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'Death rattle' after withdrawal of mechanical ventilation: Practical and ethical considerations

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Summary The noise produced by oscillatory movements of secretions in oropharynx, hypopharynx and trachea during inspiration and expiration in unconscious terminal patients is often described as '*the death rattle*'. The reported incidence of death rattle in terminally ill patients varied between six and 92%. It is most commonly reported in patients dying from pulmonary malignancies, primary brain tumours or brain metastases, and predicts death within 48 hours in 75% of the patients. Clinical studies demonstrate that hyoscine hydrobromide is effective at improving symptoms.

After withdrawal of artificial ventilation on the intensive care unit, excessive respiratory secretions resulting in rattling breathing, during the last hours of life, is not uncommon. Physicians and nurses experience considerable difficulties and frustrations in treating the death rattle. The distressing experience and negative influence in the bereavement process indicates an ethical demand to treat this symptom from the perspective of others merely than that of the patient. This article provides practical and ethical considerations in the management of this near-death symptom. The fact that relatives were relieved in almost all cases, in which a positive effect was obtained, makes treatment in anticipation of death rattle an ethical demand. In practice, injectable scopolamine is the reference drug for symptomatic treatment of death rattle.

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Introduction

The noise produced by oscillatory movements of secretions in the oropharynx, hypopharynx and trachea during inspiration and expiration in uncon-

scious terminal patients is described as '*the death rattle*' (Twycross and Lichter, 1998; Wildiers and Menten, 2002; Bennett et al., 2002). The secretions are produced by the salivary glands and bronchial mucosa. Dying patients are usually too weak to expectorate or swallow the migrating secretions. Sputum usually only accumulates in these areas if there is a significant impairment of the cough

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reflex, as in deep coma or near death. The reported incidence of death rattle in terminal patients varied greatly: 6% (Morita et al., 1999), 23% (Wildiers and Menten, 2002), 41% (Morita et al., 2004a), 43% (Hughes et al., 1996), 44% (Morita et al., 2000; Back et al., 2001), 45% (Lichter and Hunt, 1990), 49% (Kåss and Ellershaw, 2003), 50–56% (Voltz & Borasio, 1997; Voltz et al., 2004), 80% (Bennett et al., 2002) and 92% (Ellershaw et al., 1995). The majority of the patients observed in these studies were dying from cancer and most of them were admitted to palliative care units and hospices. No studies were undertaken in critical care. Observational studies report that 41–92% develop death rattle (Ellershaw et al., 1995; Morita et al., 2000; Lichter and Hunt, 1990; Back et al., 2001), larger prospective studies reported a 44–56% incidence (Morita et al., 2000; Lichter and Hunt, 1990; Back et al., 2001; Bennett et al., 2002). Death rattle is most commonly reported in patients dying from pulmonary malignancies, primary brain tumours (gliomas) or brain metastases (Morita et al., 2000; Bennett et al., 2002; Macleod, 2002; Wildiers and Menten, 2002; Kåss and Ellershaw, 2003; Saito, 2003), and predicts death within 48 h in almost 75% of the patients (Wildiers and Menten, 2002). It is also reported in terminal myasthenia gravis (Spiess and Scott, 2003) and in patients with cancer in other organs (Morita et al., 2000; Wildiers and Menten, 2002; Morita et al., 2004a).

Patients are usually not aware of their noisy breathing, and as long as they do not suffer, there is no ethical demand to treat the symptom judged from the perspective of the patient. Only three of 33 palliative nurses felt strongly that death rattle distressed the dying person (Watts and Jenkins, 1999). Once consciousness is reduced to a point that a patient no longer has cough reflexes, it is unlikely that they are aware of, or distressed by the oscillatory movements of secretions in upper airway and trachea. The primary aim of treating the noisy and rattling breathing therefore is to reduce the distress of relatives, friends, other patients on the ward and caregivers (Rousseau, 2002; Kelly and O'Driscoll, 2004). Some relatives find they are unable to stay with a dying patient with a death rattle, and others are haunted by the disturbing and unnerving noise long into the bereavement period (Hughes et al., 1996). All questioned palliative care nurses in one study thought that death rattle caused distress to the dying persons relatives, 79% of these nurses felt that it distressed the nurses (Watts and Jenkins, 1999). In another recent survey of bereaved family members, nearly 80% evaluated death rattle as distressing or very distressing (Morita et al., 2004b).

Some authors (Wildiers and Menten, 2002; Bennett et al., 2002) mention the important distinction between a rattle caused by non-expectorated (or non-swallowed) salivary and/or bronchial secretions (the *real* death rattle) and a rattle produced by respiratory pathology (a *pseudo* death rattle). The *real* death rattle, which is seen in dying patients, generally responds well to anticholinergic therapy by antimuscarinic drugs. The *pseudo* death rattle does not seem to respond well to these medications. Mixed cases can occur in patients dying from pulmonary pathology, such as lung cancer or severe pneumonia.

After withdrawal of artificial ventilation on the intensive care unit excessive respiratory secretion resulting in a rattling breathing during the last hours of life, is not uncommon, especially in patients with pulmonary and neurological conditions. The shift from the regular and reassuring sound of the mechanically produced inspiration and passive expiration through the ventilator to the irregular and disturbing death rattle can be a very distressing experience for relatives but also for the physicians and nurses. Information on the aetiology and occurrence of death rattle in intensive care patients after withdrawal of therapy, and knowledge of intensive care physicians and nurses on the treatment of death rattle is limited. A recent monograph on the management of death on the intensive care unit only pays attention to the problem in two sentences (Curtis and Rubenfeld, 2001). A recent and influential article on recommendations for end-of-life care in intensive care does not mention the symptom and its treatment at all (Truog et al., 2001). The distressing experience and negative influence in the bereavement process indicates an ethical demand to treat this symptom from the perspective of others merely than that of the patient.

Cases

Two cases were selected to represent the difference adequate management of the death rattle can make.

Case 1: A 38-year old, caucasian female patient was diagnosed with a left frontal high-grade glioma. She underwent craniotomy; in which subtotal resection was achieved. Postoperative she clinically deteriorated within 4 h after the end of surgery. A CT-scan revealed a large intracerebral haematoma in the left frontal lobe. The patient underwent a second craniotomy, in which the haematoma was evacuated. Postoperatively she was admitted to the neurosurgical intensive care unit. Following dis-

cussion with the family, withdrawal of mechanical ventilatory support and subsequent removal of the endotracheal tube was initiated 3 days after the second craniotomy. After extubation, the patient developed prolific respiratory secretions resulting in a loud death rattle. The patient was deeply unconscious. Positional changes, gentle nasopharyngeal suctioning and a single slow intravenous administration of 20 mg of morphine and 15 mg midazolam had minimal effect. The loud death rattle remained. Both intensive care doctors and nurses claimed that this was all they could do. The patients' relatives became very distressed during the patients' last hours. Six hours after extubation the patient died. Sadly enough, the dying process had become a source of grief for the spouse and 18-year old son of the patient.

Case 2: A 59-year old caucasian male patient was admitted to the neurological intensive care unit after he had been found unconscious in the house by his daughter. A CT-scan revealed a massive subarachnoid hemorrhage, with left temporal intracerebral hematoma. The patient was intubated, connected to mechanical ventilation, and remained in a deep coma. The physicians decided to withdraw ventilatory support 10 days after intensive treatment.

In anticipation of withdrawal of mechanical ventilation and extubation, intravenous fluids were reduced, and 150 mg of Hydrocortisone intravenously and 400 µg hyoscine hydrobromide subcutaneously were administered. Due to the deep coma, no sedatives were given. A continuous infusion of 1.2 mg hyoscine hydrobromide/24 hours was initiated. Some hours later, the patient was weaned from the ventilator and extubated. No stridor or death rattle occurred. The patient died peacefully seven hours after extubation in the presence of his spouse and two children.

Treatment

Treatment of death rattle consists of:

1. Withdrawal of parenteral fluids;
2. Gentle suction in the nasopharynx and trachea;
3. Postural drainage;
4. Anticholinergic drugs.

Furthermore, it is important to explain to the relatives of a patient with decreased level of consciousness that it is unlikely to be distressing for the patient.

Anticholinergic drugs include the natural belladonna alkaloids (atropine, belladonna, hyoscy-

amine, and scopolamine) and related products. Scopolamine (hyoscine hydrobromide) is an alkaloid, $C_{17}H_{21}NO_2$, obtained from the roots of *Scopolia atropoides*. It acts on the autonomic nervous system and prevents muscle spasm, and is frequently included in pre-medication to dry up pulmonary secretions and as a postoperative sedative. Hyoscine blocks receptors called muscarinic (or cholinergic) receptors that are found in the vomiting centre in the brain. This prevents the vomiting centre from sending messages to the stomach that would normally cause vomiting. A side effect of hyoscine, and other anticholinergic drugs such as atropine, is a dry mouth, and that is why these anticholinergic drugs are used for treatment of the real death rattle. Desirable effect for the treatment of death rattle is shown in 50% (Hughes et al., 1996), 80% (Bennett et al., 2002) and >90% (Wildiers and Menten, 2002). Another study shows a 56% decrease of rattling respiration 30 min after one injection of hyoscine (Back et al., 2001). Relative's distress is improved by 90% (Hughes et al., 1996). Scopolamine can also been administered intra-dermally (Dawson, 1989) or hypoglossal (Saito, 2003). Other anticholinergic drugs used for treatment of death rattle are Hyoscine butylbromide and Glycopyrrolate bromide (Murtagh et al., 2002). Both drugs offer shorter efficacy and show lesser effect than hyoscine hydrobromide (Back et al., 2001; Bennett et al., 2002) in the treatment of death rattle. As Glycopyrrolate bromide crosses the blood-brain-barrier only poorly, the use of it in end-of-life care may lead to an increased need for other sedative and antiemetic medication, which is not the case in the use of hyoscine bromide, which passes the blood-brain-barrier and can cause central effects as sedation (Back et al., 2001). Furthermore, Glycopyrrolate bromide is slower in onset, but produces less tachycardia than atropine and scopolamine, but this is of no real concern in end-of-life care. Bennett et al. (2002) provided evidence-based guidelines for palliative care of death rattle. The dying patient's mouth and lips should be wiped periodically, perhaps with moistened swabs or with ice cubes or ice chips (Twycross and Lichter, 1998b). Artificial saliva (e.g. methylcellulose solutions) could also be considered.

Discussion

One of the Statements on Challenges in end-of-life care in the ICU, made on the 5th International Consensus Conference in Critical Care: Brussels,

Belgium, April 2003 (Carlet et al., 2004), aimed at optimal care for patients in a dying process in the ICU. This includes the awareness that provision of comfort should involve the family as well as patient. Caring includes attention to the effect of the patient's condition upon the family and loved ones. Families of patients in the ICU report being anxious and depressed regarding the illness of their relative, suggesting considerable vicarious suffering (Cook et al., 2004; Engström and Söderberg, 2004; Pochard et al., 2001). In order to provide optimal care the ICU-team must feel responsible for the well being of both family and patient. This should be regarded as an ethical demand. Relatives overwhelmingly endorse pain and symptom management during the dying process (Steinhauser et al., 2000). In case of the occurrence of a death rattle in a dying patient after withdrawal of mechanical ventilation in anticipation of death, the well

being of the family should be paramount. Noisy and rattling breathing forms a source of great distress for the relatives present (Watts and Jenkins, 1999).

In the first described case in this article 20 mg morphine and 15 mg midazolam was administered in the terminal phase. This should be considered as normal palliative care for treating (suspected) pain, dyspnoea, terminal tachypnoea (as indication for morphine) and terminal agitation or restlessness (as indication for midazolam). It is an ethical obligation to relieve patients and their relatives in the dying phase of the patient. However, the use of opioids and sedatives in the terminal phase sadly has become tainted with the connection of hastened death (Cavanaugh, 1996). High doses of comfort medication (morphine and midazolam) are often necessary after withdrawing intensive care (Rocker et al., 2004), resulting in the perception by family members that most patients die in comfort.

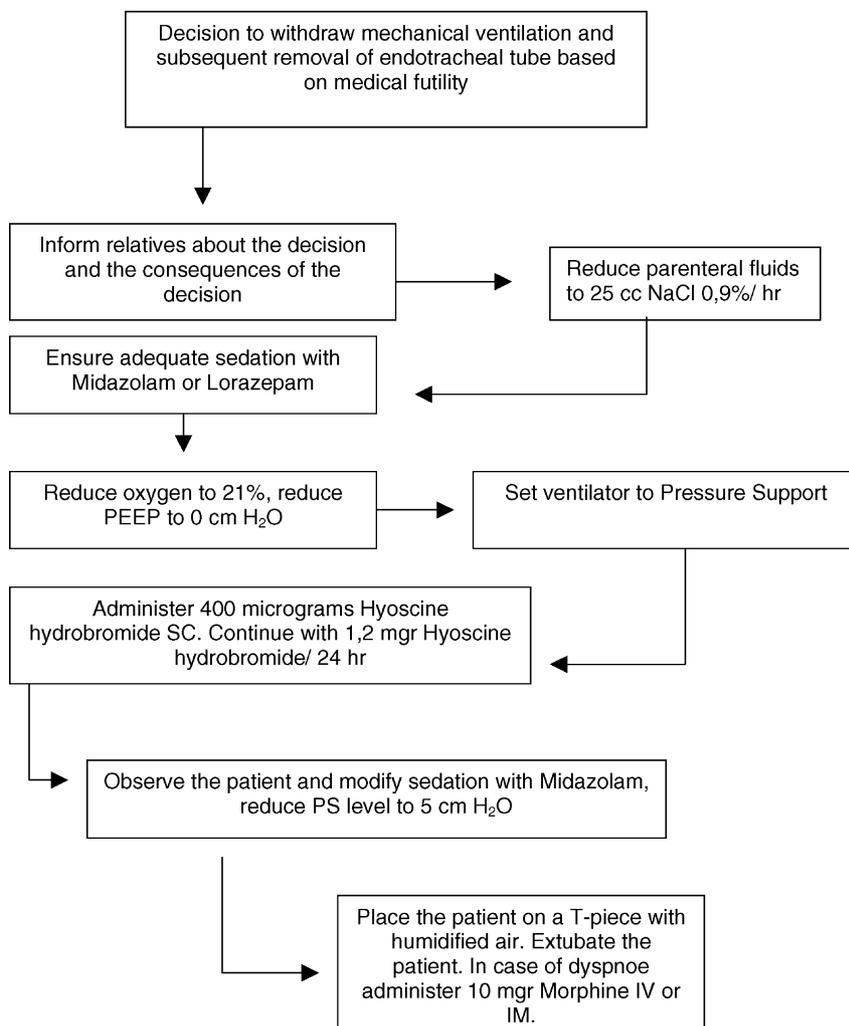


Figure 1 Flow chart withdrawal mechanical ventilation ('Terminal weaning') in anticipation of death rattle (evidence-based recommendation of hyoscine hydrobromide after Bennett et al., 2002, administration of sedation and morphine after Sykes and Thorns, 2003b).

Respiratory depression is the most quoted negative side effect of opioids and sedatives. The risk of respiratory depression is real when the agents are used in extremely high doses, but is unlikely when used appropriately (Walsh, 1990; Fohr, 1998; Thorns and Sykes, 2000; Sykes and Thorns, 2003a, 2003b; Bercovitch et al., 1999; Bercovitch and Adunsky, 2004; Morita et al., 2001; Chan et al., 2004). Pain is a physiological antagonist of the respiratory depressant effects of opioids and only cases with a sudden reduction in pain appear to precipitate respiratory depression (Quevedo and Walsh, 1999). Cardio-respiratory effects of midazolam tend to be minimal (Shafer, 1998). With the development of consensus guidelines, Hawryluck et al. (2002) hope that the confusion and anxiety regarding the use of opiates and sedatives at the end of life will decrease, improving the quality of care received by dying patients. For this reason we see no reason of conflict between providing comfort measures with opioids and sedatives and the risk on hastening death and including the administration of these agents in our flow chart (Fig. 1). There is no evidence that the appropriate use of opioids and sedatives in the dying phase requires the doctrine of double effect as a defence (Sykes and Thorns, 2003b).

Information on the aetiology of, and occurrence in intensive care patients after withdrawal of therapy, and treatments for the death rattle is limited. Intensive care staff must be trained to take appropriate care of this symptom. We can learn from our colleagues working in palliative care and hospices (Voltz et al., 2004; Husebø, 2001). Withdrawal of intensive care must be carefully planned and possible undesirable symptoms, as death rattle should be anticipated on. The low incidence of death rattle in one study (23%) was explained by the authors as a possible result of very restrictive management of parenteral fluids (Wildiers and Menten, 2002). Withdrawal of parenteral fluids before withdrawal of mechanical ventilation can reduce the possibility of excessive respiratory secretion. Pulmonary malignancies (Wildiers and Menten, 2002; Kåss and Ellershaw, 2003; Morita et al., 2004a; Morita et al., 2000) and brain tumours (Wildiers and Menten, 2002; Morita et al., 2000; Macleod, 2002) are demonstrated to be independent risk factors for the development of the death rattle. Mechanical ventilation (and subsequent removal of the endotracheal tube) is the most common life support withdrawn in the case of a patient with a cerebral catastrophe beyond hope. In dying patients with cerebral conditions, neurogenic pulmonary oedema may be the cause of pulmonary secretions and subsequent death rattle (Macleod, 2002). Withdrawing treatment in patients with these conditions should

include appropriate anticipation on the development of death rattle (Fig. 1).

Conclusions

Real death rattle disappears in 50–90% of the patients after subcutaneous or intramuscular administration of Scopolamine (hyoscine hydrobromide). This should be the first drug of choice. Early administration (before terminal weaning from the ventilator in high risk patients) of Scopolamine and reduction of parenteral fluids should become common practice in palliative intensive care in anticipation of death after withdrawal of intensive treatment. There is no contra-indication to the use of anticholinergic agents in anticipation of death rattle in dying patients. None of the described side effects will affect a patient in the terminal phase of his life. Hyoscine hydrobromide usually also has a sedative effect, which is desirable in palliative intensive care. The fact that relatives were relieved in almost all cases, in which a positive effect was obtained, makes treatment in anticipation of death rattle an ethical demand. In practice, injectable scopolamine is the reference drug for symptomatic treatment of death rattle (Anonymous, 2001).

It is an ethical obligation to relieve patients and their relatives in the dying phase of the patient. However, the use of opioids, sedatives and other medicaments in the terminal phase sadly has become tainted with the connection of hastened death. High doses of comfort medication (morphine and sedatives like midazolam, lorazepam and propofol) are often necessary after withdrawing intensive care, resulting in the perception by family members that most patients die in comfort. But there is no evidence that after appropriate titration and appropriate use of opioids and sedatives in the dying phase requires the doctrine of double effect as a defence (Sykes and Thorns, 2003b). Early identification and impeccable assessment and treatment of pain, dyspnoea, restlessness and agitation, respiratory symptoms like the death rattle and supporting the family and professionals are the heart of palliative care on the intensive care.

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