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Perspective

The Impact of COVID-19 on Rehabilitation and Proposal for a New Organization: A Report from Lombardy, Italy

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Abstract

Italy has been one of the first-hit and most affected countries worldwide by the coronavirus disease 2019 (COVID-19) outbreak, and Lombardy accounts for almost half of all Italian cases. Vulnerable population is the one suffering the most from the current epidemic, without guaranteed access to basic needs. This aspect becomes critical for people experiencing disability, either due or not to COVID-19. To face the pandemic, all the regional health system services, rehabilitation ones included, were forced to radically adapt their operating paradigm and even sometimes to leave their intrinsic mission. The Italian Society of Physical and Rehabilitation Medicine (SIMFER) since the beginning of the outbreak was profoundly involved in the clinical and organizational response to COVID-19. The Lombardy regional group cooperated strictly and continuously with the national group to coordinate rehabilitation processes region wide. The paper presents a brief report of our field experience describing the phases faced since the beginning of the pandemic and suggesting the organizational strategies that could be useful in rehabilitation services for both inpatients and outpatients. Springing from literature and the experience of the Lombardy section of SIMFER, this paper should help clinicians to respond to the need of the disabled patient facing the new COVID-19 outbreak.

Keywords: Coronavirus, disability, Italy, Lombardy, prevention, quarantine, rehabilitation, SARS-CoV-2

Introduction

Coronavirus disease 2019 (COVID-19) has taken health-care systems by storm all over the world. Italy has been one of the first and most affected countries worldwide.[1,2] Lombardy, in particular, has been hit hard by the disease, and on November 5, 2020, it accounted for more than 230,000 cases, almost a third of the total Italian cases.[3] The virus had a devastating effect on most of the clinical activity, especially elective procedures.[4]

A hub-and-spoke model was implemented for most of the "time-dependent" conditions only taking in account the need to differentiate paths for COVID-19 and COVID-19-negative patients. Rehabilitation facilities were not considered in this model. As a consequence, vulnerable and disabled populations were between the most suffering from the current epidemic, without guaranteed access to basic needs.[5] It has been estimated that just in Europe up to 2.2 million disabled people each day were left without the necessary care because of lack of access to rehabilitation.[6]

Rehabilitation services were forced to radically change their operating paradigm in order to ensure the safety of patients and operators. At the same time, only a few continued to provide their service to disabled patients.[7,8] A review on COVID-19 rehabilitation, updated monthly in order to be as up to speed as

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possible and organize the continuously flowing and changing evidence on the topic, highlighted the worldwide struggle of keeping rehabilitative services open during the lockdown and social isolation politics.[9-11] Furthermore, patients referred to rehabilitation services are affected by a wide range of pathologies and disabilities.[12] Therefore, the task to adapt all rehabilitative procedures and pathways is incredibly challenging and needs specific guidelines. Lombardy is the Italian region with the highest number of rehabilitative inpatients treated (94,050 in 2018), and mainly felt the struggle of treating patients during the COVID-19 outbreak.

The Italian Society of Physical and Rehabilitation Medicine (SIMFER) immediately responded during the early phase of the pandemic with a document to guide Physical and Rehabilitation Medicine (PRM) specialists during the prolonged lockdown.[13] Since then, 7 months have passed, and the situation has changed drastically. Italy, as well as many other countries that were hit early by COVID-19, survived the first peak and was slowly adapting to new normality (maintaining social contact-preventing measures) while the shadow of a possible second wave slowly loomed over all of us. Health-care professionals had the duty to be prepared.[14]

The aim of the current paper, proposed by the regional Lombardy section of SIMFER, is to describe the intervention/re-organization occurred on different activities provided by rehabilitation services in three different settings (intensive care units/acute wards, post-acute/sub-acute rehabilitation wards, and outpatient department) during three different moments of the first pandemic wave (emergency phase, stabilization phase, and re-organization phase) in one of the hardest-hit areas of the world. Considering that, on the fall of 2020, Lombardy is in the middle of the second wave with a new surge of cases, and COVID-19 is likely to be a seasonal disease; it seems possible that the cycle will repeat itself over time, and the consideration will remain valid in the short term.

More attention was paid to the post-acute and sub-acute rehabilitative wards with focus on the Individual Rehabilitation Plan that included an accurate assessment of the patient's needs in all areas of clinical intervention.

An analysis of the scientific literature and the clinical experiences of the authors during the pandemic allow us to affirm once again that the PRM evaluation is crucial even for COVID-19 patients.

The emergency phase

The emergency phase, in which the first diagnoses of COVID-19 were performed confirming the virus spread, required decisive action with timely and quick response.

Support to intensive care unit/acute wards

A comprehensive evaluation to define patient's rehabilitation needs during ICU/acute wards stay was focused on the following aspects:

- Evaluation of signs and symptoms suggestive both of restrictive breathing deficit[15] and ventilation deficit due to mechanical ventilation (when provided), producing weakness of respiratory muscles
- Evaluation of signs and symptoms suggestive of myopathies or peripheral neuropathies, in particular CRIMYNE (CRitical Illness MYopathy and NEuropathy), as part of the post-intensive care syndrome (PICS)[16]
- Evaluation of signs and symptoms suggestive of lesions of the central or peripheral nervous system that can cause motor symptoms (myelitis, encephalitis, and demyelination)[17-19]
- Evaluation of proning consequences (i.e., pressure ulcers or brachial plexus injuries):[20] electromyography (EMG) should be performed to investigate the possible lesion[21]
- Evaluation of clinical conditions (i.e., electrolyte imbalance) determining reversible cognitive–emotional–behavioural alterations[22]
- Evaluation of swallowing disorders and nutritional status.[23-25]

Treatments were provided for selected patients.

Post- and sub-acute rehabilitative wards

It should be pointed out that despite the measures implemented, many rehabilitation units have been converted to COVID-19 facilities and had to abdicate their intrinsic rehabilitation mission. Those are the main topics faced:

- Attention was focused on respiratory symptoms
- Implementation of pathways to safely and quickly manage the critical situation, more frequently related to the detection of acute respiratory failure
- Screening of all inpatients with nasopharyngeal swab to prevent diffusion of the virus between them
- Screening of staff member at the first appearance of symptoms (full screening was provided when/where it was possible) to provide containment of the infection within each working area and service
- Access to inpatient by staff members and their turnover was limited to the bare minimum
- Duty shifts were reorganized not to exceed (where/when possible) the duration of 6 consecutive hours because of the tolerance time of personal protective equipment (PPE) by the staff on duty
- Staff availability was critical because of the diffusion of virus between them
- Organization of training course to the correct use of PPE
- Implementation of pathways to safely manage separately COVID-19/COVID-19-free patients
- Contacts of the patients with relatives outside the facilities were entirely stopped;[26] video calls and communication facilitators were provided to ensure remote communication between the resident and family members.

Outpatient activities

Those activities were suspended, except for nondeferrable treatments (e.g., recent trauma, recent surgery; conditions where a delay could generate functional sequelae).

The stabilization phase

On March 21, Italy reached the peak of new contagion with 6557 new cases; since then, the numbers of new contagions decreased, and slowly the emergency phase was over. To guarantee the resumption of the usual rehabilitative activities, it became necessary to redefine settings and pathways of new patients' groups.

Support to intensive care unit/acute wards

Clinical evaluation in ICU and acute wards continued as stated above.

Clinical evaluation is needed to guide the discharge from ICU or acute wards in order to select the correct intensity of the rehabilitation setting.

Post- and sub-acute rehabilitative wards

Most of the rehabilitation units, converted to COVID-19 units, continued with clinical non-rehabilitative activity. Where/when the rehabilitation mission was resumed, the re-organization took into account the following four different typologies of patients:

- COVID-19-free disabled patients who need rehabilitation treatment: Crucial for those patients was the prevention of virus diffusion
- COVID-19 patients with disabilities, both respiratory and neurological, specifically caused by the infection
- COVID-19 patients who developed a disability at the same time as – but not due to – the infection (e.g., femur fracture, cerebrovascular event, and peripheral neuropathies). In this category should be included patients in rehabilitation wards who have been isolated because of COVID-19 and who can continue rehabilitation activities
- COVID-19 patients who no longer require hospital rehabilitation but need to be transferred to another setting where to continue isolation.

PRM evaluation on rehabilitative needs can be described considering the area of specific focus on basic vital functions, motility and transfer, and cognitive–emotional–behavioural.

Basic vital function area

- Evaluation of restrictive breathing deficit[15]
- Evaluation of swallowing disorders and nutritional status[23-25]
- Evaluation of bladder and bowel disorders
- Evaluation of sleep disorders.[27]

Ventilation deficit due to COVID-19 requires progressive weaning from mechanical ventilation if provided, and the support of the functional recovery of the respiratory muscles. Aerobic reconditioning is fundamental as demonstrated by recent studies.[28,29] To better define the rehabilitative needs regarding pulmonary functionality and perceived fatigue, the easier approach is considered spirometry (performed in a dedicated setting because of the risk of virus spread associated with that method), and Borg Rating of Perceived Exertion.[30]

The recognition of a possible swallowing disorder and the setting of the re-educational treatment of the case represents a critical moment to reduce the risk of complications (e.g., *ab ingestis* pneumonia) and to improve the patient's perceived quality of life. Swallowing evaluation guidelines were updated to reduce the risk of diffusion of the virus. According to the new guidelines, the frequency of evaluation of oral neurological reflexes should be reduced, in order to maintain as much as possible the safety of the operator. Unfortunately, a more cautious approach could cause a slower re-introduction of a regular diet.[23] It is also essential to assess the routine protein–energy intakes balance the needs, considering that a poor nutritional status has been indicated not only as a virulence factor but also critical for the long-term survival.[24,25]

Bladder disorders could be secondary to the catheterization required during the acute phase; neurogenic bladder and bowel are described in patients with neurological sequelae of COVID-19 (e.g., myelitis, myeloradiculitis, and Guillain–Barré syndrome).

Furthermore, the quality and quantity of sleep were disturbed because of the acute ward organization. Unfortunately, it has been seen from preliminary evidence that severe COVID-19 patients can incur sleep disorders[27] that have to be taken into account.

Motility and transfer area

- Assessment of the condition of enticement and all the consequences of hypokinesia including fatigue and asthenia[31]
- Evaluation of signs and symptoms suggestive of myopathies or peripheral neuropathies, first of all, the CRIMYNE, as part of the PICS[16]
- Evaluation of signs and symptoms suggestive of lesions of the central or peripheral nervous system that can cause motor symptoms (myelitis, encephalitis, and demyelination)[17-19]
- Evaluation of consequences of proning (i.e., pressure ulcers or brachial plexus injuries).[20]

PRM evaluations have focused on providing a comprehensive rehabilitation program for mobilization, muscle strengthening, balance, and gait reconditioning. Vital parameters (e.g., oxygen saturation and heart rate) during exercise should be monitored when respiratory pathology coexisted. Acute and post-acute patients complain of intense asthenia and fatigue, which affect initial resumption of daily activities.

It has been reported in COVID-19 patients that specific damage can be caused by critical peripheral neuropathy or by central nervous system disorders:[17-19] this aspect was probably underestimated in the first phase of the stress of the health system when prevalent attention was focused on cardiorespiratory symptoms.

Furthermore, it should be paid close attention to possible complications due to proning. After the acute phase, the patient should be fully investigated for pressure ulcers. Lesions of the brachial plexus due to the prone position could sometimes

become evident only on a later stage, in a sub-acute phase when the patient regains strength and explores space around him/her with the upper limbs. EMG should be performed to investigate the possible lesion, and a correct rehabilitative treatment should be started as soon as possible.[21]

As far as the motility and transfer area are concerned, functionality can be assessed and defined using the Modified Rankin Scale,[32] 2' walking test,[33] or 10' walking test,[34] depending on the clinical condition of the patient, and timed up and go test[35] and five-times sit-to-stand test.[36]

Cognitive–emotional–behavioural area

- Presence of cognitive disorders due to the direct effect of COVID-19 on the central nervous system, or due to PICS[19,37]
- Presence of clinical conditions (i.e., electrolyte imbalance) determining reversible cognitive–emotional–behavioural alterations[22]
- Presence of posttraumatic stress disorder or other psychological conditions[38]
- Emotional stress due to isolation from families and other patients.

In this phase, the access of the relatives to the patients was still denied[26] and remote communication between the resident and family members was made possible using video calls and communication facilitators.

Sensory deprivation during hospitalization associated with physical and relational isolation could determine a general decay of cognitive functions or a reactive depressive state proportional to the degree of the frailty of the individual patient.[39] These disorders must be investigated early and thoroughly with standardized tests to define the necessary personalized rehabilitation approach.[40,41]

To comprehensively assess issues in the cognitive – emotional–behavioural area, it is advised to perform the Mini–Mental State Examination,[42] Functional Assessment Battery,[43] and Trail-Making Test (part 1 and part 2).[44]

Outpatient activities

Those activities continued only for nondeferrable treatments as before. A specific Italian Regional law (DGR 3115 from May 7, 2020) defined the criteria and timeframe for the resumption of activities to meet rehabilitation needs.

The re-organization phase

Support to intensive care unit/acute wards

Clinical evaluation in ICU and acute wards continued as stated above.

Clinical evaluation is needed to guide the discharge from ICU or acute wards in order to select the correct intensity of the rehabilitation setting.

Post- and sub-acute rehabilitative wards

Rehabilitation wards were organized considering COVID-19 and COVID-19-free patients separately.

The organization of ward dedicated to COVID-19 patients was modulated with variable complexity and intensity in relation to the severity of the clinical need of the patient by providing (depending on the updated regional or national guidelines) adequate spaces and spacing and PPE.

In some cases, the rehabilitation activities were structured within multidisciplinary departments (e.g., clinical or surgical) dedicated to COVID-19 patients with a homogeneous intensity of care.

In COVID-19-negative wards, maximal attention was paid in the prevention of infectious outbreaks within the rehabilitation community. Inpatient rehabilitation activities inherently require multiple and repeated contacts of each patient with the staff members; furthermore, many hospital areas are shared (i.e., gym, cafeteria, occupational therapy, and speech therapy) with the other hospitalized patients often for an extended period (i.e., months). To permit those contact and avoid the risk of further virus spreading, rules and monitoring of the individual patients and operators were stressed (e.g., regular screening tests as indicated by updated regional or national guidelines). All the other access (other health professional, visitors, and family members) was still limited as much as possible (e.g., allowing visit of relatives of patients who need constant support not available from the staff, allowing medical consultation of external physicians when not executable in telemedicine).

Frequent updates of paths and safety procedures were provided (following the updated regional or national guidelines).

The practical approach considered two different risk classes for those patients:

Class A – observation

To protect both patients and operators:

- Patients admitted to the rehabilitation department for a time longer than the incubation time of COVID-19 (according to updated regional or national guidelines) but with the recent appearance of nonspecific clinical symptoms (e.g., fever, cough, dyspnea, and diarrhea), when waiting and in the absence of instrumental (e.g., chest computed tomography [CT] scan) or laboratory evidence (e.g., swab or serum-immunoglobulins), confirming the suspicion of COVID-19
- COVID-free patients recently (e.g., a time shorter than the expected incubation time of COVID-19) transferred from other departments (even when negative nasopharyngeal swabs or a positive serum-immunoglobulin search is documented before the transfer)
- Asymptomatic patients who have had direct contact with subjects who had confirmed COVID-19 infection during the previous 3 days
- Post-COVID-19 patients, asymptomatic for respiratory disorders, discharged from COVID-19 wards (when a dedicated unit is not provided) after clinical

resolution and with evidence of noninfective condition (at present: double-negative nasopharyngeal swab) according to updated regional or national guidelines.

Staff members come into contact with these patients only if equipped with PPE similar to those used for the COVID-19 patients (according to the procedures indicated by the guidelines, e.g., goggles/visor, water-repellent overcoat, surgical mask, and gloves). They should stay – when possible – in a single room.

They cannot access common areas (e.g., gymnasium, occupational therapy, and speech therapy) nor use devices for therapeutic purposes (unless advanced hygiene practices are adopted after the use of the device). Unfortunately, this aspect could potentially slow down the functional recovery of isolated patients. When possible, it is advisable to allocate small rehabilitative equipment (i.e., weights, rubber bands, and cycle ergometer) in the patient's room to allow him/her to perform a wider set of exercise.

After a period of observation without symptoms, these patients can change their status and enter the risk class B (see next).

Class B – protection

To protect mainly the patients:

- Patients already admitted to the rehabilitation department for a time longer than the incubation time of COVID-19 (according to updated regional or national guidelines). They must have been continuously without clinical symptoms (even nonspecific as fever, cough, and diarrhea), instrumental evidence (e.g., chest CT), or laboratory evidence (e.g., negative swab and serum-immunoglobulins) suggestive of COVID-19
- Patients previously included in Class A (see above): After further quarantine (according to updated regional or national guidelines) with double-negative swab test and in the absence of symptoms and radiological or laboratory findings suggestive for active COVID-19, they can be considered COVID free. In those patients, a positive serum-immunoglobulin search suggests a reached immunization.

Staff members should come into contact with these patients equipped with PPE (i.e., surgical mask, gloves) that protect the patient from a possible source (the staff member) of external contagion. When medical personnel enter in contact with these patients, differently from patients of class A, it is not required to wear an FFP2/FFP3 mask (even if it is advisable if available), and a surgical mask is enough. Furthermore, it is not required to wear goggles. They can stay in double rooms.

They can access common areas (gym, occupational therapy, and speech therapy) and use devices for therapeutic purposes (usual hygiene practices at the end of the use of the device).

Some particular clinical conditions (e.g., presence of tracheostomy, nasogastric tube; cognitive and behavioural deficits) may require derogations or adaptations of the above indications to be discussed for each individual case and where necessary, in a multidisciplinary context.

Outpatient activities

Following the Regional law (DGR 3115 from May 7, 2020) outpatient activity was gradually resumed to provide continuity of care for the patient. The following recommendations were given:

- Encourage the booking of all outpatient services by phone or web
- Have one or more dedicated access points to monitor the body temperature to anyone who enters the waiting room and provide a surgical mask to those who do not have one
- When possible, separate access and exit points from the outpatient area should be provided to ensure an orderly flow
- Adjust the flow before the access check point, ensuring an orderly and correctly spaced row
- Allow only the access to the patient, when possible. An additional subject should be allowed to enter (e.g., family member) if the patient is not self-sufficient/minor
- Adjust the duration and number of visits according to the space available in the outpatient area and the expected influx to avoid overcrowding (minimum 30 min per visit; minimum 10 min every 2 h of air exchange in the visiting room)
- Make provision for the enhancement of routine hygiene measures in the outpatient area and schedule periodic sanitation
- Maintain patient spacing at all times
- Use PPE provided according to updated regional or national guidelines
- Allocate separate paths between outpatients and inpatients
- Activation of teleconsultation and telerehabilitation services has been suggested.

Conclusions

Lombardy's rehabilitation facilities (public and private hospitals, outpatient clinics) have been involved in the COVID-19 pandemic since the first phase, quickly adapting to the new reality with extensive organizational and structural changes.

As one of the hardest-hit areas in the world, Lombardy first-handedly experimented the devastating effect of a full-scale COVID-19 outbreak. On the one hand, rehabilitative patients suffered from the lack of access to rehabilitation; on the other hand, rehabilitation providers had and have the responsibility to avoid the spreading of the virus.

The organizational interventions described before for both inpatient and outpatient rehabilitation services, springing from literature and the experience of the Lombardy section of SIMFER, should help clinicians to respond to the need of the patients facing the new COVID-19 outbreak.

Moreover, the concept of time-dependent rehabilitation emerged in our experience because not all impairments can wait to be treated if disability needs to be prevented. Above all, the general re-organization of health system facing the pandemic must avoid the obsolete idea that PRM is only a generic and symptomatic treatment of late sequelae of "true" diseases.[45,46]

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Conflicts of interest

There are no conflicts of interest.

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