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Palliative Withdrawal of Mechanical Ventilation and Other Life Supports

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Abstract

Palliative or compassionate withdrawal of mechanical ventilator support at the end of life aims to optimize comfort, alleviate suffering, and allow a natural death in patients for whom life supports are not achieving desired goals. Palliative withdrawal is a medical procedure and must be treated as such. Appropriate planning and preparations are required to optimize patient comfort, which is the goal of the procedure. Many institutions have a “one size fits all” approach to this process, but individual patient factors require consideration to meet the patient’s needs. Some of these factors include patient pathophysiology (airway edema, airway trauma, hemoptysis, secretions), current treatment modalities (ventilator settings, medications including sedatives, vasopressors, inotropes, inhaled agents, neuromuscular blockade agents), and patient and family values and preferences. This chapter will discuss the implications of each of these factors and propose methods for successful transitions to comfort-focused care. Case vignettes will demonstrate the thought processes involved and model optimal management. Common ethical considerations and questions regarding palliative withdrawal of life support will also be discussed.

Keywords: Palliative, terminal, Withdrawal, comfort care, end of life

1. Introduction

Palliative or compassionate withdrawal of mechanical ventilator support at the end of life aims to optimize comfort, alleviate suffering, and allow a natural death in patients for whom life supports are not achieving desired goals. Medical ethics discussions have shifted significantly over the decades since critical care was first developed. It is now generally, though not universally, accepted that withdrawal of life support is equivalent to withholding of life support. Some now argue that withdrawal may be ethically superior to withholding life support, as withholding assumes the life support will not achieve the patient’s goal, while withdrawal occurs only after this assumption has been proven true [1].

2. Decision-making process

A patient with capacity must be given the opportunity to participate in decision-making. This can be challenging when medical interventions limit audible speech, as with an oroendotracheal or nasoendotracheal tube. While sometimes

time-consuming, solutions such as computers or tablets with keyboards, phones with texting capabilities, sign language, letter boards, or simply pen and paper, can allow a patient to ask questions and express their own values, goals, and preferences. Some patients with a tracheostomy tube in place can generate audible fricative speech, even when the cuff must remain inflated for respiratory support. Some patients with either tube can mouth words clearly enough to be understood, though this can be difficult for both patient and medical team. The powers of the Power of Attorney may be limited by the patient, or by local laws, but generally allow the surrogate to make medical decisions on the patient's behalf when the patient is unable or chooses to defer. Capacity for medical decision-making is a complex construct and can vary over time, and with the decision to be made. Some patients are unable to process any significant medical information. Some are able to process and express clear and consistent preferences about simpler matters but not complex ones. As with language interpretation, these interpretations must be made by a member of the medical team and not exclusively by family or friends of the patient, and must be confirmed with the patient in other ways, such as nodding or shaking their head to confirm or refute accuracy.

A patient with capacity can also choose to defer to their legal surrogate, and in many jurisdictions can select and assign Power of Attorney for Health Care to one or more people to speak for them.

Still others are able to understand, manipulate, and ask questions about the medical information presented to them, and to express clear, consistent decisions on their own behalf.

3. When to discuss withdrawal of life supports

Ideally, physicians discuss with each patient their prior experiences, values, preferences, goals, and minimal acceptable outcomes prior to onset of critical illness, and prior to initiation of life supports. This is often not possible, sometimes due to the acute nature of some critical illnesses, and sometimes due to patient factors such as unwillingness to discuss these issues. Unfortunately, this is also sometimes due to physicians' and medical teams' discomfort with, inadequate time for, or failure to recognize the necessity of such discussions.

Regardless of whether routine or baseline discussions of experiences, values, preferences, and goals have occurred, the onset of critical illness is an important prompt to discuss or rediscuss these thoughts. Ideally, at the beginning of a patient's critical illness, their physician discusses with the patient or surrogate, or with both, the presumed diagnosis, the treatment options, and the likely outcomes of each and how soon the outcomes are anticipated. The patient or surrogate ideally understands and integrates this information and selects the treatment that gives them the best chance of recovery within the parameters of acceptable risk and acceptable burdens or suffering defined by that individual patient. After learning the patient's risk and burden tolerance, the physician confirms and documents the treatment plan, including any limits set by agreement with the patient or surrogate. The physician should then schedule a date to discuss progress, or lack of improvement, and further options with the patient or surrogate, unless new findings or changes require significant discussions sooner. This constitutes a time-limited trial, which is a useful framework for acknowledging the uncertainty of outcomes of critical illness [2].

If the patient is not improving to the extent they themselves would require to make continuing current life supports acceptable, or if the patient, or surrogate acting in the patient's best interest, finds the current life supports too burdensome despite good efforts at symptom management by the medical team, it is important to discuss the option of palliative withdrawal of life supports.

When multiple life supports are present, and the patient or surrogate and team are considering withdrawing one form of life support, it is necessary to consider whether or not the other forms of life support present are contributing to achievable medical goals. If any form of life support is not helping the patient progress toward achievable goals, potential withdrawal should be considered and discussed.

4. How to withdraw mechanical ventilation

Palliative withdrawal is a medical procedure and must be treated as such. Appropriate planning and preparations are required to optimize patient comfort, which is the goal of the procedure. Many previously published works, and many institutions have a “one size fits all” approach to this process, but individual patient factors require consideration to meet the patient’s needs. Unfortunately, for understandable reasons, at this time there are exceedingly few studies of how to perform any part of this procedure. Therefore, many aspects require logical consideration and expert opinion to guide practice, as well as consideration of the individual patient’s condition, needs, preferences, and goals.

Evidence suggests family satisfaction is increased when a step-wise approach to withdrawal of life support is used [3].

4.1 Ventilator weaning vs. immediate discontinuation

Older literature regarding palliative withdrawal of life supports generally describes either universal weaning or universal immediate discontinuation. More recent literature and guidelines take a more patient-centered, case-specific approach and recommend consideration of the patient’s current ventilator support requirements and level of symptoms [4]. For patients on moderate or high ventilator support, it is recommended to wean ventilator support - specifically positive end inspiratory pressure (PEEP), potentially pressure support, and fraction of inspired oxygen (FiO₂) - in a step-wise approach, titrating opioids and benzodiazepines especially to control dyspnea and anxiety respectively.

For example, for a patient who is on assist control volume control with a set rate of 14, tidal volume 6 mL/kg ideal body weight, PEEP of 14 cmH₂O, and FiO₂ 60%, it would be advisable to achieve comfort with medications before initiating weaning, then reduce PEEP and FIO₂ to 10–12 and 40% respectively, titrate medication boluses to achieve and maintain comfort, and continue to wean ventilator support every 15-30 minutes as tolerated.

4.1.1 Mode

Modern ventilators allow for a wide variety of mandatory, intermittent mandatory, assisted breath, and entirely spontaneous modes. Each mode has potential benefits and potential burdens to the patient.

When transitioning to comfort measures, patient condition and clinician comfort with managing the various modes will determine optimal mode for weaning or continued support. A patient who is awake, alert, and requires little ventilator support may be most comfortable right away with low levels of pressure support and PEEP. A patient with poor lung compliance or with neurologic or myopathic limitations to breathing may require a more sensitive trigger or a more controlled mode that ensures volume delivery, and for some, having a minimum breath frequency is necessary for comfort.

4.1.2 Rate

In modes with a set minimum rate, reducing a rapid set rate may unmask intrinsic tachypnea, which may be physiologic, or may be due to pain or anxiety. In synchronized intermittent mandatory ventilation settings, reducing the set rate may increase the frequency of spontaneous breaths; depending on the level of support provided with these spontaneous breaths, patients may feel more dyspnea if under-supported, or less dyspnea if their respiratory efforts are sufficiently supported.

4.1.3 Peep

Reducing PEEP can allow pulmonary edema, alveolar secretions, or pulmonary hemorrhage to become more prominent. Some patients may experience increased cough and may have difficulty expectorating the secretions. A stepwise approach, reducing PEEP by 2–4 cmH₂O per step, may allow for titration of symptom control medications. Most ventilators have backup apnea settings that cannot be discontinued. For patients who are maintained on ventilator support throughout the comfort care process, it is important to remind families and team members that the ventilator will continue to deliver breaths even after the patient has died.

4.1.4 Oxygen

Some patients are asymptomatic or relatively asymptomatic with hypoxemia, while others note symptoms with even relatively small reductions in oxygenation. Again a stepwise approach, reducing by approximately 20% per step, allows for symptom management with medication titration. Supplemental oxygen through the ventilator can be weaned to as low as 21%, especially if the plan is for discontinuation of ventilator support without supplemental oxygen.

4.1.5 Tidal volume

Since the first ARDSnet trial publication [5], when tidal volumes are set on the ventilator, they are commonly set to a low tidal volume, lung protective strategy of 8 mL or less per kilogram of ideal body weight. Some patients find this strategy uncomfortable, as it forces small, limited volume breaths. If ventilator support is to be continued, especially if awaiting arrival of family members, or another significant event, continuing the current set volume is typical, but liberalizing the set volume somewhat may improve comfort.

4.1.6 Drive pressure, inspiratory pressure, or pressure support

These terms all refer to pressure added by the ventilator for the inspiratory phase of each breath to inflate the lungs and generate a tidal volume. The size of the tidal volume depends on the pressure administered and on the patient's lung and airway compliance. For patients with acute lung injury or acute respiratory distress syndrome, the pressure is generally set to target lung protective low tidal volumes. For patients without lung injury, the pressure requirement may be fairly low, or may be set to allow more liberal breath sizes for comfort.

4.2 Extubating vs. maintaining oro- or nasoendotracheal tube

Many institutions, and some older articles written about the process of palliative withdrawal of life supports, have a near-universal practice of removing the patient's

oral (or nasal) endotracheal tube. It is generally assumed that patients and families prefer extubation and will be more comfortable after removal of the tube. However, there are some important considerations that may limit or worsen patient comfort after removal of these tubes. Airway compromise caused by edema, trauma, masses, or other lesions may make removal of the oro- or nasoendotracheal tube risky for causing or allowing burdensome symptoms to occur. Similarly, significant hemoptysis or secretions, whether purulent or edematous, may require excessive effort by the patient to clear, and may limit comfort after extubation.

Decades ago, some institutions also routinely removed tracheostomy tubes at end of life. Unless there are specific patient-centered reasons to do so, this is no longer recommended.

4.3 Sedatives, analgesics, anxiolytics

4.3.1 Basal rate titration vs. bolus dose administration

As with enteric opioid medication administration, as needed bolus dose administration and titration should be the mainstay of symptom management. Anecdotally, ICU physicians and nurses often treat opioid and benzodiazepine infusions as though they have the pharmacokinetic and pharmacodynamic properties of vasopressors in terms of time to peak effect and time to steady state. This is not consistent with the actual activity of these medications, and can cause both ineffective symptom management initially, and excessive dosing later in the patient's course.

Pharmacologic principles must be remembered and utilized in the management of infusions of opioids and benzodiazepines. When a patient has significant symptoms, bolus doses can and should be administered as often as the time to peak effect for the drug in question. If the bolus dose is effective in controlling symptoms, the dose can be repeated after time to peak effect when it is needed again. If the dose is only moderately helpful for symptom control, the dose can be increased by 50% at the next administration to improve efficacy. And if the dose is minimally or ineffective, the dose can be doubled at the next dosing interval, or an alternative medication can be considered.

4.3.2 Propofol

Propofol is an anesthetic and sedative without analgesic properties. Some institutions restrict use without a secured airway. However, it can have benefits, including control of seizures, and may occasionally be a helpful adjunct to symptom control for those with severe anxiety, for example, where the patient prefers deep sedation over the possibility of experiencing their severe symptoms at end of life.

4.4 Inhaled vasodilator agents

There are no significant studies to inform best practices on withdrawal of inhaled pulmonary vasodilators. Generally it is probably reasonable to discontinue the agent at the start of transition to comfort measures, before weaning any ventilator settings. Based on half life, symptoms may become significant or severe approximately 15 minutes after discontinuing nitric oxide, or 25 minutes after discontinuing inhaled epoprostenol. Opioid administration as needed for dyspnea or chest pain, and benzodiazepine administration as needed for anxiety after discontinuation are the mainstays of management.

4.5 Neuromuscular blockade agents

Medication must be stopped and effect must be absent prior to withdrawal of life support to ensure ability to demonstrate any discomfort they are experiencing, and to avoid active euthanasia by this mechanism. Even if practicing in a jurisdiction where active euthanasia is legal, withdrawing life support in the presence of neuromuscular blockade is not acceptable because of the temporary and avoidable inability to actively monitor for symptoms and address them during the process.

Ethically, this differs from palliative withdrawal of life support in a neurologically devastated person who is intrinsically unable to demonstrate discomfort during end of life care because their inability to demonstrate discomfort is permanent and irreversible. In this case, for a patient whose surrogate feels the patient would not wish to continue life sustaining treatments, best practice is to aggressively treat for potential symptoms, using changes in vital signs as markers for possible distress and treating accordingly.

Ideally, neuromuscular blockade infusion can be stopped at the initiation of the transition to comfort measures and the effect allowed to wear off gradually as the drug is metabolized. Cessation of neuromuscular blockade allows patients to physically express whether symptoms such as pain, anxiety, dyspnea, or other forms of distress are present.

However, in some instances, patients may have such severe hypoxemia that oxygenation may start to falter before the drug effect is entirely resolved, sometimes to the point that the patient could die before physical symptoms can be fully assessed. In such situations, reversal of neuromuscular blockade may be considered, with neostigmine and glycopyrrolate for any agent, or with sugammadex for rocuronium or vecuronium only.

4.6 Dialysis

When to discontinue dialysis is highly dependent on the patient's situation. For patients with volume overload who are on continuous dialysis, continuing volume removal at least until the time of ventilator withdrawal or extubation may improve comfort by reducing pulmonary edema and whole body anasarca.

For patients with end-stage renal disease, some patients tolerate dialysis well and feel better with continuing it. In the United States, patients who enroll in hospice for a terminal diagnosis not related to their end-stage renal disease may be able to continue outpatient dialysis for a time; this is generally situation-dependent.

4.7 Vasopressors and inotropes

Optimal timing of withdrawal of vasopressors and inotropes is dependent on the situation. For less responsive patients, some physicians recommend discontinuing these early in the course of withdrawal of life supports, to induce a hypotensive or hypoperfusion-related encephalopathy, with the hope of reducing experience of symptoms through this mechanism. Other physicians elect to continue pressors until symptoms are noted to be well controlled after completion of palliative ventilator weaning or withdrawal to ensure medications can be circulated through the body to maximize their effect. Still other physicians discontinue vasopressors and inotropes concurrent with early palliative ventilator withdrawal. To date, there are no studies examining optimal timing; clinical judgment regarding which strategy will most likely meet the individual patient's values, goals, and preferences in light of their condition is needed.

4.8 Pacemakers and implanted cardiac defibrillators

Implanted Cardiac Defibrillators (ICDs) should be deactivated as soon as transition to comfort measures is started, if not already deactivated with DNR order. Implanted pacemakers are typically not deactivated unless the pacemaker function is felt to be significantly prolonging the dying process. Temporary pacemakers are typically deactivated at some point during the withdrawal process; timing can be considered similar to vasopressors.

4.9 Lines, drains, and tubes

At the time of transition to comfort care, the medical team should discuss all lines, drains, and tubes in place and decide whether to maintain or remove each. Urinary catheters may be maintained or removed depending on patient preference and perceived comfort. Temporary central venous catheters and tunneled central venous catheters can generally be maintained unless causing discomfort; temporary catheters may be considered for removal if the patient will be discharged to a setting where use of the catheter may not be feasible.

Nasogastric and orogastric tubes can generally be removed unless continued gastric decompression is necessary or unless there are medications that absolutely must be continued for comfort after extubation. Orogastric tubes should almost always be discontinued if extubation is planned due to significant risk of gagging and oropharyngeal discomfort. Surgical drains and wound vacuum systems should be discussed with the surgical or wound care team.

Pulmonary arterial catheters and arterial lines generally do not improve comfort and should be removed at initiation of transition to comfort measures.

Chest tube management depends on the indication for placement. If a chest tube was initially placed for pneumothorax and maintained in place only because of continued positive pressure ventilation, clamping and removal can be considered, especially if ventilator support will be discontinued. Chest tubes placed for significant, symptomatic pleural effusions likely should be continued to allow continued pleural drainage, unless pleurodesis has occurred. Those placed for pneumothorax that has not resolved likely should also be maintained and kept to suction to avoid symptomatic expansion of the pneumothorax. In all cases, the patient's condition should be the driving factor in decision-making.

4.10 Artificial hydration and nutrition

The limited benefits and significant risks, harms, and symptoms induced by artificial hydration and nutrition should be discussed with the patient or surrogate prior to the palliative withdrawal process. Ideally these should be discontinued hours before initiation of the withdrawal process to avoid full stomachs or fluid overload. Patients who are able to express desire to eat or drink after extubation should be allowed to do so with caution and support, with a focus on comfort and quality of life.

5. Other consideration

5.1 Brain death

Jurisdictions may vary in their laws regarding management of patients diagnosed as brain dead. In some, the local organ procurement organization must be

notified and allowed to assess the patient for donation before withdrawal of life supports can be considered.

5.2 Organ and tissue donation

Depending on local or national laws regarding organ and tissue donation, the local organ procurement organization may be required to be notified prior to initiation of the withdrawal process. It may also be required to allow the agency to assess the patient and discuss potential for donation with the patient or surrogate.

Ethically, clinicians involved in the patient's care should not be involved in discussing organ or tissue donation. Perceived or real pressures to procure organs for other patients can adversely affect both decision-making processes of the patient or family and of the medical team. This can also erode the patient's trust in the medical team to prioritize their needs and care. Discussions regarding organ and tissue donation should occur between the patient or family and procurement specialists not involved in the patient's care.

6. Process of palliative ventilator withdrawal

6.1 Time out

Prior to the initiation of palliative withdrawal of life supports, the care team should convene to discuss the patient's condition and formulate a plan consistent with the patient's and family's goals, values, and wishes, and making every effort to minimize or at least control symptoms. This process should be a formal, focused discussion and should occur before initiation in every case. The discussion should include the physician, bedside nurse, and respiratory therapist (RT) at least, ideally should include the chaplain, and the clinical pharmacist when needed.

Topics for discussion during the time out must include plans regarding timing of and method for withdrawing each form of life support, symptoms anticipated due to withdrawal of each life support, and plans for managing these symptoms. The team should also clarify which team member is to be the first point of contact if initial symptom management strategies are insufficient, or if other issues arise.

Where required, the local organ procurement organization must be notified of the plan for palliative withdrawal of life supports and anticipated or possible patient death prior to initiation of the process.

The bedside nurse in particular must be given support and time to focus exclusively or nearly exclusively on the patient undergoing transition to comfort measures, to ensure a smooth transition with excellent symptom management.

Prior to initiation of any steps in the process of withdrawal, the appropriate Do Not Resuscitate order must be signed by the appropriate medical team member. Remaining full code while undergoing palliative withdrawal of life supports is completely counter to the goals of the process; it is absolutely predictable that at some point after withdrawal, cardiopulmonary arrest will occur and require either cessation of efforts based on futility, or require re-initiation of some forms of life support. At best, life supports required at this point might be the same as those in use prior to withdrawal, but more likely would include additional supports to sustain a condition that would at best be equal to the patient's condition at the initiation of withdrawal. If the patient or surrogate desires resuscitative efforts at time of death, current management should be continued. This can include agreed-upon plans to limit escalation (e.g., not adding additional pressors, dialysis, or other new therapies), or to plan to discuss progress, or lack thereof, at a specified date and time, typically a few days.

The patient, surrogate, and family should be asked about what cultural or spiritual practices related to death and dying are meaningful to them, and efforts should be made to support these needs and wishes. These can include Last Rites or specific prayers to be said prior to death, creating memorial items before or after death, and rituals regarding cleaning and care of the patient's body after death. Some memorial items such as handprints, hand casts, recordings, and ECG tracings, can be made fairly easily and inexpensively. Some family members may wish to preserve locks of hair. It is essential to ask open ended questions and not project what the patient or family 'should' or 'should not' want at this point.

Once the plan is created and agreed upon, it should be reviewed with the patient as able, and with the family, to their desired level of detail. Anecdotally, many families and most patients are satisfied hearing that the plan for transition and withdrawal has been discussed and agreed upon by everyone participating, and has been designed to maximize the patient's comfort.

Once transition has started, the bedside nurse should update the designated point of contact for the medical team to discuss any inadequately controlled symptoms or changes in clinical status.

After the patient's death, family should be allowed and encouraged, but never forced, to assist in caring for the patient's body after death. Specific cultural or religious practices regarding care and monitoring of the body after death should be elicited and respected.

7. Case examples

7.1 Case 1: a 'simple' case

Mrs. A is a 78 year-old woman with chronic obstructive lung disease with chronic hypoxic and hypercarbic respiratory failure, and pulmonary cachexia. Her baseline oxygen requirement is 3 liters of oxygen by nasal cannula around the clock. She has been in the intensive care unit (ICU) for three weeks with acute on chronic respiratory failure due to chronic obstructive pulmonary disease (COPD) exacerbation and pneumonia, which have been fully treated. She has failed non-invasive ventilation repeatedly and was reintubated for the third time four days ago. She has spent a total of 16 days on the ventilator thus far. She has mild to moderate secretions and is able to expectorate them without distress. She is on assist control volume control with a tidal volume set at 6 mL/kg ideal body weight, requiring peak inspiratory pressure of 20, rate set at 12, PEEP of 5, and FiO₂ 35%.

She has a good cuff leak, but failed her spontaneous breathing trial this morning for dyspnea and tachypnea. She requests palliative extubation as she is not amenable to tracheostomy or prolonged ventilatory support.

She is awake, alert, able to write long coherent paragraphs about her understanding of the situation and about her wishes regarding her further care. Her spouse and children are understandably sad but supportive of her wishes, agreeing that this request is consistent with her long-stated wishes regarding prolonged life support. She is on no sedation and reports feeling comfortable on assist control.

After confirming the patient has capacity and is expressing a consistent choice with internally consistent logic based on good understanding of her medical condition, and answering any questions she or her legal surrogate or family have, the physician should discuss with the bedside nurse, RT, and when needed, the ICU charge nurse, to ensure the nurse and RT will have time to properly devote to this patient as the transition to comfort measures occurs. They should discuss what

as-needed medications she has been given over her ICU stay, and what her response has been to each, to determine what she is likely to need during the withdrawal process, and orders for these medications should be placed.

The physician or nurse should ask the patient and family if they wish to visit with a chaplain and when. If a chaplain visit is desired prior to transition to comfort measures, the chaplain should ensure they ask about any specific spiritual or cultural practices they wish to observe. If the chaplain's visit is declined, the physician and nurse should coordinate to explore culture or spiritual needs and wishes related to the transition process.

After the appropriate Do Not Resuscitate order is signed, and preparations for symptom management are made, and the patient and family are ready, as she is already on minimal ventilator settings, a spontaneous breathing trial should be initiated again, and comfort medications titrated to maintain her comfort with minimal ventilator support. Once she is comfortable on minimal ventilator support, she can be extubated when she and her family are ready, placed on oxygen via supplemental nasal cannula as is her baseline, and treated with the minimal effective dose of an opioid as needed for pain or dyspnea, or benzodiazepine as needed for primary anxiety, and supported until death or transition to another location for further care.

7.2 Case 2: a more challenging case

Mr. B is a 57 year-old with a remote mid-thoracic spinal cord injury with paraplegia but no known chronic respiratory insufficiency who was admitted to the intensive care unit 2 weeks ago for septic shock due to urinary tract infection with secondary bacteremia. He was initially intubated for respiratory fatigue after hours of working to compensate for lactic acidosis, but developed acute respiratory distress syndrome (ARDS) requiring PEEP of 18 cmH₂O at most, FiO₂ 80–100%, with a set respiratory rate of 34. He has required pressors for the past two weeks, and developed renal failure requiring continuous renal replacement therapy for the past week. He requires deep sedation to maintain ventilator synchrony, and is encephalopathic and agitated when sedation is lightened. When updated at a meeting to discuss his clinical condition and values, preferences, and goals, his legal surrogate states he would not accept prolonged life support measures, including a tracheostomy, a longer-term feeding tube, or more than a few weeks of ventilator support or dialysis. The surrogate feels he has 'had enough' and would not want to continue current management; he feels the patient would wish to have Last Rites administered by a priest, and has no other specific requests for rituals surrounding death.

His code status is changed to Do Not Resuscitate. As soon as is feasible, family and friends are allowed a few hours to visit and say goodbyes. The patient's priest comes to the hospital and administers Last Rites. The patient's nurse and respiratory therapist are relieved of some of their other duties for a time, to be allowed to provide dedicated care to this patient. As discussed in the time out prior to withdrawal, first medications and therapies that do not improve his comfort are discontinued. Renal replacement therapy is then stopped and the machine is removed from the room. Vasopressors are then stopped. Blood pressure falls to a MAP of 50 mmHg but stabilizes, and heart rate increases from 90 to 110 and stabilizes.

His face appears calm and he is synchronous with the ventilator. His current opioid and benzodiazepine infusion rates are continued. Ventilator weaning is initiated; rate is reduced by 4–6 breaths per minute, FiO₂ is reduced by 10%, and PEEP by 2 cmH₂O simultaneously. Tidal volume is not changed, or may be increased slightly to improve comfort. Any respiratory distress or apparent anxiety are treated

with boluses of opioids or benzodiazepines or both, and once controlled, rate, FiO₂, and PEEP are weaned again with ongoing boluses and titration of bolus doses as warranted by his symptoms. His SpO₂ falls to 60%, but his vital signs remain fairly unchanged. Once he is weaned to 30% with a PEEP of 6, and a set rate of 14 with a total rate of 18, and he appears comfortable based on lack of grimacing and lack of restlessness, the oroendotracheal tube is removed. Additional doses of opioids are given as needed for respiratory discomfort, and benzodiazepines are given as needed for evidence of anxiety. Family remains at the bedside until he dies.

7.3 Case 3: an unusual circumstance

Mr. C is a 30 year-old man with relapsed acute myeloblastic leukemia who develops severe tumor lysis syndrome after induction chemotherapy and is transferred to the ICU for management. He is started on a bicarbonate infusion and IV fluids. He is placed on BiPAP to support his respiratory compensation for acidemia while arrangements are made to start continuous renal replacement therapy, but is unable to maintain respiratory compensation for acidemia and is intubated. His respiratory rate is moderate, with minimal pressure and oxygen requirements. He remains remarkably alert, calm, and coherent after medications given for intubation wear off. After discussion of his overall condition, in which he has fully participated, he writes out clearly that he wants to transition to comfort care. The medical team discusses his physiologic derangements and recalls his extremely high respiratory rate prior to initiation of bicarbonate infusion. After a short spontaneous breathing trial in which he remains somewhat tachypneic but does not feel distressed.

He requests his code status be changed to Do Not Resuscitate and Do Not Intubate; these orders are completed. He is extubated to allow him to speak with his family. Continuous renal replacement therapy is continued for a few more hours until the cassette requires changing, at which time the set-up is taken down and not restarted. Bicarbonate infusion is continued to ameliorate his acidemia in hope of preventing dyspnea due to tachypnea. He is offered opioids for dyspnea when he appears to have respiratory distress and allowed to choose whether or not he feels he needs them, as well as being allowed to request them when needed. After several hours of good conversations with his family, he feels his breathing is tiring out and requests more frequent opioids, even if this means he may be too sleepy to interact with family. Opioids are given to relieve his dyspnea and respiratory distress. When the bicarbonate infusion bag is nearly empty, the rate is reduced and opioids are titrated to comfort before the bag is completed and the infusion stopped. His breathing pattern becomes irregular as he is no longer able to maintain compensation, and he appears comfortable until and through his death.

7.4 Case 4: a very challenging case

Mx. D is a 37 year-old person with antiphospholipid antibody syndrome and patent foramen ovale, with multiple deep venous thromboses and pulmonary emboli in the past, on therapeutic anticoagulation, develops diffuse alveolar hemorrhage and acute hypoxic respiratory failure requiring intubation and mechanical ventilation. They are treated with steroids and inhaled tranexamic acid, and chronic anticoagulation is held. They unfortunately have several seizures and are found to have multiple embolic strokes with severe hemorrhagic conversion, including several of the cerebellum and visual cortex. On meeting with their family including parents who are their legal surrogate, they feel that the likely long-term impairments caused by the strokes would be unacceptable given their career as a dancer, and that they would not want to continue disease-directed therapies.

Given the continued moderate and occasionally large volume hemoptysis requiring suctioning through the oroendotracheal tube, the patient's sibling, who is a respiratory therapist, expresses concern about the patient's ability to breathe comfortably if extubated. Code status is changed to Do Not Resuscitate prior to transition to comfort care. Ventilator support is weaned down to the lowest PEEP level at which the patient appears comfortable. Pressure support, SIMV-PSV, and APRV with only a small difference between high and low PEEP. The medical team advises their family that the ventilator will continue to trigger after the patient's death, as the ventilator's apnea backup settings can be minimized but not completely discontinued. Their comfort is maintained with opioid and benzodiazepines as needed until death.

7.5 Case 5: organ procurement

Ms. E is a 25 year-old woman with a long-standing history of opioid abuse including ingestion and injection- both subcutaneous and intravenous- of prescription opioid pills, and injection of heroin and fentanyl. She has suffered several overdoses requiring hospitalization and brief periods of intubation and mechanical ventilation in the past, has undergone rehab including some periods of abstinence, but has unfortunately suffered multiple relapses. Five days ago she was found unresponsive with agonal breathing at home after last speaking to family by phone hours earlier. MRI of the brain and serial head CT scans over several days in the ICU showed diffuse anoxic injury with severe edema and progressive herniation. Her clinical exam with normal electrolytes, normal temperature, and normal pCO₂ and pH progresses to demonstrate no brainstem reflexes.

Several forms of testing clearly demonstrate brain death. The medical team informs and consoles her family, and requests the chaplain and social worker to further assist in supporting the family. The bedside nurse contacts the local organ procurement organization, whose representative comes to the hospital and reviews Ms. E's case. She is noted to be a self-registered organ donor, and is deemed to be a candidate for donation of multiple organs. The representative from the organ procurement organization discusses with her family the process of assessing her and preparing for potential organ donation. She is maintained on mechanical ventilation via oroendotracheal tube. Pituitary failure is managed with IV levothyroxine, DDAVP, and hydrocortisone. Blood pressure is maintained with vasopressors. When assessment is complete and the organ procurement organization and explant surgeons are available, she is taken to the operating room with a solemn procession in her honor, where life supports are withdrawn simultaneously. Cardiac death occurs 20 minutes later, and all viable organs are harvested for transplantation.

8. Conclusions

The above discussions, and the case examples, are not exhaustive of the situations clinicians may find themselves facing in the course of caring for patients. They are examples of some of the more common conditions that require consideration and flexibility for patient-centered management. Far from a simple, 'one size fits all' process, they illustrate that palliative withdrawal of life supports is a medical procedure that requires thoughtful collaboration and consideration to provide each patient with the most comfortable transition to end of life care possible.

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