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Infection control practices and device management when mobilizing critically ill patients

Early mobilization and rehabilitation are recommended for critically ill patients in intensive care units (ICU), especially given the large impact on critical illness due to the COVID-19 pandemic.¹ During early mobilization, unnecessary intravenous infusions may be a barrier or potential safety concern.² Hence, intravenous infusions and invasive medical devices are often temporarily disconnected/discontinued to improve feasibility of mobilization and reduce the risk for accidental dislodgement or removal. In addition, urine collection and fecal management systems may be re-positioned, and ventilator circuits may be temporarily disconnected if using a transport ventilator during ambulation. All of these procedures have the potential to increase the risk of infection. While general recommendations exist for preventing and controlling infections within the healthcare setting, there are little existing data on how to reduce such potential infectious risks and little associated guidance when mobilizing critically ill patients. Hence, the

objective of this paper is to provide guidance on infection prevention and related safety issues for ICU-based mobilization. A group of critical care rehabilitation experts, consisting of three different professions (Nursing, Medicine, and Physiotherapy), from four different continents (North America, Australia, Asia, and Europe), all with expertise in rehabilitation-related clinical practice and research, created and iteratively refined this guidance, based on current literature and clinical experience.

The World Health Organization (WHO) recommends “5 moments for hand hygiene.”³ This concept is relevant to mobilization and rehabilitation, including cleaning and disinfecting health-care providers’ hands before touching a patient, before clean/aseptic procedures (e.g., disconnection of intravenous catheters), after body fluid exposure risk, after touching a patient, and after touching the patients’ surroundings. The WHO also recommends performing a risk assessment for possible contamination and the need for personal protective equipment (PPE) prior to mobilization.⁴ Patients with COVID-19 or other airborne infections require special considerations, including use of closed ventilator circuits, appropriate PPE, and decontamination of re-usable equipment to reduce cross-contamination.

To address infection control concerns, we recommend separating medical devices into 3 categories, each requiring a specific action plan (Figure 1). First, “clean” devices (e.g. central venous catheter), which require aseptic procedures during disconnections, have a high risk of becoming contaminated, and require hand disinfection before any manipulation or disconnection. Second, “neu-

Figure 1.—Infection control procedure before mobilization. First, disinfect hands. Start with clean lines/tubes, continue with neutral lines, and end with dirty lines. “Clean” devices, such as central venous catheters, have a high risk of being contaminated and hand disinfection before disconnection is required. “Neutral” devices have a low risk of being contaminated. “Dirty” devices have a high risk of being contaminated and change of gloves and disinfection after disconnection are required. Note: these recommendations should be adapted to local policies and patients’ conditions. ETT: endotracheal tube; ECG: electrocardiogram.

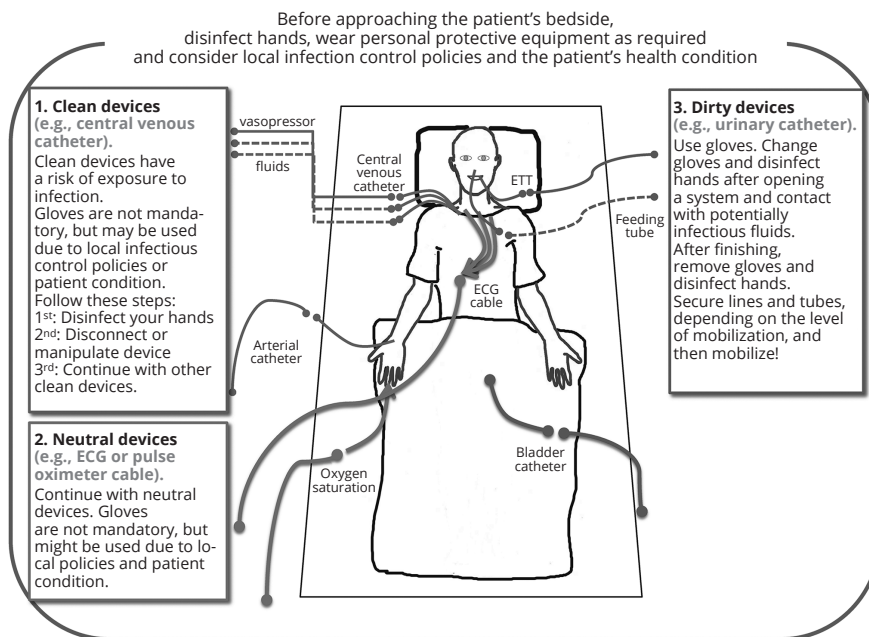


TABLE I.—*Checklist before early mobilization.*

Organizational assessment	Check
Portable ventilator, monitor, suction device, oxygen, and manual resuscitator bag are available if plan for mobilization away from bedside	<input type="checkbox"/>
An experienced physician is available nearby	<input type="checkbox"/>
Mobilization equipment is available (e.g., wheelchair, sliding board, walker) depending on the mobilization target and required support	<input type="checkbox"/>
Patient assessment	
Level of consciousness, presence of delirium, and physical function ^a is assessed	<input type="checkbox"/>
Inclusion and exclusion criteria for mobilization, including risks are checked ^b	<input type="checkbox"/>
Based on patients' assessment, a target mobilization level has been defined	<input type="checkbox"/>
Explanation provided to patient and any concerns addressed, or an alternative plan is developed	<input type="checkbox"/>
Involvement and instruction of family members	<input type="checkbox"/>
Device, tubes, and lines are assessed	<input type="checkbox"/>
All devices, tubes and lines are secure and checked ^c	<input type="checkbox"/>
If away-from-bed mobilization is planned, a decision between necessary and unnecessary continuous infusions ^{d,e} has been made, based on physician consultation and local practice. In general, life-saving infusions must be kept	<input type="checkbox"/>
If medical devices can be disconnected or removed, infection control practices are applied (Figure 1)	<input type="checkbox"/>
Lengths of tubes and lines are checked, according to the targeted mobilization level. Extended lines are applied, if needed, before mobilization	<input type="checkbox"/>
Safety loops and fixations for tubes and lines are applied	<input type="checkbox"/>
Ventilator circuits: ventilation circuit is fixated with only light to moderate pressure on the endotracheal tube/tracheal cannula (ETT/TC). In case of tension, the circuit will be disconnected, but the ETT/TC remains in place	<input type="checkbox"/>
Team assessment	
<i>A priori</i> assessment and consideration of potential safety risks during mobilization, potential strategies and alternatives are discussed and readily available	<input type="checkbox"/>
All involved clinicians, patient, and family member know the targeted mobilization level and the procedure, all questions have been addressed prior to mobilization	<input type="checkbox"/>
All involved clinicians, patient, and family members know their roles and responsibilities	<input type="checkbox"/>
A stopping code is known to all involved persons, e.g. shouting "stop!", or raising hand	<input type="checkbox"/>

^ae.g., Richmond Agitation Sedation Scale, Confusion Assessment Method for the Intensive Care Unit, and Medical Research Council scoring of muscle strength; ^bby Traffic Light System including, green (color in the online version): benefits outweigh risks, yellow (color in the online version): individual decision due to balanced benefits and risks, red (color in the online version): risks outweigh benefits of mobilization,⁵ or other detailed safety criteria for consultation with physical and occupational therapists in the intensive care unit (see free resources available at: <https://www.johnshopkinssolutions.com/solution/amp/activity-mobility-promotion-amp-icu/>); ^cif fixations of devices do not appear to be safe, change before mobilization and apply safe fixations; ^de.g., vasopressors, antiarrhythmics, antihypertensive infusions should be continued without any interruptions; ^ee.g., parenteral nutrition and dietary supplements.

tral" devices that are part of the patient's surroundings and have a low risk of being contaminated (e.g. cables for cardiac monitoring), do not require repeated hand disinfection. Third, "dirty" devices, which have a body fluid exposure risk and are a source of

possible contamination, require a change of gloves and disinfection of hands after manipulation or disconnection to protect patients and clinicians (Figure 1). These steps should also include preparing and cleaning any necessary equipment.

Clinicians should be aware of patients' infection-related isolation status to avoid nosocomial infection between patients due to close contact of clinician with patients during mobilization. Accordingly, PPE should be considered for mobilizing such patients and to protect immunocompromised patients.

With respect to managing medical devices, especially before out-of-bed mobilization and ambulation, clinicians often consider temporary disconnection of non-essential catheters and tubes. All life-saving and essential infusion medications, such as vasopressors, antiarrhythmics and antihypertensive drugs, should not be disconnected. In most cases, these medication infusions have a very short half-life and interruption could lead to critical safety events. Hence, these catheters should be secured and infusions continued without interruption. Other infusions, such as parenteral nutrition, dietary supplements, and electrolyte replacement, generally can be temporarily disconnected. Infusions with a longer half-life, such as opiates, may require individual decisions depending on patient need. In general, every disconnection of a medical device should be carefully considered by balancing risks and benefits, and then be performed with consideration of infection control, as mentioned above.

With increasing mobilization levels, there may be cardiac and pulmonary adaptations. Hence, supporting medications and medical devices may be adjusted before and during mobilization activities. For example, a clinician may increase the dose of a vasopressor infusion before mobilization for patients with known postural hypotension, or may titrate ventilator settings for mobilization with potential change in ventilator mode or increase in pressure support, flow rate, oxygen and/or positive end expiratory pressure to minimize respiratory distress or fatigue.

Mobilization is a necessary part of the complex and holistic rehabilitation process and requires the collaboration of many different professions. To enhance mobility and patient safety, medical devices should be secured or, if possible, temporarily removed and re-connected after mobilization. Especially larger bore access devices (e.g., for Extra Corporal Membrane Oxygenation [ECMO] or Continuous Renal Replacement Therapy [CRRT]) require special attention, careful securement, and safety management. Team training, including planning for worst case scenarios, might be considered prior to rehabilitation activities. Securing infusion catheters can be performed by using clips, hook-and-loop fasteners, and plasters. Other solutions are extended lengths of intravenous lines for infusions and of tubing for ventilator circuits – some manufacturers offer lines and circuits with 2- or 3-meter length, enabling standing, walking in place or around the bed, without any disconnection.

The same principles apply when the mobilization has ended, including an organized assessment of patient, devices, tubes, and catheters (Table I). Potential safety events should be monitored, with standardized definitions and coding for such events available.⁵ Frequent infection control should be applied and monitored, with results communicated within the team. When all ICU and rehabilitation professions follow these hygienic rules, infection risks can be minimized. Attention to these infection control and device management principles are important to helping ensure safety throughout mobilization.

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