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Proposed practice guidelines for burn centres in the context of the SARS-CoV-2 pandemic

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Dear Editor,

Considering the emergence of numerous cases of SARS-CoV-2 infection and the global pandemic of the disease it causes – COVID-19, healthcare in all the fields of medicine had to adapt to new challenges. Despite the protective measures and management protocols applied, SARS-CoV-2 caused over 3 million infections and 200 thousand deaths worldwide (data of May 2020) [1]. Infection control seems to be essential considering asymptomatic carriers and the latency period from the time of infection to the first symptoms of this viral infection [1, 2]. A special approach is needed in burn centres that manage acute patients, who may potentially require prompt interventions before the initial diagnostic procedures to exclude SARS-Cov-2 infection have been completed prior to initiating burn wound therapy. The first attempt to compile the experience gathered and formulate the management protocols was made by the group from the Zhejiang University School of Medicine in the Handbook of COVID-19 Prevention and Treatment. Thanks to the efforts of the students of the Poznań University of Medical Sciences, the handbook has been translated into Polish (*Podręcznik prewencji i leczenia COVID-19*). Both language versions, containing several suggestions based on the Chinese experience, are widely available on the Internet.

Concurrently, some other groups of researchers have published their findings and the resultant recommendations developed specifically for burn care provision centres. The recommendations can be divided into those regarding the changes in the centre infrastructure, procedures related to admission and classification of epidemiological risks in newly admitted patients, minor procedures (changes of dressings, fluid therapy) as well as surgical procedures, preparation for surgery and anaesthesia, post-procedure management and rehabilitation, if required.

INFRASTRUCTURE OF THE CENTRE

Due to the potential risk of transmission of the infection among patients, many suggestions concern the organization of a given burn care centre. First of all, it is suggested to divide all the activity areas (emergency rooms, clinics, wards and departments, intensive care units) into 3 zones: clean, transiently dirty (potentially dirty) and dirty, according to the epidemiological status of patients managed in the zones. The SARS-CoV-2-infected patients or patients whose infection has not been excluded are hospitalized in the dirty and potentially dirty zones. According to the study by Li *et al*. [3], patients without the symptoms of infection during the 14-day isolation in the dirty zone can be transferred to the clean zone. In contrast to this approach, Ma *et al*. [4] have proposed a 3-5-day observational period, extended to 14 days, if possible. After this period, the patient can be transferred to another part of the centre.

ADMISSION PROCEDURE, RISK ASSESSMENT

On admission, it is obligatory to take the epidemiological history, which includes information about contacts

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with COVID-19 or SARS-CoV2 diagnosed individuals, those with respiratory symptoms (cough, dyspnoea), or fever, as well as contacts of the household with the above mentioned groups [4, 5]. The Chinese authors have suggested screening for those who were present in the Wuhan area or had contact with those residing in the aforementioned areas, in accordance with the local guidelines [5]. The Polish recommendations of the sanitary-epidemiological stations regarding SARS-CoV-2 infections were similarly structured, i.e. they used the epidemiological criterion of "travelled to and stayed in the country in which SARS CoV-2 transmission was observed" [6]. However, due to the presence of local virus transmission, the epidemiological criterion thus formulated has lost its relevance. On admission, obligatory temperature measurements and peripheral blood tests, particularly white blood cells (WBCs), are recommended as well as chest computed tomography (CT). The presence of fever, lymphopenia and CT features of COVID-19 are an indication for consulting the relevant centre for infectious diseases [4]. Some patients with COVID-19 develop acute respiratory failure related to a cytokine storm. It seems grounded to complement the above described examinations with oxygen saturation determinations or gasometry to identify this clinically relevant subgroup [7].

The study performed in 1014 patients in the epidemic region has shown a high sensitivity of chest CT in detecting the lesions which are likely to be responsible for COVID-19. In the subgroup in which the negative genetic test results changed to the positive ones, 67% of patients demonstrated CT features suggestive of COVID-19 [8]. In the group of patients with COVID-10 confirmed in genetic testing, the common radiologic features found on chest CT included: ground glass patterns, nodular lesions, interlobular septal thickening, and an air bronchogram [9, 10]. The changes are mainly located in the lower lobes and subpleurally [11, 12]. The role of CT in the diagnosis of COVID-10 has been proven; nevertheless, it is also stressed that the CT scan itself cannot used to differentiate the cause of changes [9]. Adding CT to the screening algorithm that includes the genetic tests, increases the sensitivity of SARS-CoV-2 detection at an early stage of infection, which has been emphasised in the CEBM guidelines and others [13].

Since the changes are localised subpleurally, the chest ultrasound (US) is a valuable addition while diagnosing COVID-19. The US scan correlates with both the CT scan ($r = 0.65$) and a decrease in saturation during atmospheric air breathing ($r = -0.66$) in the infected patients [14]. The most common US imaging pathologies are diffuse B lines and subpleural consolidations [15, 16]. Until the SARS-CoV-2 infection has been excluded, the patients should stay in isolation rooms. The opinions regarding the patients who have to be assisted by their carers are inconsistent; according to Ma one care giver is acceptable; in paediatric patients, Li suggests two carers at most [3, 4]. All the authors agree that the carers should undergo the same temperature measurements and epidemiological screening as the patients. Importantly, the carer cannot be a patient infected with COVID-19, suspected of SARS-CoV-2 infection or an individual who had contact with SARS-CoV-2. Moreover, it is not recommended to change the carer or allow him-her to leave the isolation room [3, 4]. To balance the restricted direct social contact of the hospitalised patients and to reduce the risk of infection transmission by family members, remote contact measures are suggested [3].

IN-HOSPITAL PROCEDURES

Huang *et al*. [5] have made the attempt to analyse the procedures performed in patients with burns exceeding 50% of the total body surface area. The most common procedures were changes of dressings and intravenous fluid therapy (100% of cases), followed by provision of central venous access (28% of cases), endotracheal intubation, and tracheostomy (19%). Moreover, the authors stress that in the most severely or critically ill patients, tracheostomy is likely to be performed in the intensive care unit setting, which may have an impact on a possible risk of infection. According to the available literature dealing with the diseases caused by corona viruses, all the procedures involving the airway are characterised by the highest risk of Corona virus transmission [17], which is associated with aerosol generation (relative risk of infection transmission = 6.6) [18]. The simulations in the model of endotracheal intubation have demonstrated that significant amounts of the aerosol deposit on the facial skin, hair, and shoes despite the use of N95 masks, eye and hand protective measures as well as protective aprons [19]. Considering the above, Huang *et al*. have suggested dividing the personal protective measures (PPMs) into routine, everyday use and those for special cases requiring direct contact with patients. The last group of PPMs can be divided into 3 levels according to a potential risk of infection. Routine protective measures include surgical masks, standard hand hygiene and additionally gloves whenever necessary. In cases in which the personnel stays in the same ward (room) with pyretic patients, the use of surgical caps and hospital gowns with an additional layer of disposable clothes is advisable; moreover, gloves are obligatory, protective shoe covers can be considered. The next level of protection regards direct management of patients suspected of or with confirmed SARS-CoV-2 infection and involves the use of N95 masks, protective shoe covers, face shields or goggles. The highest level of protection concerns the procedures which potentially generate aerosol, i.e. endotracheal intubation, provision of artificial airways, and bronchoscopic procedures. In such cases, all the above-mentioned strategies are obligatory; additionally, a double layer of protective gloves is required. In addition to the PPMs mentioned above, Li *et al*. [3] suggest performing the procedures in the isolation rooms, preferably in negative pressure isola-

TABLE 1. Personal protective measures depending on the potential risk (based on [5])

Level of protection	Clinical setting	Hand hygiene	Surgical cap	Airway protection	Goggles or face shield	Gloves	Additional protective clothes	Shoe covers
Routine	Everyday ward	+	–	Surgical mask	–	To consider	–	–
1st level	Department with patients with fever	+	+	Surgical mask	–	+	+	+
2nd level	Suspicion/confirmation of SARS-CoV-2	+	+	N95 mask	To consider	+	+	+
3rd level	Procedures generating aerosol	+	+	N95 mask	+	+ Two pairs	+	+

tion rooms. All the above protective strategies are listed in Table 1.

The basic procedure in patients with airway burns is bronchoscopy. The guidelines regarding bronchoscopy during the COVID-10 pandemic, published by the CHEST, suggest testing the asymptomatic patients from the areas where SARS-CoV-2 transmission is observed prior to bronchoscopy. Furthermore, if the patients belonging to this group as well as those suspected of or with confirmed SARS-CoV-2 infection undergo bronchoscopy, the bronchoscopists should use N95 masks or powered air-purifying respirators (PAPRs). The same protective equipment ought to be used in the post-procedural observational room. Scheduled bronchoscopies in patients who recovered from COVID-20 should be postponed, yet for how long is unknown. It is suggested that for 30days after the symptoms have subsided and two genetic tests for SARS-Co-2 have been negative [20].

The above proposed guidance can be compared with the Polish consensus statement of the Working Group of the National Consultant in Anaesthesiology and Intensive Therapy of June 3rd, 2020. The statement regards all the procedures. In accordance with the applicable regulations, the statement distinguishes emergency, urgent, accelerated, and scheduled procedures. When the procedure (irrespective of its mode) has to be carried out in a patient of undefined status, the full set of protective devices should be applied, i.e. FFP2 or FFP3 masks, goggles, face shields, gowns, or protective aprons. According to the recommendations, patients with negative SARS-CoV-2 tests should be treated as non-infective patients throughout the hospitalisation, unless the symptoms of infections have developed during their stay in hospital [21].

PREPARATION FOR SURGERY, ANAESTHESIA

Pre-procedural management strategies change depending on the category the patients are assigned to: patients undergoing scheduled or emergency procedures with SARS-CoV-2 excluded or those suspected of/with confirmed SARS-CoV-2. Three groups of patients are distinguished, which require different management protocols: patients with excluded SARS-CoV-2 awaiting scheduled or emergency procedures, patients of unknown condition awaiting scheduled procedures and those of unknown status requiring emergency procedures.

It is suggested to postpone all the scheduled surgical procedures. In this group, Huang suggests screening of patients (routine laboratory tests, chest CT, tests for the presence of SARS-Cov-2 genetic material) for reliable exclusion or inability to exclude SARS-CoV-2 and further management depending on the result obtained [3, 5]. Irrespective of the procedure mode of surgery (emergency, scheduled), it is advised to perform the procedures in patients with excluded SARS-CoV-2 following the previously used standard protocol [5]. The group that requires the most meticulous approach includes patients of unknown status who have to undergo emergency procedures. If the patient`s condition allows, screening tests are recommended; however, the authors emphasise that the procedure may take at least 6 hours. In patients in whom the screening procedure is infeasible, the surgery should be performed in the operating room under negative pressure and using the 3rd level PPMs (Table 1) [5].

According to the above-cited Polish statement of the Working Group, in patients qualified for accelerated or scheduled procedures, the material for SARS-Co-2 infection should be routinely collected. PCR techniques are suggested and not serological tests. In patients undergoing emergency or urgent procedures, the material should be collected yet the procedure should be postponed until the results are available. Before emergency procedures, the patients should be collected after surgery, during preparation for or provision of anaesthesia. Urgent procedures should be preceded by testing only when the test result can be known withing 4 h; in the remaining cases, the protocol for emergency procedures is followed. Aside from the epidemiological history and temperature measurements mentioned in some guidelines, screening chest X-ray is suggested instead of CT recommended by Chinese authors. Moreover, prior to the surgical procedure, 7-day isolation, self-monitoring of temperature, use of protective masks and limited contact are advised. The date of material collection and of surgery should be selected to be able to perform the procedure within 72 h after the negative PCR result has been obtained [21].

POST-PROCEDURE MANAGEMENT AND REHABILITATION

Post-operative management should include standard patient`s assessment;

additionally, it is strongly emphasised to evaluate possible symptoms of the respiratory infection. When they occur, the centre for infectious diseases should be consulted to determine further management, including potential therapy of infection [4].

It is recommended to restrict contacts with patients during postoperative rehabilitation after discharge. Instead, remote methods of contacts are suggested to supervise and modify the process of rehabilitation [3, 4].

CONCLUSIONS

COVID-19 is a novel disease and therefore, the available data and recommendations based on them are far from complete. Three major recommendations repeated in the studies include: the use of screening with history taking as well as imaging techniques and laboratory testing, routine use of personal protection measures and restricting contact to emergent cases. The above recommendations are an attempt to summarise the current state of knowledge and to present our opinion in the discussion regarding the strategies of adjusting the health care institutions to functioning during the epidemic.

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