



## Helicopter Transfer of Patients with Covid 19 is it Safe Enough for Crew Members Our Experience

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### Abstract

Coronavirus disease is very contagious and spreads rapidly through human-to-human transmission. On March 11, 2020, the World Health Organization declared a global pandemic. During its outbreak in Sicily the demand for intensive care beds exceeded availability within days, that's why helicopter transport over longer distances became necessary. Limited information exists regarding the response of HEMS programs and the true risk for medical crew is not known. Our experience seems to demonstrate that these transports can be performed safely with the proper use of full PPE, disciplinary dressing and undressing routine and cleaning procedures. The Emergency is going on, that's why we think that our manuscript should be published.

**Keywords:** Coronavirus; Personal Protective Equipment (PPI); Helicopter Transport

### Introduction

Coronavirus disease 2019 (COVID 2019) is highly contagious infectious disease. It put in crisis world medical transport chains. On March 11, 2020, the World Health Organization declared a global pandemic. Italy put on national lockdown protocols to combat the spread of the virus and limit a devastating outbreak, since March 9<sup>th</sup>, 2020. From March 3-2020, 250.000 cases have been reported, with 6.100 deaths in Sicily. Most infections were mild or asymptomatic. However, the elderly patients and those with cardiovascular or respiratory comorbidities developed acute respiratory distress syndrome [1]. These patients often required transport to tertiary care facilities with dedicated intensive care unit and advanced devices such as extracorporeal membrane oxygenation.

Sicily has a population of 5.100.904 inhabitants. In addition to regular ambulance service, our isle is covered by six physician-staffed HEMS (Helicopter Emergency Medical Service) teams. Every year, more than 200 critically ill patients are transferred by our HEMS which are frequently used to transfer them to tertiary care

centers. HEMS care is always guaranteed by clinical staff members (anesthesiologists) and specialized nurses. Healthcare staff is "not dedicated", but usually, primarily working in intensive care units.

On March 3, 2020, the first Coronavirus Disease patient was admitted to a Sicilian Hospital (Siracusa). Suddenly, the virus spread rapidly through human to human. All over the isle, the demand for Intensive Care (IC) beds increased dramatically in a few days. Ground ambulances provided regional redistribution of IC patients [2] until longer distances became necessary. When time-consuming transport began, helicopter transport of critically ill COVID-19 patients started. COVID 19 has created an unprecedented risk to transporting crews. COVID 19 poses a serious health risk to healthcare staff, because of their close contact with infectious patients and particularly during high-risk aerosol generating procedures, including endotracheal intubation and nasotracheal suctioning. A few data exist at the moment concerning the efficiency of HEMS programs to patients with known or suspected COVID 19 [3]. The close physical proximity of air medical personnel to patients in con-

financed spaces and limited supplies of personal protective equipment (PPE) made air medical transport a unique and challenging infection control environment. Ideally, the purpose of our study is to discuss our working method (proper PPE and a disciplined dressing and undressing routine) regarding current HEMS practices for COVID 19 patients.

## Methods

In this retrospective single center observational study a survey of the Air Medical Section was conducted between May 2020 and May 2021. Three helicopters were engaged in these transports: Palermo and Lampedusa helicopters were AW 139; Pantelleria helicopter was AW 169. All the crew members (n = 55 physicians, n = 45 nurses, n = 20 pilots) applied a routine protocol concerning proper use of personal protective equipment (PPE), dressing and undressing routine and cleaning procedures. Four weeks after completing the aeromedical transport all crew members were monitored for the presence of IgG antibodies to SARS-COV-2 and for possible COVID 19 symptoms.

We collected the data from ventilated and not ventilated COVID-19 patients. The data were collected from the documented flight reports in the SUES 118 (Sanitary Urgency and Emergency System); we collected only data from secondary transport (Hospital to Hospital). The total exposure time to COVID-19 for each HEMS member, was considered from time of first patient contact until hand-off at a receiving hospital.

The mission time starts when the doctor and the nurse receive communication of need helicopter transport of critically ill COVID-19 patient. The infective protective measures included impermeable gowns, double-disposable gloves with long sleeves, FFP2 facemasks and eye protection with splash guard goggles. Total exposure time was considered from time of first patient contact until hand-off at a destination hospital. The pilots remain next to the helicopter while medical staff receives an oral and written handover. All our helicopters have a fixed wall installed, resulting in independent cockpit and cabin ventilation. We connected the patient to our monitor, to our syringe pumps (if necessary) and finally to the respiratory tubing of our Hamilton T1 ventilator. Some patients were in spontaneous breathing with an oxygen mask up to 15 L, others were mechanically ventilated (seven). We recommended preemptive intubation for patients with the potential of respiratory decompensation during helicopter transport, regardless of COVID 19 status [6]. This choice was linked to increased

transmission of respiratory infections with the use of noninvasive ventilation (NIV), that we have temporarily halted the use. We pre-oxygenated ventilated patients with 100% oxygen, deepened sedation and administered neuromuscular blockade if appropriate, before transfer to the stretcher. We set the transport ventilator at the institutional setting. We clamped the tube on inspiratory hold and then we switched off the institutional ventilator. Subsequently we reconnected the tube of the transport and ventilator and we released the clamp from the tube. At that point the patient was transferred to the stretcher and covered with sheeting. During flight the patient was monitored by HEMS physicians. Intubated patients were generally considered to represent the lowest infection risk. When the strategy for early intubation became clear to be not tenable because the limited availability of ventilators and because it was not clinically necessary [2], less invasive therapies became more common. Communication during COVID 19 patient transport was achieved with headsets because cell phones could not be held in proximity to the medical staff's head to limit contamination [6]. The receiving hospital was informed by the pilot about the exact time of arrival and transmitted instructions so that local teams could adequately prepare the patient. Background noise makes impossible the use of speaker modes of any communication device. To address these issues, clinical information of the patients were communicated before arrival of the aeromedical staff to final destination. Any acute clinical changes was communicated during handover of the patient. Subsequently the patient was connected to the institutional ventilator, monitoring and syringe pumps and in the end disembarked from the helicopter and brought to the destination ICU. Timing to complete transfer of COVID 19 patients was longer than previously necessary; it was due to the increased complexity of patient preparation, due to PPE and to the necessary decontamination of the aircraft, which took several hours [6]. The average duration of these transports was 119,55 minutes. Finally, the HEMS nurse disinfected the stretcher, medical equipment and potentially contaminated surfaces inside the helicopter with di-cildimetilammonio cloruro (Surfà Safe) dressed in full PPE [4]. We have adopted the use of a vaporized ozone disinfection system (Protea) which minimizes health care workers exposure.

We didn't apply any statistical analysis to our data.

During these operations all crew members were available for critical care and transport of NON COVID-19 patients too. It was not possible to have dedicated crew members because of the lack of staff. Obviously all sanitary staff was in good physical (no cough,

shortage of breath, fever, loss of taste and smell without nasal congestion) and mental condition at the time of the operation. Every team member was instructed how to put on and remove his PPE correctly. Each team member had a personalized PPE package which was compiled on the basis of a checklist.

Fifteen days after ending transport operations, physical and mental condition was reevaluated. Anyone who felt unwell came back home until they were asymptomatic. Seven crew members had experienced clinical symptoms corresponding to the criteria for possible COVID 19 infection 2/3 days after two different operations. They had mild pneumoniae. At the start of these operations none of the members had symptoms that could correlate with COVID-19. No symptoms suggestive of COVID 19 were reported by others crew members.

Although HEMS cabin space is limited and air is recirculating, we didn't experienced any adverse events. Our experience suggests that protective measures can potentially limit disease transmission and reduce occupational risk.

Our Helicopters transported 7 ventilated COVID 19 patients.

Patients characteristics are reported in table 1.

	Number or mean+/- SD
Gender (M/F)	30/8
Age	63
Oral tube/Tracheostomy	6/1
Mechanical Ventilation	7
Arterial/Central venous line	7
Comorbidities	Cystic fibrosis (1) Pulmonary fibrosis (1) AAA** (1) Obesity (1) COPD* (1) Hypertension (1) Diabetes (1)
Sedative/opioids/vaspressor	7

**Table 1:** Patient characteristics.

\*Chronic obstructive pulmonary disease; \*\*Abdominal Aortic Aneurysm.

Acknowledgements of potential risks during procedures, in particular during patient position are very important. Careful checking of all connections is of utmost relevance. All these is logical but basic to increase patient safety and to protect health care providers against a sudden peak of COVID 19 aerosols. The physicians and nurses are exposed for longer periods than pilots.

**Discussion**

Our challenge was to limit cross-contamination of the crew in the close quarters of an helicopter. We couldn't separate a "hot" zone (contaminated area with patients) and a "cold zone (uncontaminated area for crew) because our aeromedical organization didn't make available larger aeromedical. However according to our data the helicopter transport of contagious critical care COVID 19 patients can be performed with safety and the use of PPE by crew members minimized the risk of infection. In contrast to an ICU, HEMS transport occurs in a confined space (6,8 m³). During the flight the range of motions is very limited due to the safety belts and the physician sits close to the patient. Patient' surveillance during flight can be stressful because he can only be observed visually; this expose to risk of inattention to details. A meticulous preparation of the staff for each transport achieved by carefully following the taught instructions was the key to the success of every operation. This is what our experience shows. However we have to recognize that all these operations of patients with severe acute respiratory syndrome coronavirus intubated or not were performed by experienced HEMS crew members.

**Conclusions**

According to our experience, helicopter transport of critical care COVID-19 patients can be performed safely when strict rules are applied.

Less than 7% of HEMS staff experienced COVID 19 illness within 14 days of transport of a COVID 19 patient. We are sure that the effect on HEMS will last until the very end of the COVID 19 pandemic. There is not literature examining the risk of COVID 19 transmission to air medical staff. It is of utmost importance that clear rules are made for the transport of COVID 19 patients, either positive or suspected.

We tried to organize a safe helicopter transport with experienced crew members while the COVID 19 pandemic in Sicily seriously put in trouble intensive care units. The key point to achieve a

good standard was the proper use of full PPE, strict rules for dressing and undressing routine and cleaning procedures. We would like to share our practical considerations from our experience with helicopter transport of COVID 19 patients not only with aeromedical transfer crews, but also with the referring and receiving emergency medical teams.

### Ethics Approval and Consent to Participate

Not applicable.

### Consent for Publication

Not applicable.

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request

"The authors declare that they have no competing interests" in this section.

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### Authors' Contributions

Each author made substantial contributions to the work. DMP and ANC for the conception of the work; MP, DT, GR and RL for the design of the work; AF, FT and GO for the acquisition of data, FG has revised the work. All the Authors have approved the submitted version (and any substantially modified version that involves the author's contribution to the study); and have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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