**Tracheostomy Management and Weaning of a Patient with Covid Pneumonitis on an Intensive Care Unit, From a Student’s Perspective: A Case Study**

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***Abstract******Background****Coronavirus disease (COVID-19) is an infectious caused by the SARS-CoV-2 virus, that adversely affects the respiratory system and may result in Covid pneumonitis. In severe cases where prolonged mechanical ventilation is required, a tracheostomy may be necessary. There are currently no guidelines on the strategies for tracheostomy weaning specifically in patients with Covid-19. The aim of this case study is to outline reasons for the prolonged tracheostomy weaning and optimal time for decannulation, from a student perspective whilst on clinical placement.*

***Case description****A 56-year-old female admitted to the Intensive Care Unit (ICU) due to worsening respiratory failure secondary to Covid pneumonitis.*

***Evaluation****The time frame for tracheostomy weaning for this patient was significantly prolonged. The complexity of the patient’s condition, severe effects of the virus and secondary complications made decisions around decannulation challenging. As a result of the tracheostomy remaining in situ, her ICU length of stay was extended.*

***Conclusions****Adjustments are required to maintain realistic expectations of the timescale of weaning and decannulation for patients with Covid pneumonitis. Individual centres should review their processes for the management of tracheostomies within specific patient cohorts. Further research is necessary to provide supportive evidence to enable safe, best practice guidelines.*

**Introduction**Coronavirus disease (Covid-19), a contagious viral disease caused by the SARS-CoV-2 virus, led to a global pandemic in 2019 (Coronavirus disease (COVID-19), 2021). People infected with the virus experience a variety and severity of symptoms including fever, fatigue, cough, and breathing difficulties (WHO, 2021).

Some patients with severe symptoms require intensive care unit (ICU) admission for mechanical ventilation (Cegolon et al., 2020). By April 2020, 4960 ICU admissions for Covid-19 infection were reported in England, Wales, and Northern Ireland (ICNARC report on COVID-19 in critical care, 2020).

Pre-pandemic, guidance suggests that tracheostomy insertion may be indicated for patients ventilated for 12 days (Plummer and Gracey, 1989). Around 10% of ICU Covid-19 patients required invasive ventilation for at least 14 days and therefore tracheostomy insertion was considered (Multidisciplinary COVID-19 tracheostomy guidance, 2020). Emerging data from the pandemic, found a median tracheostomy insertion time of 15 days (Multidisciplinary COVID-19 tracheostomy guidance, 2020). Despite this clinicians faced multiple challenges in effective decision making around weaning and decannulation, with limited guidance, due to the novelty of Covid-19 infection (Attaway et al., 2021).

This case study explores the difficulties around the weaning and decannulation process, experienced as a final year student, on an ICU clinical placement.

**Case Presentation**

***Past medical, medication and social history***The patient was 56 years old. She lived in a house with her partner. She had a daughter, a son and two grandchildren. She mobilised with a walking stick at a steady pace. She worked in a pharmacy dispensary. She enjoyed being a grandparent, the radio, television, and bingo. She had an extensive past medical history including non-alcoholic fatty liver disease with mild fibrosis, hypothyroidism, peripheral oedema, urinary incontinence, and obesity.

***History of presenting condition***The patient presented to the emergency department four days after a positive Covid-19 test. She had a continuous cough and low oxygen saturations of 85-87%. Following four days on a Covid ward with alternating High Flow Nasal Oxygen (HFNO) and Continuous Positive Airway Pressure (CPAP), the patient was intubated, ventilated, and transferred to ICU with worsening type 2 respiratory failure.

Once mechanical ventilation was established, she received 12 cycles of prone positioning over 16 days. On day three of ICU admission, she developed an acute kidney injury requiring regular filtration. The patient developed an increased secretion load by day six, requiring bronchoscopy in week three as well as increased cardiovascular support for supraventricular tachycardia. In week five, a cardioversion was required to restore normal heart rhythm and due to an ongoing high secretion load, a second bronchoscopy was performed, and a tracheostomy was inserted. The patient’s condition continued to fluctuate, and nitric oxide was introduced for six days in week six. A second cardioversion was performed and tracheostomy weaning plan began once spontaneous ventilation had been established.

Following initiation of weaning, the patient developed recurrent respiratory infections requiring return to full ventilatory support. Tracheostomy weaning was deemed inappropriate and delayed for two weeks but recommenced in week ten progressing to cuff deflation and speaking valve trials.

The patient initially tolerated a 20-minute period once a day on HFNO. This was slowly increased to a 45-minute period with the addition of a ten-minute cuff down trial. Ventilator-free breathing (VFB) was incrementally increased over a week from 30-minute periods three times a day, doubling each day if tolerated. When the patient could tolerate two intervals of four hours of VFB per day, consistent cuff down and speaking valve periods were commenced. Finally, once an achievement of a 12-hour, then 24-hour ventilator free period was achieved, decannulation was considered.

From a student perspective decannulation seemed appropriate considering non-covid population parameters. Interestingly however, the decannulation process was delayed, due to patient fatigue, the high risk of recurrent infections and likely deterioration. The decision to prolong decannulation in the hope of avoiding a difficult re-intubation was made by the multidisciplinary team.

Rehabilitation was essential to support the progression towards decannulation, due to profound ICU-acquired weakness because of prolonged mechanical ventilation (Jolley, Bunnell and Hough, 2016). However, secondary complications impacted on rehabilitation and delayed successful weaning and decannulation. For example, because of renal failure the patient required Tesio line insertion for long-term renal replacement therapy. Consequently, rehabilitation was interrupted and later postponed due to the sensitivity of the filter and alarm protocols.

***Active problems***

* Surgical tracheostomy and mechanically ventilated
* Medically unstable
* Intensive Care Unit Acquired Weakness (ICUAW)
* Increased secretion load
* Weak cough
* Poor lung compliance
* Large lung cavities
* Fatigue
* Resistant to multiple antibiotics

**Discussion**The complexity in this case study experienced from a student perspective, revealed the difficulties in tracheostomy weaning for critical Covid-19 patients. Prior to the pandemic, average ICU length of stay was 3.3 days (Hunter, Johnson and Coustasse, 2014) and time to decannulation was usually several days. However, complications following Covid pneumonitis resulted in an extended ICU admission of more than 80 days and a prolonged weaning process of almost six weeks in this case.

Although tracheostomy indication matched that of a pre-pandemic patient, the weaning process greatly differed. Standard protocols for tracheostomy weaning require strict parameters to be met and consists of gradually increasing periods of VFB, cuff deflation and speaking valve trials (Hunt and McGowan, 2015). The time scale of weaning for this patient was lengthened due to multiple fluctuations in these factors. Despite the original reason for ventilation being resolved, her ability to self-ventilate and maintain normal gas exchange was affected by the damage caused to her lung anatomy including large cavities and irreversible fibrotic tissue visible on a CT scan (Wells et al., 2021,). In addition, Covid-19 can lead to severe fatigue that long outweighs the initial acute illness (Townsend et al., 2020). This was evident for this patient as she began to show signs of fatigue, including increased work of breathing, oxygen desaturation and drowsiness after a short period of 10 minutes, limiting her VFB time.

Cuff down and speaking valve trials were introduced alongside VFB but she was unable to produce vocal sounds at first, in keeping with literature estimating an increase in patients with laryngeal dysfunction following Covid-19 (Piazza et al., 2020). In addition, the virus itself, although unpredictable at the time, has now been found to impact laryngeal function due to the inflammatory response, ischemia, and scarring (Neevel et al., 2021).

General guidelines for successful tracheostomy decannulation include clinical stability, secretion management, cough strength and airway patency (Tornari et al., 2020). ICUAW and subsequently weak respiratory muscles significantly reduces peak cough flow, compromising adequate secretion clearance. In addition, the physical blocking of secretions by the tracheostomy itself was a factor in the clinical reasoning regarding timing of removal. This case study demonstrates that patients with severe Covid-19 may not achieve these guidelines, prolonging their ICU admission (Tornari et al., 2020).

Whilst prolonging decannulation can negatively impact on quality of life and evidence suggests regaining speech should be of utmost importance following mechanical ventilation (Nakarada-Kordic et al., 2017), in some cases the advantages of keeping a tracheostomy in situ may outweigh these. In this case study, prolonged decannulation was needed due to the high risk of deterioration.

An adjustment of expectations in weaning timeframes for this patient population is needed (Tornari et al., 2020). This is due to the extensive damage and secondary complications caused firstly by the virus itself and secondly by prolonged ICU admission.

Despite over one third of Covid-19 patients being successfully decannulated, literature on the predictive factors that led to success and altered criteria or protocols used is limited (Benito et al., 2021). Clinical judgement is the best approach for agreeing the optimal time to decannulate severe Covid-19 patients. It would be beneficial for healthcare professionals to update weaning and decannulation protocols for this patient population, particularly for those patients who are admitted to ICU and require a tracheostomy.

When considering step down to a ward, this patient was deemed appropriate from a rehabilitation perspective. Over five weeks whilst on clinical placement, she progressed from having static sitting balance to completing functional tasks in sitting independently and began transfer practice. Normally the advanced rehabilitation level and complete absence of ventilatory support needed at this stage in the patient’s recovery would enable a patient to be transferred to a ward. However, ICU-step down was deemed unsuitable due to the tracheostomy. Step down with a tracheostomy is possible if the receiving location can adequately receive and manage these patients, supporting the need for pragmatic approaches (Guidance for Tracheostomy Care, 2020).

**Conclusion**The significant damage caused by Covid-19 on the respiratory system, multi-organ failure and the secondary complications of prolonged ICU admission, made decannulation and weaning challenging. Adjustments in expectations on timing of tracheostomy weaning is needed in this complex patient group. Parameters for decannulation may require flexibility to enable ICU step down in patients with severe Covid-19 infection. This may reduce ICU length of stay and reduce costs.

**Key points**

* In patients with severe pneumonitis caused by SARS-CoV-2 virus requiring ventilation, tracheostomy weaning is likely to be prolonged and requires a cautious approach to clinical reasoning and decision making of optimal decannulation.
* Pros of delayed decannulation may outweigh cons.
* Processes to enable a safe step-down and care for patients with tracheostomies may need to be reviewed.

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