

# MESSENGER

News and Information from  Charter Main

## Dangerous Sequelae of the Covid-19 virus

**F**ollowing up on the initial report on Covid-19 virus in the last issue (V1/N2), we at Charter Main would like to present this information on the sequelae of contracting the SARS-CoV-2 (Covid-19) virus. About 30% of patients admitted to intensive care suffering from Covid-19 may experience long-term, permanent pulmonary damage.

*It seems that for some patients, recovery from the acute phase of Covid-19 is only the beginning.*

About 20% of Covid-19 patients require hospitalization and 5% intensive care for ventilatory support. In severe Covid-19 disease, there is an altered immune response resulting in fewer circulating immune cells which not only fail to control the virus but cause an exaggerated inflammatory response; the so-called 'cytokine-storm' hence the use of dexamethasone in patients who require oxygen or intensive care.

Early reports are indicating that the virus may be capable of causing long-lasting damage to the lungs, heart, nervous system and gastrointestinal tract. Reports of long-term fatigue, headaches, vertigo, cognitive impairment, hair loss, cardiac issues and of course diminished cardiorespiratory fitness are also beginning to be seen. The interesting thing for us in nuclear medicine is the observation of coagulation abnormalities resulting in small-vessel and large-vessel arterial and venous occlusions and the implications for pulmonary vitality.

*This highlights the importance of the V/P S.P.E.C.T. scan.*

Pathology and autopsy have revealed severe pneumonia and A.R.D.S. with extensive inflammation. A V/P S.P.E.C.T. scan can visualize and

quantify the FUNCTIONAL effect of lung inflammation which occurs in the acute phase of the illness. The predominant pattern of lung lesions is diffuse alveolar damage which may be detected as mismatches with a V/P S.P.E.C.T. scan. This damage can be evaluated with follow-up V/P S.P.E.C.T. scans, to assess the *extent of the recovery or prolonged damage* to a patient's lungs and the viability of remaining pulmonary tissue without exposing the patient to unnecessary

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### Ventilation and Perfusion imaging may provide valuable data .....

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radiation exposure and invasive tests. The combination of the information gathered from performing BOTH Ventilation and Perfusion imaging may provide valuable data regarding the patient's deteriorating lung function as the Covid-19 virus attacks the lung capillaries resulting in vascular defects such as vasculitis. Increasing V/P mismatch indicates deteriorating gas exchange at the alveolar level. This brings on clinical symptoms such as shortness of breath which could be mild to severe. There is evidence of that a quantitative V/P S.P.E.C.T. scan can predict the development of carbon dioxide retention and acid-base disturbance due to deteriorated pulmonary function. REFERENCE?? While there are not yet any long-term studies on the respiratory effects of Covid-19 disease on recovered patients such respiratory damage can be inferred from observations in previously healthy patients suffering from severe influenza who experience 'cytokine storm' and end up with permanently scarred lungs. The fear is that even asymptomatic COVID-19

patients may experience permanent lung damage.

Of particular interest to us is the relevance of this information specifically in lung disease. It is apparent that SARS-CoV-2 (Covid-19) may trigger abnormal blood clotting in some people resulting in the formation of pulmonary emboli and cerebrovascular accidents (CVA's). The V/P S.P.E.C.T. scan remains the method of choice to detect thromboembolic disease of the lungs.

Generalised organ damage viz. heart, C.N.S., renal and gastrointestinal, are other areas of major concern as the 'cytokine storm' and inflammatory mediators may ultimately lead to chronic cardiac problems and cognitive defects. The V/P S.P.E.C.T. scan shows a typical anti-gravitational redistribution pattern of pulmonary perfusion in (left) heart failure.

*The pathophysiological defects mentioned above may not be adequately visualised on CT.*

In addition, the extent of functional parenchymal changes might be greater than initially suspected from morphological changes in CT. To effectively diagnose and treat the pulmonary damage occurring in Covid-19 disease, the patient's lungs require repeated CT scans which may not be the answer.

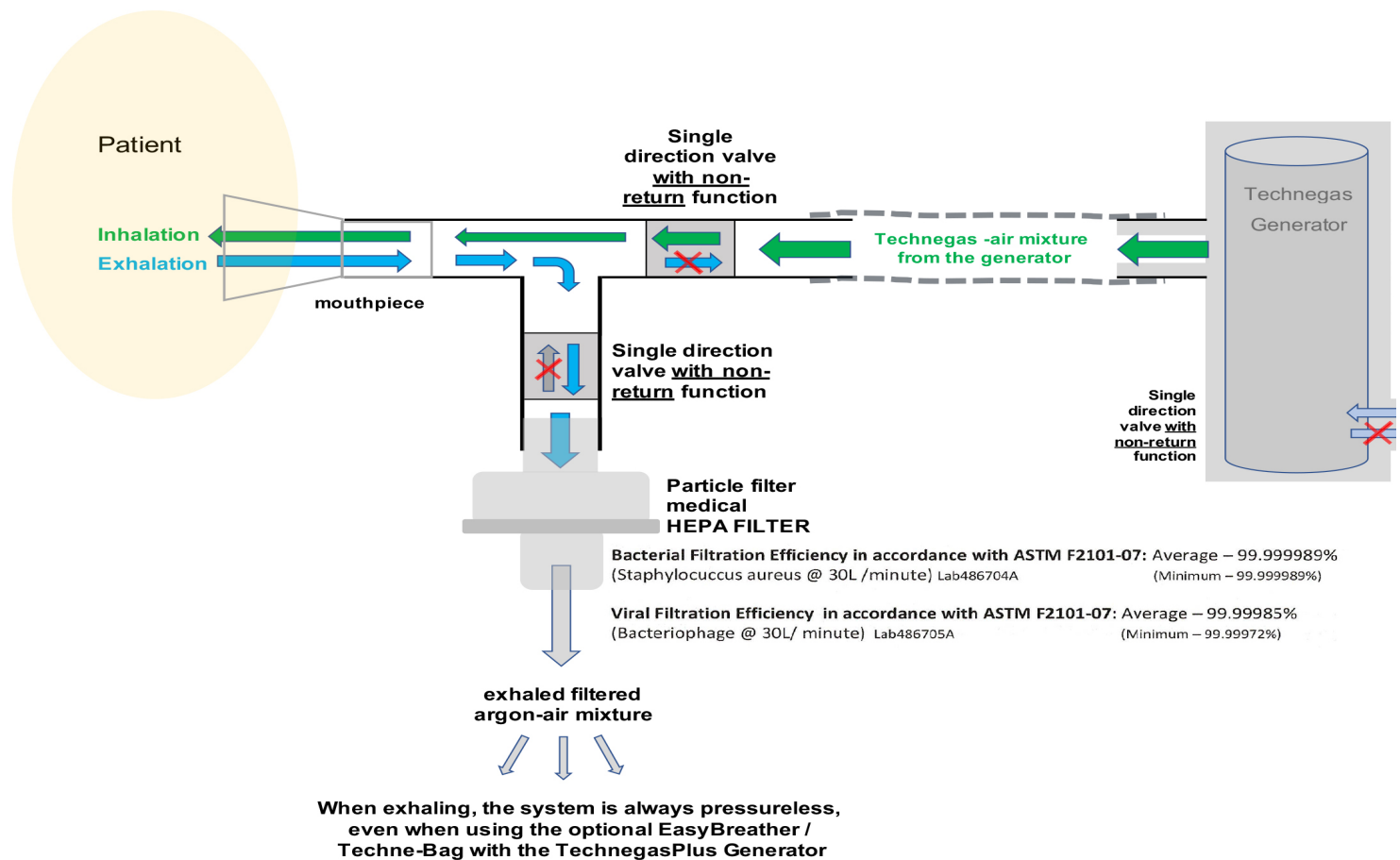
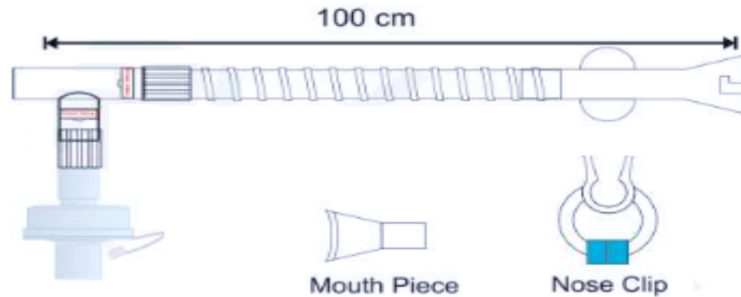
The clinician's decision must therefore be based on patient welfare and the ultimate goal of providing effective, optimal care to gather sufficient information from the tests done to make informed decisions about ongoing treatment.

The trusted V/P S.P.E.C.T. scan may just be what the doctor ordered!

*Your Charter Main Support Team*

## How the almedis-Set for administering Technegas to the patient works

27.03.2020 AR



A diagram of the vent-medix 'radio-aerosol administration kit (RAK)' is provided to explain the safety features of this system when administering a radio-aerosol from the generator into a patient's lungs.

Firstly, there is a non-return valve attached to the generator as a safety measure to prevent contamination of the generator.

*The administration set is a single use, disposable unit.*

When the patient inhales, a second non-return valve in the RAK opens to allow radioactive gas to flow from the generator into the patient's lungs. The third non-return valve at the junction with the HEPA filter closes and radioactive gas flows in one direction only into the patient's lungs.

When the patient exhales, the non-return valve in the plastic tubing attached to the generator closes and the non-return valve leading to the HEPA filter opens allowing flow of radioactive gas and argon in one direction; into the HEPA filter where it is trapped on the ultra-efficient filter which is compliant to the required standard and effectively traps 99.99985% of bacteria and viruses.

# Understanding Technegas Use

**In recent times the issue of thyroid uptake following the Ventilation part of a V/P S.P.E.C.T. nuclear medicine study has been raised. Specifically, the involvement of the carbon crucible in the process.**

The basis for using the Pseudo-Gas, Technegas, a Ventilation Lung Imaging Agent is its characteristic property of remaining in the air space of the lung alveoli. This property is attributed to the nature of the Technegas Particles. They consist of the insoluble Technetium-99m metal entrained on nano-meter-sized graphite particles produced during their manufacturing process. This process is based on reduction of the Per technetate ions during the flashing process in an oxygen-free environment saturated with Pure Argon Gas in the presence of graphite. The process reduces the soluble high oxidation state of Technetium-99m (Per technetate) to the insoluble metal. The metal then vaporizes and subsequently re-condenses with graphite particles available for inhalation by the patient. This combination of graphite-Technetium-99m particles are insoluble and therefore not available for transport into the blood and subsequently to other organs.

However, the presence of any oxygen due to an air leak into the Technegas Generator Chamber or as an impurity in the Argon Carrier Gas will cause incomplete reduction of the Per technetate ions to the metal. This will result in the presence of non-reduced soluble oxides of Technetium-99m species mixed with the graphite particles. Inhalation of particles carrying soluble Tc-99m will cause transport of the radioactivity into the blood stream and its eventual uptake into the patients' thyroid and allow its imaging.

Incidentally, Per technetate is potentially a very useful agent as well. It was discovered when a wrongly labelled gas cylinder was used to generate Technegas in a Queensland hospital. This set Birch et al. on a quest to discover how much oxygen was needed to generate Per technegas; less than 3-5% was their finding.

At the outset, while not wishing to disagree with learned colleagues, thirty five years of experience servicing, maintaining and teaching nuclear medicine technologists all around the world has taught me that there are several reasons for this phenomenon occurring.

Before proceeding further; when in doubt read the User Manual! It is available on-line. There are many reasons, described in the User Manual, for visualizing thyroid uptake and some are very simple to resolve. This should be your first attempt at problem resolution -

## **1. Argon gas bottle.**

The Argon gas should be high purity Argon. Mixtures for welding purposes may have impurities which could generate unwanted by-products which the patient should not breathe.

In addition, some Argon gas comes with 3% oxygen content. Even this small amount can lead to the production of per technetate and poor image quality.

## **2. Change contacts.**

The contacts must be changed when the generator prompts you to do so. This should be done whenever a new box of consumables is used. The old contacts should be removed and discarded, the new contacts inserted and tightened so that they are not loose.

As the contacts age throughout their life-cycle, they become pitted and uneven leading to poor contact, low yield and potential problems in the burn cycle.

## **3. Carbon Crucible.**

The carbon crucible **MUST** be properly seated. In order to ensure adequate contact, the carbon crucible must be seated properly and twisted a few times until a squeaking sound is heard to ensure proper contact for the burn.

## **4. Patient training.**

Prior to administering the radio-aerosol, the patient **MUST** be trained on the proper way to breathe the gas. This should simulate the actual test but without the radio-aerosol being administered.

The patient should be resting on the bed, connected to the generator, and asked to take several breaths. They should ensure that they breathe through the plastic tubing provided and all measures to prevent gas escaping into the atmosphere complied with.

## **5. Moistened with alcohol.**

Alcohol is required to prevent bubble formation during the burn phase. The alcohol lines the inside of the crucible and stops the Technetium from erupting out of the crucible and into the chamber. The crucible **MUST** be moistened with alcohol **BEFORE** administering the Technetium so that the activity can be uniformly distributed around the crucible.

If the crucible is dry by the time you are administering the Technetium, remoisten and top with Technetium while still wet.

**IT'S NOT TO STERILIZE THE CRUCIBLE!!**

## **6. Concave isotope level.**

The level of isotope injected into the crucible should be concave when the needle is withdrawn from the crucible. If it is convex, there is the potential for Argon to blow the excess Technetium out of

the crucible, contaminate the chamber and reduce yield.

## **7. Regular Servicing.**

Regular servicing prevents easily rectifiable problems from becoming serious issues. Ideally, the generator should be serviced annually or after 500 burns.

Issues such as simmer temperature, burn temperature and cleanliness can be addressed by the service engineer and problems such as low yield, excess salt in the chamber, excess soot in the chamber, etc. mitigated by such preventative measures.

## **8. Excess salt in the ash tray.**

Excess salt in the ash tray may be an indication that the simmer temperature may not be within the required limits. If this is a problem, try cancelling out the simmer after 6 minutes and start a re-simmering cycle. The crucible should be dry before the burn is attempted.

## **9. Check the regulators.**

In some instances the hose regulators may be faulty. In this case air may be sucked into the system (venturi effect) during generation of the radio-aerosol. If this occurs per technegas will be generated and thyroid uptake will occur.

This is the value of a general service once per annum. Your service engineer can check all of these issues and repairs can be effected immediately.

## **SUMMARY.**

Any of these issues may lead to the production of per technetate in the generator.

The cause of the generation of per technetate is the availability of oxygen at the time of the burn **NOT** the presence of carbon.

So, if you are experiencing thyroid uptake;

1. Read the User Manual
2. Ensure steps 1 to 8 above are being followed
3. Call the your technician

*Your Dedicated*

**Charter Main Support Team**

# Vent-Medis disposable kit for Ventilation Scintigraphy

**Large 0.3ul  
highest purity  
graphite crucible**



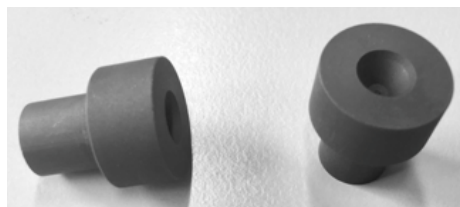
*Vent-Medis Kits include the improved high-purity, high-volume carbon crucible with a 0.3ul bowl capacity. This crucible saves time and minimises multiple simmers allowing the use of dilute Tc-99m generator elutions thus reducing operator radiation exposure.*

**Rugged design  
smooth-bore  
patient  
delivery set**



*The inhalation breathing unit contains a high efficiency HEPA, exhalation filter, T-piece with robust non-return valve, a robust one meter smooth-bore tubing with 15mm inner diameter and the special generator connection. A rigid mouthpiece and a nose clip complete the set.*

**High purity  
and long life  
graphite  
contacts**



*With every Vent-Medis Box you get one pair of high-purity carbon contacts for 50 scintigraphic examinations. The carbon contacts are very robust and fit the Generator specifications with great contact reliability.*

**Vent-Medis Kits -**

**Larger volume crucible equals more efficient use of dilute Tc-99m eluate**

**High-Efficiency HEPA filter**

**Time and cost saving**

**Less radiation through reduced simmers**

**Improved and more reliable crucible contact**

**More rugged design**

**Improved packaging**

**TGA Certified**

**Reliability of supply**

**CE marked**

**Major price advantage**

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