

1. What are the common user errors, and how are they resolved?

Attaching tubing to wrong port. Blue pressure sensing tube from cuirass must be connected to the "cuirass" input port on the machine. The RTX Will not function if cuirass pressure tube is connected to "airway" port.

Not replacing the seals frequently enough. Seals wear at varying rates depending on the intensity of the settings, the frequency of application and removal, and the frequency of secretion clearance. Be sure to request cuirass seals as needed before exhausting your supply. When worn-out seals are used beyond their life-cycle, which to it can increase the potential for skin issues.

Poor application of the cuirass. If the cuirass is not spread or flexed enough during application or removal, it will result in a poor seal at the sternum and abdomen, resulting in unnecessary wearing of the seal. It is best for the cuirass to be placed well on the chest before starting CNEP.

Giving up too quickly. Maximum benefit may not be achieved until the patient has become adjusted to the effects of the device. This takes different time for each individual and may require persistence to reach.

Probably the most common mistake is not using BCV on patients that can benefit. BCV should be able to significantly improve clinical results in all care venues from critical care to home. Few interventions can facilitate improvements like BCV. When used aggressively, BCV can restore normal FRC, and provide support for patients with bronchiolitis, asthma, atelectasis, ARDS, pulmonary hypertension, CF, COPD, MND, SCI, and many other patient groups.

2. How does the ramping of pressures affect application?

An important idiosyncrasy of the RTX to recognize is that it ramps to the input settings. In the biphasic modes, it may take 3 to 5 minutes to ramp up to the set pressures, particularly if it is compensating for a leak. If the patient is being removed from PPV or BiPAP to be placed on BCV for support, allow the RTX to fully ramp before making the switch.

3. Is there a recommended duration a patient should be on the RTX versus the patient being on continuously?

No specific duration is recommended. The RTX can be used as a timed treatment using CNEP and Secretion Clearance for lung recruitment at frequencies from q l h to daily. There are cases of patients benefiting from using BCV support 4 hours a day, many use BCV at night only to enhance rest, while others need to use it continuously until they can be weaned, and some may use BCV for years.

4. Are there risks for skin breakdown at the points of contact between the patient and the device?

The most significant risk for skin breakdown occurs if the seals are not changed appropriately. If the seal is allowed to wear, skin breakdown can occur but can greatly prevented by:

- Keeping cloth, such as hospital gown or t-shirt material, between seal and skin
- Seal is maintained and changed properly
- Reddened skin area under the seal are padded proactively

5. What are the cautions and contraindications for the RTX?

- Burned skin or draining wounds under shell or seal area
- Indwelling lines or tubes that are located under seal (within shell is fine)
- Weight > 180 KG
- Patient's thoracic structure precludes establishment of good seal
- Lack of viable airway either natural or artificial
- Cardiopulmonary arrest

6. Is there increased risk for aspiration during BCV use?

Aspiration with the use of BCV deserves consideration but is usually not a problem. It is recommended to schedule secretion clearance treatments before meals or bolus feeds. If on continuous feeds, pause feeds for a reasonable time before secretion clearance.

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7. What are some tips for management of patient using BCV for airway clearance?

Please see any of our setting selection tools for starting Secretion Clearance settings for patient size ranges. In general, the therapeutic range for oscillation in secretion clearance is 600-800 cpm. Rates higher than that produce a fine oscillation wave that is less impactful and may not cause enough movement at the airway level to effect secretion thickness as desired. Oscillation rates below that may create greater impact than the patient will accept. Lower frequencies have a greater effect on secretions, but as frequencies drop lower, the more difficult it may be for the patient to tolerate. In difficult cases, 450 cpm in bursts interspersed with 750 cpm has produced better results and tolerance. Use below 600 is rare, except for patients downward on the frequency and up on the pressure until the desired intensity and tolerability are achieved.. It is recommended generally to start with higher frequencies and low pressures for infants and then titrate down as tolerated.

If the patient complains about secretion clearance, short but gentle treatments will allow patients to see there is nothing to fear. Start with short treatments with high frequencies and low-intensity cough assist. Gradually, as subsequent treatments are given, increase duration, decrease frequency to therapeutic during vibration, and increase the intensity of the cough.

In cough due to the ramp, it is better to set for 2 minutes of cough and 3-4 minutes of vibration with settings per guidelines. If tolerable, repeat for 5 cycles. These settings can be applied as often as q1 or extended for severe cases of atelectasis or secretion retention. Adjust for more gentle application with higher frequencies and lower pressures if needed to achieve tolerance and for smaller patients. Patients can be taught to give whatever cough effort they can generate timed with the cough resulting in an increased cough and secretion flow. If capable, instruct patients to huff or force cough with effort immediately prior to peak positive pressure assist. Additional help with cough can be obtained by pressing gently on the front cuirass as in a ptussive assist in timing with the device. Cough rate can be varied to rates patients coordinate most effectively with. Rates as low as 12 for larger sizes and as high as 50 for infants adjusted for maximum effect. Cough and vibration settings are often best guided by the patient, if capable of providing feedback.

8. Describe management of RTX during patient ambulation and functional mobility?

Occupational therapy, dangling, transfers, and sit to stand activities can be supported during the use of BCV. Patients can move from bed to chair or to commode while using the device. Some patients disconnect temporarily, leaving the cuirass shell on to use the commode and reattach the tubing upon returning to bed, simplifying the transfers. Patients may need different cuirass shell sizes when they are sitting and when they are laying down.

Please note that the machine will require a connection to a wall outlet; therefore, it does not lend itself to full ambulatory mobility. BCV can conceivably support patients who might use a treadmill, stationary bike, or who perform walking or marching in place, but for now, not walking up and down corridors.

9. How is BCV an effective medical strategy that might be able to potentially help prevent the need for tracheostomy?

A tracheostomy placement has a high risk of infection and other side effects. BCV can potentially prevent or reverse a tracheostomy insertion. Whether BCV can facilitate this, depends on the reasons a tracheostomy placement is being considered or was performed. If some of the original reasons for insertion have been resolved, it may allow for the removal of the tracheostomy. BCV offers a clinical strategy that enables more patients to avoid intubation, and thereby preventing the advancement to a tracheostomy, in some cases.

Depending on the medical condition of the patient, a tracheostomy is placed for many reasons. If the primary reason for placement is to support positive pressure ventilation, then there is a strong potential that the patient can receive ventilation without the tracheostomy by using Biphasic Cuirass Ventilation. Another reason a tracheostomy may be placed is to improve the clearance of pulmonary secretions by allowing suctioning through the tracheostomy tube.

Pulmonary secretion issues are another indication that can often be treated with the Biphasic Cuirass using RTX's highly effective secretion thinning oscillatory phase for secretion mobilization, which can then be cleared with its assisted cough. There have been cases in which patients received a tracheostomy to support ventilation who were transitioned to BCV and were then able to be decannulated.

10. Does the patient experience any discomfort with use?

Although few patients will complain of additional discomfort during BCV use, consideration for the patients' comfort during use is essential. Monitor mid axillary, clavicles, upper sternum, and iliac crest for signs of tenderness. If tenderness or redness presents, replace seal and add padding to the area. For some patients, the increased chest wall movement can create a temporary chest wall discomfort that usually can be resolved with short term use of mild analgesia.

With initial use, patients may find it disconcerting. After a brief period of use and effective relaxation techniques, they will be able to become accustomed to it.

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11. What about PEG tubes, chest tubes, trachs and such?

BCV will work with any line, tube, or drain, as long as the point of entry into the skin of the LTD is not directly between the patient and the cuirass seal during use. Percutaneous feeding tubes can be coiled within the cuirass when not in use. When in use, it can be run out the bottom of the cuirass without occlusion while making sure that valves or connectors are not between seal and patient. BCV will work for patients with a tracheostomy in place. The trach can provide a patent airway. BCV can function with a speaking valve or a capped tracheostomy if the patient is able to tolerate it. For patients immediately post-op tracheotomy, BCV may be associated with some increase in discomfort, particularly in the biphasic modes. This will pass as tracheostomy becomes established and less tender, but may require some temporary increased pain control and possibly temporary decreased use of biphasic modes. If the seal becomes soiled, it will need to be replaced. Consider a barrier to cover the seal when used with a tracheostomy.

12. What strategy is recommended to help address patient anxiety?

Patients are often quick to embrace BCV as they begin to experience the support and relief their cardiopulmonary system craves. Many patients will relax once supported with BCV and rest better than they have been able to for days. However, some patients will not readily accept BCV often due to anxiety related to many factors. The cycling of the device on the chest and allowing it to perform the work of breathing can feel disconcerting for patients at times. A confident and empathetic application can go a long way in easing the patient's anxiety upon initial use. Some patients, as they may with other forms of ventilation, may require anxiolytics, but generally less than with other types of ventilatory support. Patients who experience anxiety related to dyssynchrony in Control Mode will often do better and in Respiratory Synchronized mode.

13. What makes this different or better?

Since BCV can provide non-invasive lung recruitment, and ventilation in a more natural way using the structures of the chest wall and a natural lung pressure curve while preserving the patient's ability to be seen as an individual, communicate verbally and take fluid and food normally if all capabilities are intact, it offers benefits not available via other forms of non-invasive and invasive ventilation.

14. If a patient has a positive pressure support device, can BCV be covered also?

Yes. The prescriber would need to document in the record and the LMN how BCV is needed to achieve the best plan of care along with the PAP device.

15. I have sleep apnea, can BCV help me?

Sleep apnea may be obstructive, central or mixed for the most part. BCV can provide respiratory support to obstructive and mixed apnea patients in combination with appropriate CPAP in many cases. For patients with strictly central apnea, BCV can provide non-invasive support without mask or trach in most cases.

16. Can this be an alternative to a mask ventilator or a trach and vent?

For many patients BCV allows them to receive the respiratory support they need without either and experience significant quality of life improvements.

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