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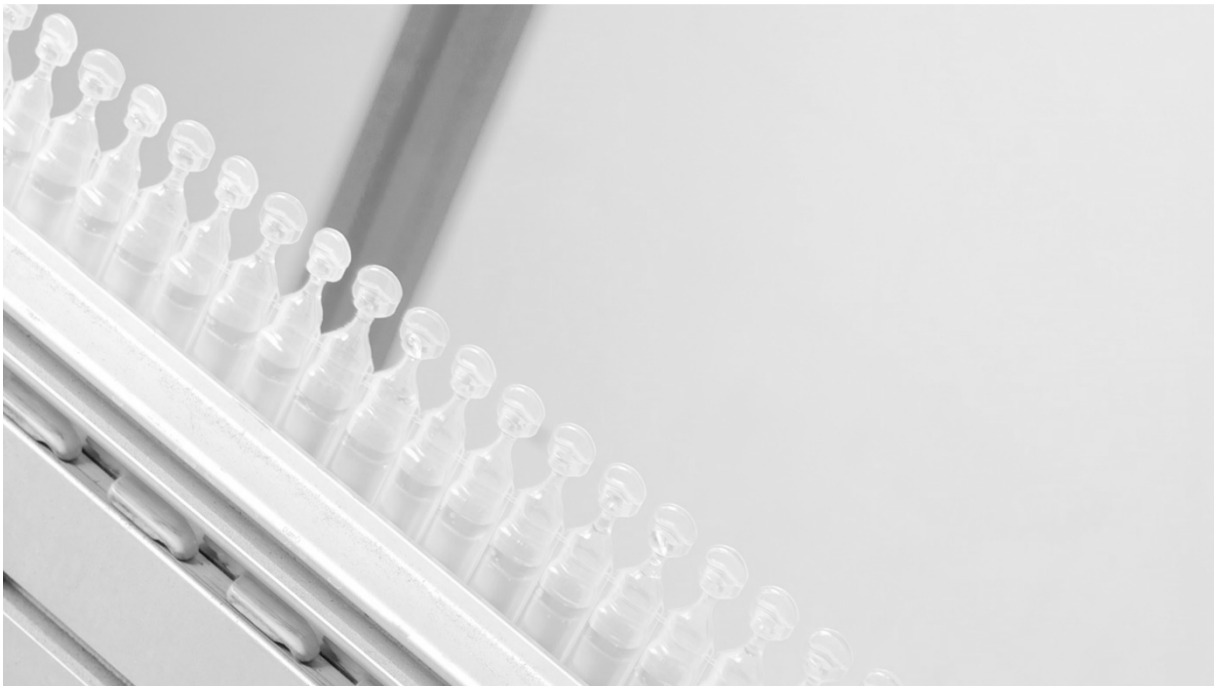
Saline Solution, Rhinovirus and Sars-COV2

Bibiliographic Review 2021/2022



Saline Solution, Rhinovirus and Sars-COV2

When SARS-COV2/COVID19 emerged in early 2020, the lack of knowledge about the virus led to the appearance of numerous, often contradictory, and sometimes scientifically inappropriate guidelines.

Taking stock of the knowledge gained over the last two years is important, especially regarding the application of saline, nasopharyngeal lavage, and nebulization practices.

A great deal of work around the world has advanced knowledge to refine the understanding of saline use in rhinology.

Several relevant publications are summarized below.

Essentials in saline pharmacology for nasal or respiratory hygiene in times of Covid19 European Journal of Pharmacology 2021

https://doi.org/10.1007/s00228-021-03102-3

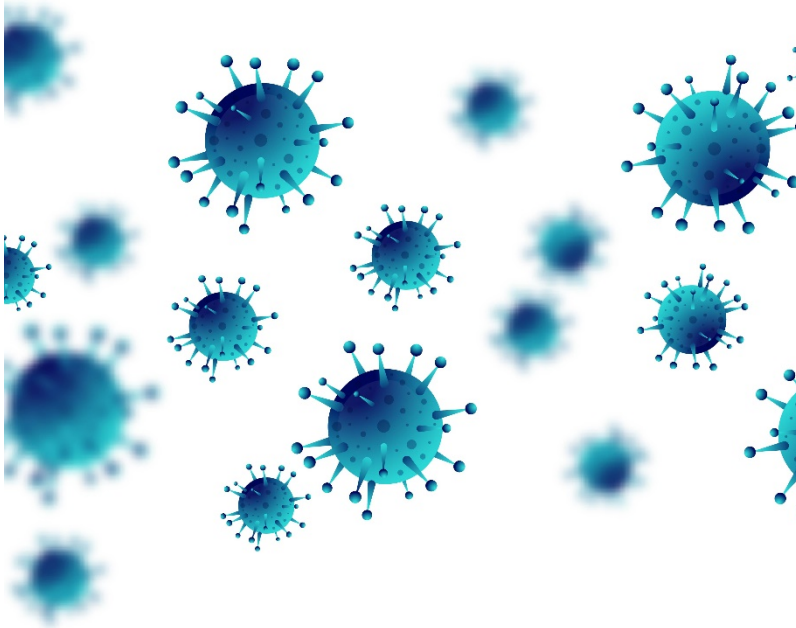
In this publication (published on March 27, 2021 in the European Journal of Pharmacology), the authors (Ghent University Hospital/Belgium) provide an overview of the different works available.

They remind us in the introduction that nasal lavage and nebulization of isotonic and hypertonic saline are part of the common practices in pneumology. These practices are used to alleviate the symptoms of pulmonary viral infections.

The Deutsche Gesellschaft für Krankenhaushygiene (DGKH) has made recommendations for gargling/rinsing to contain SARS-CoV-2 transmission in households, nursing homes, and schools.

At the beginning of the Covid 19 crisis, many health authorities, including the WHO, actively advised against the use of nebulization techniques. This was to prevent the risk of spreading the virus and contaminating family members and/or caregivers.

With the benefit of hindsight and numerous studies, this fear has been lifted, in particular by German pneumologists who have published a Position Paper (1) - https://doi.org/10.1159/ 000509104) which reminds us that the nebulization of physiological serum reduces the emission of bio-aerosol by 72% (7).



Indeed, it has been observed that the virus, whose size is in the order of 60 to 140 nm, is disseminated via micro-aerosols generated by the respiration of infected persons.

While it is possible to detect RNA for long periods of time, the actual infectivity of influenza virus particles in an aerosol or deposited on surfaces decreases very rapidly. Within 90 minutes, infection is reduced by a factor of 102 (5).

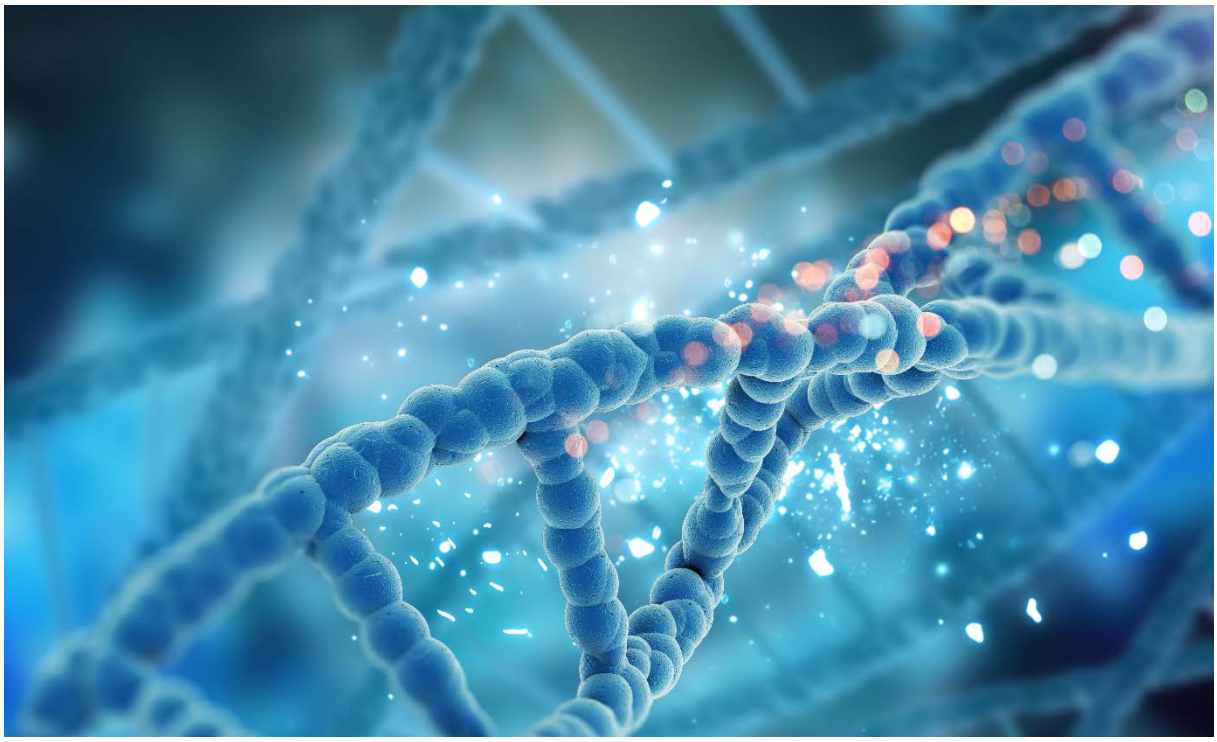
In exhaled aerosols, the particles evolve according to atmospheric conditions, mainly relative humidity and temperature. Low relative humidity causes the particles to compact or high humidity causes them to grow. This considerably changes their infectivity.

It is known that fine solid or liquid aerosols (diameters <5µm), which are the most infectious have the particularity of not settling quickly by gravity and therefore remain in suspension longer. Particles of 0.5µm to 1µm can remain suspended in the air for very long periods (several hours).

Measurements made with influenza RNA viruses have shown that 46% of viral particles are found in particles > 4µm and # 49 % are found in particles between 1 to 4 µm. These studies showed that 99% of viruses were found in the respirable fractions that could contaminate either the upper airways (size > 5µm) or the lower airways (size <5 µm).

In airplane cabins during the flu season, 5.8103 to 3.7 104 copies of virus per m3 of air were measured. This corresponds to 2 to 20 times the quantity of virus necessary to induce infections. At a breathing volume of 10 l/min the infection can take place in these conditions between 5 and 50 minutes.

The half-life of the Covid 19 virus in the air would be 1,1 hour. In an hour, 50% of the contaminations would be completed.



Bioaerosols are essentially produced in the pulmonary alveoli.

When nebulizers are used by patients, it is of course possible to note a significant increase in aerosol particles around the patient during treatment. However, during the 2003 SARS episode (6) it was not possible to identify an increased risk of contamination of nursing staff during intubation or active oxygenation.

At the same time, authors have noted that inhalation of an isotonic saline solution induced a 72% reduction in aerosols emitted by the lungs over a 6-hour period in hyper-emitting subjects (7). The origin of this effect would come from a modification of surface tension of the pulmonary mucosa. These patients producing large quantities of bio-aerosol correspond in fact to the so-called 'super-contaminator' subjects who had been identified at the beginning of the crisis.

The reduction of contaminated bio-aerosols mathematically reduces the risk of contamination of the patient's environment.

Studies (7) have also shown that saline nebulizations increase the average size of bio-aerosols emitted by patients. This allows, on the one hand, for better effectiveness of protective masks used by the entourage and nursing staff. On the other hand, for a significant proportion of particles to settle rapidly by gravity. Nebulization can also reduce the bronchial viral load.

Rôle of saline solutions in the mucociliary clearance mechanism (MCC)

The mucociliary clearance mechanism (MCC) is the main component of the pulmonary system, allowing continuous mucociliary clearance.

By different techniques, saline solutions have shown a positive effect on ciliary beats under normal or pathological conditions (2,3,4). This effect is the result of osmolarity, mucosal hydration and mucin composition.

In normal conditions, the mucins secreted by the mucous membranes form an elastic gel of low viscosity easily transported by the ciliary mucous membranes.

On the other hand, in pathological conditions (pulmonary infection, inflammation...), mucins have a higher viscosity and a greater elasticity. A decrease in ciliary activity or a more viscous mucus leads to the accumulation of mucus favorable to the development of pathogens (bacteria and viruses) through the formation of a biofilm.

Inhaling, gargling, and rinsing with a saline solution can help restore the properties of mucus and, hence, eliminate pathogens more effectively.

Most of these effects are obtained with an isotonic or even slightly hypotonic solution. It is sometimes preferable to use a hypertonic solution, especially when the mucus is highly dehydrated or the mucosa is fibrotic.

Interaction of SARS-Cov2 with saline solutions

The replication of SARS-Cov2 is disrupted or inhibited in the presence of saline and more particularly by hypertonic solutions (8). This inhibition would seem to be the result of several parameters including perturbations in the adhesion of the spike protein to the ACE2 receptor. In vitro inhibition can be close to 100% with a 1.5% hypertonic solution on monkey renal cell lines.

Rapid initation of nasal saline irrigation: hospitalizations in Covid19 patients randomized to alkalinization or povidone-iodine compared to national dataset

https://doi.org/10.1101/2021.08.16.21262044

Department of Emergency Medicine - Agusta University - Georgia USA

Preprint August 2021 - Not certified by peer review

In this pre-publication from Agusta University (Georgia - USA) the authors describe a clinical study done to compare hospitalization rates with and without nasal irrigation. In their comments, they state that irrigations are low-risk 'over the counter' treatments that may be of value in the evolution of the disease.

The study included 79 patients who tested positive for Covid. 62 patients completed the irrigation protocol with either bicarbonate or dilute povidone-iodine reinforced saline. The study did not have a specific control group but compared its data with the data published by the US CDC. In the CDC data, people meeting the study's inclusion criteria had a 19% chance of being hospitalized, compared with 1.3%

for the study patients. This study, which is not very robust in terms of protocol, also seems to confirm the value of nasal irrigation and to reduce the severity and duration of symptoms. An extensive bibliography is also presented.

Nasopharyngeal and oropharyngeal rinses with neutral electrolyzed water prevents COVID 19 in front line health professsionals. A randomized open label-controlled trial in a general hospital in Mexico City.

Biomedical reports 16:11,2022 - DOI: 10.3892/br.2021.1494

This publication describes a study of 170 volunteers, front-line health care personnel, in hospitals in Mexico City.

These volunteers had all the recommended protections for health care personnel (gowns, gloves, goggles, masks, socks, hydro-alcoholic solution...) for the care of COVID patients.

The observations were made before the vaccines were made available in Mexico. Protective measures were necessary to prevent infections.

The group receiving the treatment 3 times a day with:

- One irrigation in each nostril - 4 sprays (0.4ml) of Esteriflu® https://esteriflu.com

- An oropharyngeal rinse by garagrism with Estericide® of 10ml of Bucofaringeo https://estericide.com

The 2 formulations from the company COFEPRIS

After 4 weeks of work in direct contact with COVID-19 patients, the group having performed these nasal and oro-pharyngeal washes only detected 1 positive patient, while 10 patients of the control group were confirmed positive over this period. The difference in incidence is significant with a P-value of 0.0039 indicating a protection factor of more than 90% obtained by these prophylactic measures of washing with these solutions.

In this publication, the authors recall that several publications, often in the absence of evidence, have contraindicated or not recommended the use of saline in lavage. Even today,

in January 2022, the WHO indicated that there is no evidence of the value of regular nosewashing. https://www.uwc.ac.za/about/alumni/news-events/coronavirus-disease-covid-19-advice-for-the-public-myth-busters-109

The authors recall that, at the beginning of the pandemic, the authorities feared an uncontrolled spread of the virus in the environment. They did not take into account the interests of the patients or their entourage in lowering their viral load.

Interim analysis of an open-label randomized controlled trial evaluating nasal irrigations in non-hospitalized patients with coronavirus disease

Int Forum Allergy Rhinol. 2020;10,1325-1328

In this publication the authors from Gerolymatos do a mini review of the studies done on the use of nasal irrigation with isotonic or hypertonic saline solutions. They also recall the consensus of many professional medical organizations that recommend nasopharyngeal irrigation with these saline solutions.

This is to reduce the viral load of patients, reduce their symptoms more quickly and reduce the risks of transmission of the virus. Hypertonic solutions should be preferred because they facilitate nasal decongestion and simultaneously improve mucosal cleaning.

Nasal Irrigation in the Covid-19 Era International Journal of clinical studies & medical case reports

September 2021

DOI:10.46998/IJCMCR.2021.13.000314

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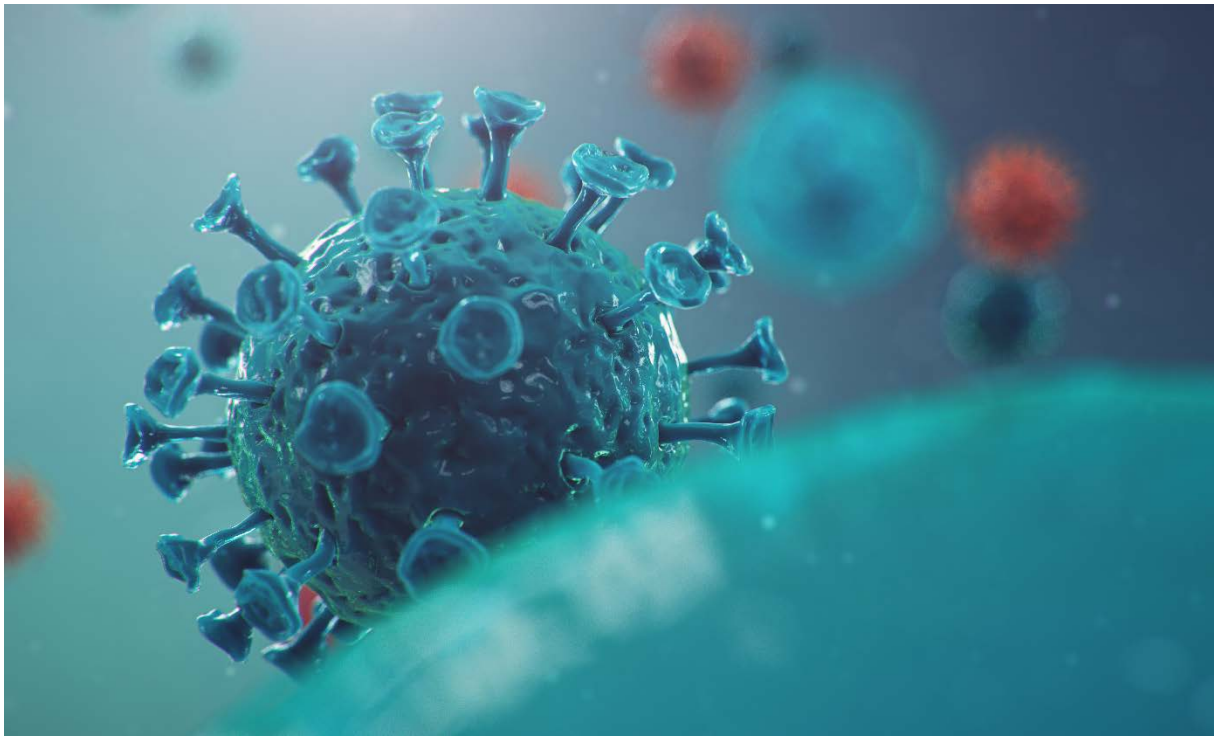
Of course, they also remind the caregiver of the importance of hygiene precautions and the importance of following protocols to prevent contamination.

Since COVID 19 was a new virus, the fear of the unknown and the lack of knowledge about it led to most of the prevention actions being guided by the fear of spreading the virus.

Hygiene measures that have been recognized for a long time, such as washing mucous membranes with saline solutions, had been discarded as a precautionary measure, primarily because of the fear of dissemination of the virus. This risk induced a benefit-risk ratio that did not appear favorable.

Due to the introduction of effective vaccination campaigns which have greatly reduced the severity of the disease, and a pandemic diffusion of the virus which has reduced the risk of virus dissemination to anecdotes, the initial fears have been removed, especially when considering the immunity that has been acquired by the population. Hygiene and patient care strategies can be reevaluated and the practices that have been proven to be effective for years can be reintroduced to treat all oropharyngeal diseases.

After 2 years of accumulation of knowledge, it seems clear that the vast majority of studies done on the use of saline solutions for nasopharyngeal mucosa washing show a very favorable benefit/risk ratio given the absence of



side effects of these uses. This use is of particular interest for vaccinated persons whose risk of severe forms is greatly reduced.

Most old studies on rhinoviruses or recent studies on Covid19 made on the influence of the washing of mucous membranes and the nebulization of saline solution show many advantages:

- As the amount of transmissible viral load present on the mucous membrane of the oropharynx of the infected person decreases, the risk of transmission to the intrafamilial entourage and caregivers is reduced.
- The increase in the average size of the bio-aerosol after nebulization of highly contaminated patients reinforces the effectiveness of the protective masks and reduces the risk of contamination of the surrounding population.
- Although the studies include a small number of participants, the decrease in viral load seems to also have an important impact on the severity of the disease. This is because it reduces the duration of symptoms.
- As a result of the endemic situation of the virus and its high contagiousness (Delta and Omicron viruses), the risk of spreading the virus following mucous membrane washing or inhalation is again a manageable risk by simple hygiene measures of isolation and washing with all the processes recognized as effective (washing with soaps, disinfectants, hydro-alcoholic solutions).
- Additionally to conventional measures (distancing, ventilation of rooms, hand washing, wearing masks...), preventive cleaning of the nasopharyngeal mucous membranes of the entourage of contaminated patients seems to be a reasonable complementary measure to prevent multiple infections within families.
- The use of hypertonic solutions seems to bring a small advantage by providing:
    - A decongestant effect
    - Facilitating the cleaning of mucous membranes
    - By limiting the mucosal replication of viruses

Complementary references

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