Triage decision-making at the time of COVID-19 infection: the Piacenza strategy

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Dear Editor,

Since its detection in China in December 2019, coronavirus disease 2019 (COVID-19) rapidly spread throughout the world becoming a Public Health Emergency of International Concern. In January 2020, the WHO Emergency Committee decided to declare a global health emergency. On February 21, 2020, the first case of COVID-19 had been reported in Northern Italy (Codogno, Lombardy), becoming the beginning of the COVID-19 pandemic and humanitarian crises in Italy. The COVID-19 outbreak in Northern Italy has been the cause of the healthcare system crisis with a massive influx of patients to the Emergency Departments, particularly in Piacenza due to its proximity to Codogno. In few days, the COVID-19 epidemic paralysed our public health system and hospital organization, becoming a challenge for our Emergency Department. At the beginning of the Italian COVID-19 outbreak, we based the suspicion of COVID-19 infection upon the epidemiological risk: the exposure to confirmed COVID-19 case or prolonged contact with people in the geographical area with confirmed COVID-19 cases in the past 14 days. Unfortunately, with the global and severe spread of COVID-19 and the dramatically increased number of infected patients in Piacenza, despite being a relatively small city, our hospital became one of the epicentres of the Italian epidemic with 2276 cases and 447 deaths at this moment. The situation quickly turned critically with overcrowded Emergency Department and Intensive Care

Unit, nearing collapse. As consequence, our own hospital became a quite totally dedicated COVID-19 hospital with 80% of beds reserved for ill COVID-19 patients. We felt deeply concerned both by the alarming levels of spread and severity, and by the number of critically ill patients who required an immediate hospitalization in the Intensive Care Unit. To avoid the complete collapse of our healthcare system because of the lack of expertise in epidemics and the presence of limited human resources, we needed to change our perspectives and develop a long-term plan against catastrophic consequences to warrant a “COVID-19-free way” in the Emergency Room and prevent COVID-19 spread in “COVID-19-free wards” in our hospital.

From the literature, we have learned that fever and cough are the most common signs of COVID-19 infection, and the infection can progress to pneumonia with dyspnoea and chest symptoms in approximately 75% of patients. Based on these evidences, in the absence of flu-like symptoms, patients are considered “low-risk of COVID-19”. We partially agree with this consideration: some patients can complain symptoms as abdominal pain, vomiting, diarrhoea, fatigue, and general malaise even in the absence of fever and respiratory symptoms and even asymptomatic patients can have abnormalities on chest CT [1]. As reported in the literature, lung CT scan is the gold standard technique to diagnose COVID-19 pneumonia and nowadays, CT protocols are used to estimate the pulmonary damage. Unfortunately, in a mass influx situation, CT scan is not feasible for all the patients admitted to the Emergency Department, particularly in developing countries and small hospitals with limited resources. In this contest, point-of-care lung US can be an effective alternative, being a safe, low-cost, and easy technique commonly used by emergency physicians at the bedside for early diagnosis of pneumonia. Data reported in the literature confirmed that lung US gives results like chest CT scan and superior to chest X-ray in patients with

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Fig. 1 Flowchart for COVID-19 triage. Positive and negative are referred to the presence or absence of typical ultrasonographic signs of COVID-19 pneumonia, respectively. *ED* Emergency Department, *SpO2* peripheral capillary oxygen saturation

pneumonia or adult respiratory distress syndrome (ARDS). Recently, three studies have confirmed the role of lung US in the diagnosis of COVID-19 pneumonia [2, 3]. Ultrasonographic features of COVID-19 pneumonia include thickened pleural line, B lines (focal in the early stage and in mild infection, multifocal and confluent in the progressive stage and in critically ill patients) and small subpleural consolidations with or without air bronchograms.

According to the current appraisal of the WHO, we strongly believe that preventive measures and early diagnosis of COVID-19 are crucial to interrupt virus spread and avoid local outbreaks. Starting from this idea and to avoid misunderstanding COVID-19 diagnoses, we established a bold triage strategy based on an algorithm to investigate all the patients admitted to our Emergency Department with point-of-care lung US, even in the absence of clinical suspicion of COVID-19 infection (Fig. 1). For this reason, we created a “key area” in the triage room and a clear triage process based on the strictly collaboration between the triage nurse, who scheduled the patient, and the emergency clinician, who performed the point-of-care lung US to quickly identify ultrasound signs of interstitial syndrome. Patients, who did not complain classical symptoms of COVID-19 infection but with positive lung US, have been considered as probable cases and needed further investigation before admission to “COVID-19-free wards”.

The primary goal was to increase as better as possible measures to prevent COVID-19 infection and avoid COVID-19 spread among hospitalized patients in “COVID-19-free ward” of our own hospital.

Here we report our experience and preliminary results in the first month of Italian epidemic.

From February 23, 2020, to March 24, 2020, ten patients (six males, four females) presented to our Emergency Department complaining of syncope, proctorrhagia, rectorrhagia, abdominal pain, vomiting, right foot and leg pain, and neurological symptoms. Patients’ characteristics are reported in Table 1. None of them referred flu-like symptoms or dyspnoea, even though four out of ten (40%)

had severe hypoxemia with pulse oxygen level (*SpO2*) below 95%. Fever (body temperature above 37.5 °C) was present in four patients, three of them with hypoxemia. Even in the absence of respiratory symptoms, the patients were immediately investigated with lung US, which showed in all the cases ultrasonographic findings of COVID-19 interstitial pneumonia. The diagnosis of COVID-19 pneumonia has been confirmed by chest CT scan in all the patients. Interestingly, nasopharyngeal (NP) swabs for 2019-nCoV by real-time PCR confirmed the diagnosis of COVID-19 pneumonia only in five out of nine (55%) patients; in four patients (45%) it was negative. Unfortunately, in one case (pt 3, Table 1), the result was unavailable due to a technical problem. We collected a second NP swab from this patient after 48–72 h, which resulted positive. Our data confirm that despite high specificity, the reported sensitivity of rRT-PCR testing is as low as 60–70% [4].

Our experience demonstrates that in the epidemic phase of COVID-19, diagnosis of COVID-19 pneumonia is a real challenge for emergency physicians and point-of-care lung US can help us to early detect pulmonary and pleural findings in patients without respiratory symptoms and/or fever. For this reason, we strongly recommend US lung to assess COVID-19 pneumonia in all the patients referred to Emergency Department even in the absence of suspicious symptoms of COVID-19, especially if pulse oxygen levels are lower than normal values. Our results highlight the role of point-of-care US lung in the triage decision-making at the time of worldwide COVID-19 infection and global healthcare system crisis. We hope that our experience will be helpful for other Emergency Departments to solve quickly these pandemic and humanitarian crises, particularly in developing countries with limited resources and Emergency Departments where CT scan is not available.

Table 1 Patients' characteristics at admission in the Emergency Department

	Pt 1	Pt 2	Pt 3	Pt 4	Pt 5	Pt 6	Pt 7	Pt 8	Pt 9	Pt 10
Age (yo)	67	86	78	61	81	83	53	76	77	54
Sex	F	F	M	M	M	F	F	M	M	F
Symptoms at admission	Vasovagal syncope	Proctorrhagia	Right foot and leg pain	Abdominal pain	Abdominal pain and rectorrhagia in OACs	Dysarthria, confusion, left hemiplegia	Vomiting	Abdominal pain and fatigue	Confusion after cranial trauma in OACs	Abdominal pain and vomiting
SpO ₂ (%)	98	97	96	90	96	97	86	84	85	98
Body temperature (°C)	36.0	36.0	36.6	38.2	37.3	37.0	36.0	37.5	37.6	39.0
Lung US	Diffuse basal B lines	Diffuse B lines + bilateral basal subpleural Cs	Diffuse B lines in the left lobe, and focal B lines in the right lobe	Diffuse bilateral basal B lines and subpleural Cs	Focal basal bilateral B lines	Diffuse bilateral basal B lines	Diffuse bilateral basal B lines	B lines and subpleural Cs in the right lower lobe	Diffuse bilateral basal B lines and fine subpleural Cs	Diffuse bilateral basal B lines and fine subpleural Cs
Chest CT scan	GGO + crazy-paving pattern	ND	GGO + Cs with air bronchograms	GGO + crazy-paving pattern and basal Cs	GGO + basal Cs	GGO	GGO + basal Cs	GGO + Cs with air bronchograms	GGO	GGO
Chest X-ray	ND	Diffuse interstitial pneumonia	Basal bilateral Cs	ND	ND	Left basal interstitial markings	ND	ND	ND	Normal
Nasopharyngeal swab	Negative	Positive	NA	Positive	Negative	Negative	Negative	Positive	Positive	Positive
Final diagnosis	Syncope in COVID-19 pneumonia	Proctorrhagia in COVID-19 pneumonia	Critical limb ischemia in COVID-19 pneumonia	Intestinal perforation in COVID-19 pneumonia	Rectorrhagia in COVID-19 pneumonia	Cerebral ischemia in COVID-19 pneumonia	COVID-19 pneumonia	Intestinal perforation in COVID-19 pneumonia	Traumatic brain injury in COVID-19 pneumonia	Gastrointestinal symptoms in COVID-19 pneumonia

Abnormal values are in bold

Pt patient, YO years old, M male, F female, OAC oral anticoagulants, SpO₂ peripheral capillary oxygen saturation, GGO ground glass opacity, Cs consolidations, ND not done, NA not available

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The study is a retrospective study and the local Ethics Committee of Guglielmo da Saliceto Hospital has approved the publication of the data.

Statements of human and animal rights Compliance with ethical standards was adhered to through Institutional Review Board approval and the study including human participants have been performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments.

Informed consent For this type of article, informed consent is not required.

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