is generally associated with impaired cognition and physical strength and this impairs the patient's ability to mobilise the secretions. Placing patients in a semi-prone position and onto alternate sides encourages postural drainage and may help alleviate the sound of excessive respiratory secretions (Clary and Lawson, 2009; Hipp and Letizia, 2009; Wildiers et al, 2009).

Agreement has not been reached on whether suctioning is beneficial or not. Hipp and Letizia (2009) suggest that suctioning is generally not helpful and can lead to distress, while Clary and Lawson (2009) propose that gentle anterior nasopharyngeal or tracheal suction is useful in alleviating death rattle and is not necessarily distressing for patients.

In relation to the use of artificial hydration in the terminal phase, there is considerable variation in practice. Some research suggests that restricting fluids may reduce the incidence or severity of death rattle (Wildiers and Menten, 2002). However, Ferris et al (2003) contend that artificial hydration may stimulate the release of endorphins and may therefore contribute to comfort during the dying process. Bruera (2005) found that sedation and myoclonus (sign of opioid toxicity) were improved with artificial hydration in the terminal phase. A Cochrane review published in 2008 set out to determine the effect of artificial hydration on quality and length of life in the terminal phase. The authors concluded that there was insufficient high quality evidence and, consequently, it was not possible to make any strong recommendations for practice. It is suggested that clinicians need to make a decision based on the perceived benefits and harms of artificial hydration in individual patient circumstances, without the benefit of high quality evidence to guide them. (Good et al, 2008).

Management must also include maintaining effective communication with the patient's family. Effective communication with the family includes explaining in plain language why and how the sound that is the death rattle, and providing reassurance that it is unlikely to cause distress in patients. Pointing out the behavioural indicators of comfort

and lack of distress to the family is also useful including a peaceful facial expression (no furrowed brow or tightened lips) and an absence of vocal moaning (Hipp and Letizia, 2009). Education of the family regarding the dying process may be as effective as positioning and medications (Clary and Lawson, 2009). Hughes et al (2000) found there was a 90% reduction in relatives' distress levels when reassurance was given and interventions were used to reduce death rattle. Finally, the phrase death rattle should be avoided in discussion with families (Morita et al, 2004).

Discussion

The question as to why patients are treated for death rattle when it is not known which drug is best, when most patients do not appear distressed, have not consented to treatment and are unable to describe side effects or benefit, is an important one for clinicians to consider. There is little research into the factors that influence the management and treatment of death rattle. A recent qualitative study where palliative care doctors and clinical nurse specialists were interviewed (n=15) identified the factors that influenced their decision making with regard to the management of death rattle (Bradley et al, 2010). Their reasons for initiating treatment for death rattle included: fear of family distress, to avoid patient distress and optimise comfort, to protect other patients from the sound, to avoid staff distress and local policy. Nine of the study participants raised ethical issues such as the importance of being clear as to 'who' is being treated and a small number were concerned regarding the lack of patient consent. Six participants revealed that the sound had little impact on them, with one of these six participants expressing the view that the sound was a helpful indicator of end of lifetime scale. Finally nine participants described the impact on themselves as ranging from uncomfortable to distressed (Bradley et al, 2010). This and other research suggest that treatment is often initiated because clinicians feel morally obliged to reduce the distress death rattle causes to family members (Oberle and Hughes, 2001; Kelly and O'Driscoll, 2004; Bradley et al, 2010).

Relatives can interpret the sound of death rattle as an indication that the patient is 'drowning in secretions' so it is not surprising that death rattle has been reported to upset relatives at the time of dying (Hughes et al, 2000) and even several years after the death (Wee et al, 2006). A group of bereaved relatives were asked about how they were

affected by noisy secretions at end of life in a qualitative interpretive study undertaken by Wee et al (2006). Twenty seven bereaved relatives were interviewed two to four months after their relative's death about their personal experience of hearing the death rattle. Nine relatives noted no change in relatives' breathing. Twelve relatives experienced death rattle; and five of these experienced distress. Some of the relatives found the sound helpful as a warning sign of impending death. Therefore, the assumption that all relatives are distressed by death rattle is unsubstantiated. This has implications for practice as it effectively means that, in many cases there may be no justification for pharmacological intervention or treatment.

However, convincing some staff to re-consider a 'blanket approach' to instigating pharmacological treatment for death rattle may be difficult. It has been reported that the sound of death rattle has a negative impact on hospice staff and volunteers when caring for dying patients (Wee, 2008). Some also believed the sound caused distress for family and other patients even when they had not asked them. A minority said they were disturbed by the sound only if the patient seemed distressed by it (Wee, 2008). Moreover, it has also been reported elsewhere that doctors and nurses did not agree about why they intervened. Their decisions to intervene were influenced by their own negative feelings, concern for other patients and or relatives, perceptions about the expectations of their role and feeling obliged to use a therapeutic option because of its availability; none of which relate to patient benefit (Bradley et al, 2010).

Conclusions and implications for practice

The impact of treatment on patients who are dying is not clear because the patient is usually unconscious and unable to report effects, adverse or otherwise (Bennett et al, 2002; Wee and Hillier, 2010). Nevertheless, the use of anti-cholinergic drugs for death rattle is routine in palliative and end-of-life care practice even when the patient does not appear distressed (Wee et al, 2006). Some evidence suggests that pharmacological and non-pharmacological measures have a beneficial response. The Victoria Respiration Congestion Scale (VRCS) (Figure 1) has been used by clinical staff to evaluate patients' response to anti-cholinergic drugs by means of measuring audibility of excessive secretions at different distances (Back et al, 2001; Wildiers et al, 2009). However, this

tool and similar measures have been criticised for being overly subjective (Morita et al, 2000; Wee and Hillier, 2010).

The recent Cochrane review of Wee and Hillier (2010) established that there is no evidence to support the superiority of any pharmacologic or non-pharmacologic over a placebo; however, the difficulties for staff who feel they must intervene in the context of the emotions that accompanying imminent death was also acknowledged in the review. Patients need to be closely monitored for lack of therapeutic effect and adverse effects of treatment (Wee and Hillier, 2010). However, there is an ethical obligation on healthcare staff to consider why treatment is being initiated in the first place and to observe patients on treatment carefully for lack of benefit or unpleasant side effects and halt futile treatment. Research is also needed to ascertain the effect of death rattle itself and effects of treatment on the patient. Side effects of anti-cholinergic agents include varying degrees of blurred vision, sedation, confusion, delirium, hallucinations, palpitations, constipation and urinary retention (Wee and Hillier, 2010).

Clinical staff need to recognise that how they interpret death rattle is likely to influence their decision to intervene rather than the decision being based on what is best for the patient. How they feel about the sound of death rattle will also affect how they explain it to families. Throughout the dying process, ongoing objective assessment of the patient is required in order to diagnose new signs or symptoms, including death rattle; when a new sign or symptom arises, checking if it is causing distress to the patient is important. If distress is absent, then explanation to the family and ongoing patient assessment may be more appropriate and more helpful than pharmacological interventions that are not indicated (Wee, 2008).

In conclusion, Wee (2008) suggests that clinical staff need to consider why, when and how they intervene and to be aware of the consequences of that intervention rather than applying a universal pharmacological approach to death rattle management. The care of the family is also part of this change of approach. This includes providing information

and reassurance to them regarding the dying process itself and their role in companioning and supporting their loved one (Clary and Lawson, 2009).

Key Points

- Death rattle occurs in 23-92% of dying patients
- Two sub types of death rattle have been proposed - ‘real’ (type 1) and ‘pseudo’ (type 2). ‘Real’ death rattle is easier to treat.
- Refractory death rattle is likely to be associated with lung pathology resulting in bronchial rather than salivary secretions.
- There is no evidence to support that any treatment for death rattle is better than placebo.
- Relatives can find death rattle distressing and need explanation and reassurance from clinical staff.

References

Back IN, Jenkins K, Blower A, Beckhelling J (2001) A study comparing hyoscine hydrobromide and glycopyrrolate in the treatment of death rattle. *Palliative Medicine* **15**: 329-336

Bennett M (1996) Death rattle: an audit of hyoscine (scopolamine) use and review of management. *Palliative Medicine* **12**(4): 229-233

Bennett M, Lucas V, Brennan M, Hughes A, O'Donnell V, Wee B (2002) Using anti-muscarinic drugs in the management of death rattle: evidence based guidelines for palliative care. *Palliative Medicine* **16**: 369-374

Bradley K, Wee B, Aoun S (2010) Management of death rattle: what influences the decision making of palliative medicine doctors and clinical nurse specialists? *Progress in Palliative Care* **18**(5): 270-274

Bruera E, Sala R, Rico MA, Moyano J, Centeno C, Willey J, Palmer JL (2005) Effects of parenteral hydration in terminally ill cancer patients: a preliminary study. *Journal of Clinical Oncology* **23**(10): 2366-2371

Clary PL, Lawson P (2009) Pharmacological Pearls for End-of-Life Care. *American Family Physician* **79**(12): 1059-1065

Ellershaw J, Sutcliffe JM, Saunders CM (1995) Dehydration and the dying patient. *Journal of Pain and Symptom Management* **10**: 192-197

Ferris F, VonGunten C, Emanuel L (2003) Competency in end of life care: last hours of life. *Journal of Palliative Medicine* **6**(4): 605-613

Good P, Cavanagh J, Mather M, Ravenscroft P (2008) Medically assisted nutrition for palliative care in adult patients. *Cochrane Database of Systematic Reviews 2008* **3**(CD006274). DOI: 10.1002/14651858.CD006274.pub2

Hipp B, Letizia MJ (2009) Understanding and Responding to The Death Rattle in Dying Patients. *Medsurg Nursing* **18**(1): 17-21

Hughes A, Wilcock A, Corcoran R, Lucas V, King A (2000) Audit of three antimuscarinic drugs for managing retained secretions. *Palliative Medicine* **14**:221-222

Kass RM, Ellershaw M (2003) Respiratory tract secretions in the dying patient: a retrospective study. *Journal of Pain and Symptom Management* **26**(4): 897-902.

Kelly L, O'Driscoll T (2004) The occasional palliative care patient: Lessons we have learned. *Canadian Journal of Rural Medicine* **9**:253-256

Lichter I, Hunt E (1990) The last 48 hours of life. *Journal of Palliative Care* **6**(4): 7-15

Mercadante S, Villari P, Ferrera P (2011) Refractory Death Rattle: Deep Aspiration Facilitates the Effects of Antisecretory Agents. *Journal of Pain and Symptom Management* **41**(3): 637-639

Morita T, Tsunoda J, Inoue S, Chihara S (2000) Risk factors for death rattle in terminally ill cancer patients: a prospective exploratory study *Palliative Medicine* **14**: 19-23

Morita T, Hyodo I, Yoshimi T et al (2004) Incidence and underlying etiologies of bronchial secretion in terminally ill cancer patients: a multicenter, prospective, observational study. *Journal of Pain and Symptom Management* **27**(6): 533-539

Oberle K, Hughes D (2001) Doctors' and nurses' perceptions of ethical problems in end-of-life decisions. *Journal of Advanced nursing* **33**:707-715

Twycross R (1997) *Symptom management in advanced cancer*. 2nd edn. Radcliffe Medical Press, Oxford.

Twycross R, Wilcox A, Charlesworth S, Dickman A (2002) *Palliative Care Formulary* (2nd edn), Radcliffe Medical Press, UK

Victoria Respiratory Congestion Scale (VRCS) (2006) Victoria Hospice Society. *Medical care of the dying* (4th ed.). Victoria, British Columbia, Canada: Victoria Hospice Society Learning Centre for Palliative Care.

Wee BL, Coleman PG, Hillier R, Holgate SH (2006) The sound of death rattle 1: are relatives distressed by hearing this sound? *Palliative Medicine* **20**:171-175

Wee BL (2008) Death rattle: its impact on staff and volunteers in palliative care. *Palliative Medicine* **22**: 173-176

Wee B, Hillier R (2010) Interventions for noisy breathing in patients near to death. *Cochrane Database of Systematic Reviews 2008* **1**(CD005177). DOI: 10.1002/146518558.CD005177 pub2

Wildiers H, Menten J (2002) Death Rattle: Prevalence, Prevention and Treatment. *Journal of Pain and Symptom Management* **23**(4): 310-317

Wildiers H, Dhaenekint C, Demeulenaere P et al (2009) Atropine, Hyoscine Butylbromide, or Scopolamine Are Equally Effective for the Treatment of Death Rattle in Terminal Care. *Journal of Pain and Symptom Management* **38**(1): 124-133

Table 1. Common Anti-cholinergic Medications for Management of Death Rattle (*CSCI: continuous subcutaneous infusion)

Medication	**Indications for use**	**Single Dose**	**Route**	**24hour CSCI* dose**	**Onset & duration of action**	**Properties & side effects**
Hyoscine Butylbromide (Buscopan)	First line for death rattle in some Specialist Palliative Care (SPC) services	20mg 4 hourly	PO/SC/IM/IV (preference for SC in SPC services)	20-40mgs (some SPC teams use 60-120mg)	Rapid onset of action: ≤ 10mins (SC/IM/IV); Short duration of effect ≤2hrs	Anti-secretory and anti-spasmodic agent; Does not cross BBB – so no central anti-emetic effect & does not cause drowsiness. May cause tachycardia; dry mouth; retention of urine. Blocks effect of prokinetic drugs. Cheaper than Hyoscine H.
Glycopyrrolate (Robinul)	First line for death rattle in some Specialist Palliative Care services	0.2-0.4mg 4-6 hourly	SC/IM/IV (preference for SC in SPC services)	1.2 mgs (some SPC teams use up to 2.4mgs)	Slow onset of action 30-40mins (SC/IM/IV); Long duration of action - 6hrs	Anti-secretory and anti-spasmodic agent; More potent than Hyoscine Hydrobromide as anti-secretory agent. Rarely causes sedation or delirium. May cause dry mouth, retention of urine. Lower doses are effective in renal impairment. Blocks effect of prokinetic drugs. Cheaper than Hyoscine H.
Hyoscine Hydrobromide (Hyoscine)	Second line for death rattle in some Specialist Palliative Care services – some avoid due to risk of anti-cholinergic syndrome	0.4mg-0.6mg 4-6 hourly	SC/IM/IV (preference for SC in SPC services)	1.2mgs (some SPC teams use up to 4.8mgs)	Rapid onset of action ≤20min (SC/IM/IV); Short duration of effect 2-3 hours;	Anti-secretory and anti-spasmodic agent; Crosses BBB so may cause central anticholinergic syndrome (excitement, ataxia, hallucinations, behavioural abnormalities & drowsiness). Can be useful if sedation is indicated. May cause dry mouth, retention of urine.
Hyoscine Hydrobromide Transdermal Patch (Scopoderm TTS)	For Death Rattle if injections not appropriate. (May be used for drooling in head and neck cancer or motor neurone disease).	1.5mg patch every 72hours (patient absorbs 1mg in 72hrs)	Transdermal	Not relevant	Slow onset of action: 5-6 hours	As above for Hyoscine Hydrobromide

Sources: Hipp and Letizia (2009); Bennett et al, (2004); Wildiers and Menten (2002); Twycross et al, (2002)