Multidisciplinary Respiratory Medicine 2020; volume 15:682

LETTER TO THE EDITOR

OPEN ACCESS

First COVID-19 sub-intensive respiratory unit in Europe: the Italian experience

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ABSTRACT

European SARS-CoV-2 pandemic epicenter was detected in Northern Italy, in a little Italian town of Lodi province, the Lodi Hospital was therefore rapidly saturated, and in particularly the departments of respiratory diseases and Intensive Care Unit had been largely involved. In this paper, we describe how the first Sub-intensive Respiratory Unit in Europe completely dedicated to COVID-19 patients was organized and managed in our hospital. From February 25th to April 30th 2020, 156 patients were admitted to our Respiratory Sub-intensive Unit. Among them, 100 were discharged, 28 dead and 28 transferred to ICU for intubation.

Key words: COVID-19, severe pneumonia, sub-intensive respiratory unit, department organization, ARDS, ventilation.

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Contributions: cSH, CBC, manuscript drafting; NV, MC, ACR, GC, MM, EE, MF, IRC, data acquisition, manuscript revision; MS, paper critical revision for important intellectual content. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of interest: The authors declare no conflict of interest.

Funding: None.

Availability of data and materials: Research data are stored in the hospital database.

Ethics approval and consent to participate: Not applicable.

Consent for publication: Not applicable.

Dear Editor,

SARS-CoV2 spread firstly in China and then worldwide, becoming pandemic on March 2020 [1]. First European case of infection was detected on February in Lodi province. In the following weeks, the pandemic spread in Northern Italy. SARS- CoV-2 related disease, COVID-19, presents a wide spectrum of clinical manifestations, from flu-like symptoms to severe pneumonia and acute respiratory distress syndrome (ARDS) [2].

In this emergency setting, the hospitals and particularly the departments of respiratory diseases and Intensive Care Units (ICUs) were rapidly saturated and the need to enlarge their capacity became mandatory.

We describe how the first Sub-intensive Respiratory Unit (UTISIR) in Europe completely dedicated to COVID-19 patients was organized and managed within one month in Lodi Hospital, a public Institute with 440 beds, 1 respiratory Unit with 18 beds, 4 of them dedicated to respiratory sub-intensive care.

Firstly, a filter zone was created, with personal protective equipment (PPE), a sanitary area and spaces dedicated to warehouses. The number of sub-intensive-care beds was implemented up to 24, to meet the growing needs of inpatients. Each bedside was equipped with monitoring system and the department was provided with 20 high performance ventilators, 24 Continuous Positive Airway Pressure systems (CPAP), 20 Hight Flow Nasal Canulae (HFNC), 3 Ultrasound Machines and single use bronchoscopes. A multidisciplinary team with pneumologists, cardiologists and anesthesiologists was created. The nursing stuff was implemented, to assure one to four nurses to each patient. To reduce the isolation of patients from relatives, due to the high contagion risk, a system of day-to-day telephone calls to the families for medical updates and video calling was organized.

The Emergency department (ED) in Lodi became the epicenter of the European SARS-CoV-2 pandemic "wave", with high flux access. The careful observation of patients permitted to stratify them into five prevalent categories, with different needs for medical assistance and a new triage model was created [3] (Table 1).

In UTISIR were admitted patients testing positive to SARS-CoV-2 throat swab with phenotype 3,4,5, ICU patients weaned from intubation, with tracheostomy and transferred from other low-intensity care departments of the hospital, when appropriated.

Assessment of patients included: invasive monitoring of blood pressure, body temperature every eight hours, continuous monitoring of cardiac and respiratory frequency, oxygen saturation, continuous electrocardiographic recording, monitoring of urine amount. Arterial blood gas test (ABG) was repeatedly assessed. Blood tests at the admission included: routine complete blood count, C- reactive protein, procalcitonin, renal and liver function, coagulation, troponin, Legionella and Pneumococcal urinary antigens.

According to the 2019 ESPEN guidelines on clinical nutrition in critical patients, a nasogastric tube was placed in the patients supported with CPAP or dependent on non-invasive ventilation (NIV). This approach allowed enteral nutrition without desaturation, reduced gastric distension, maintained the physiologic activity of gastrointestinal tract, minimized sarcopenia [4]. Only when nasogastric tube was contraindicated, for psychomotor agitation or anatomical abnormalities, a total parenteral nutrition was started. Hydration was administered in order to obtain mild negative balance.

The patients with interstitial pneumonia and SpO_2 <95% with oxygen 15 L/min, PO_2/FiO_2 <250 and/or respiratory rate >25 were supported with CPAP: 10 cm H_2O was the mostly chosen Positive End Expiratory Pressure (PEEP), since a major reported drawback of higher PEEP is the overdistension in more compliant parts of the lung [5]. When possible, the use of helmet with filter above the PEEP valve was preferred over the face mask, to reduce the aerosolization of droplets. NIV was used in selected patients with persistent hypoxemic respiratory failure despite CPAP use to gain time awaiting intubation, or in patients not fit for invasive ventilation. Moreover, we decided to use low tidal volumes, limiting it to 6 mL/kg ideal body weight (IBW), following the practical mechanical ventilation strategy [6]. The effectiveness of NIV was evaluated through the monitoring of ABG after 1-2 hours from the ventilation start. Since the prone position is reported to improve lungs oxygenation in ARDS [7-8], we used it in CPAP or NIV patients off label, with adequate monitoring. The duration of prone positioning sessions was based on patient tolerance, with cycles from 4 to 12 hours. In our cohort, we did not report any complication and we achieved good effectiveness (*unpublished data*). When prone positioning was contraindicated due to obesity or intolerance, we used the lateral decubitus position.

The use of HFNC was of choice in patients with pulmonary barotrauma with contraindication to CPAP or NIV and for the weaning from NIV/CPAP. To reduce the staff exposure to droplets, all patients had surgical masks. Sedation, obtained with morphine and dexmedetomidine, was necessary and very helpful to reduce patient respiratory distress or ventilation discomfort.

Physiotherapy had a crucial role in assistance of COVID-19 critical patients. In UTISIR, two physiotherapists worked each shift to maximize the yield of NIV by allowing postural changes, mobilization, prone positioning, and during the weaning from invasive mechanical ventilator support in tracheostomized. Passive and active mobilization of the patients improved function outcomes, cognitive and respiratory conditions, above all in patients coming from ICU [9].

The literature reported alterations of coagulation tests, with increase in D-Dimer levels associated with adverse outcomes in COVID-19 patients. High risk for venous thromboembolism has been highlighted, with high prevalence of symptomatic acute pulmonary embolism and deep vein thrombosis in ICU patients. Therefore, low molecular weight heparin (LMWH) has become part of the therapy of COVID-19 [10,11]. As evidences about the right dose are still lacking, we administered 100UI/Kg/day. Lung Ultrasound Score (LUS) and compression ultrasound (CUS) of the

Table 1. The five main phenotypes of COVID-19 symptom presentations to Lodi Emergency Department.

1. **Fever without respiratory failure** (normal ABG and 6-minute walking test) and normal Chest X-Ray → patient can be discharged with indication to quarantine.
2. **Fever with Chest X-Ray and ABG suggestive for interstitial pneumonia and/or mild respiratory failure** (PO_2 >60 mmHg without oxygen): oxygen therapy required → hospitalization in COVID-19 Departments.
3. **Fever with moderate/severe respiratory failure** (PO_2 <60 mmHg without oxygen): oxygen therapy or CPAP required → hospitalization in COVID-19 Departments or COVID-19 UTISIR.
4. **Respiratory failure with suspected ARDS or severe pneumonia:** CPAP or intubation required → hospitalization in COVID-19 ICU or COVID19 UTISIR.
5. **ARDS at onset:** CPAP or intubation → hospitalization to COVID-19 ICU or COVID-19 UTISIR.

ABG, blood gas test; UTISIR, sub-intensive respiratory unit; ICU, intensive care unit.

lower extremity veins were performed to all patients at the admission and repeated during the hospitalization if needed; chest X-Ray or lung CT scan were done in case of clinical worsening, especially if thromboembolism or bleeding was suspected.

Up to now, no direct treatment has been proven effective against COVID-19. We administered different drugs taking part in ongoing clinical trials. The effectiveness of each treatment is still under study [12-15]. From February 25th to April 30th 2020, 156 patients were admitted to UTISIR: 100 discharged, 28 dead and 28 transferred to ICU for intubation.

Abbreviations:

COVID-19: Coronavirus Disease 2019;
ARDS: Acute respiratory distress syndrome;
ICU: Intensive care unit;
UTISIR: Sub-intensive respiratory unit;
PEE: Personal protective equipment;
CPAP: Continuous positive airway pressure;
HFNC: Hight flow nasal canulae;
ED: Emergency department;
NIV: Non-invasive ventilation;
LMWH: Low molecular weight heparin;
LUS: Lung ultrasound score;
IBW: Ideal body weight;
PEEP: Positive end expiratory pressure;
CUS: Compression ultrasound.

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Received for publication: 1 June 2020. Accepted for publication: 4 June 2020.
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Multidisciplinary Respiratory Medicine 2020; 15:682
doi:10.4081/mrm.2020.682