

Case Report

A Case Series of Trauma Resuscitation in the Intensive Care Unit Bypassing the Emergency Room During the Conversion to a COVID-19 Only Hospital



Seok Hwa Youn ^a, Hyemi Kwon ^b, Sun Young Baek ^a, Sung Soo Hong ^a, Younghwan Kim ^{a,*}

^a Department of Surgery, National Medical Center, Seoul, Korea

^b Department of Nursing, National Medical Center, Seoul, Korea

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*Corresponding Author:

Younghwan Kim
Department of Surgery, National Medical Center, 245, Eulji-ro, Jung-gu, Seoul, 04564, Korea
E-mail: galgunbam2@daum.net

ORCID

Seok Hwa Youn
<https://orcid.org/0000-0001-5983-3056>
Hyemi Kwon
<https://orcid.org/0000-0002-0743-5571>
Sun Young Baek
<https://orcid.org/0000-0002-3327-5938>
Sung Soo Hong
<https://orcid.org/0000-0001-7343-6276>
Younghwan Kim
<https://orcid.org/0000-0003-3836-8743>

ABSTRACT

When a patient with severe trauma is admitted to the emergency room (ER), they are evaluated before transfer to either the intensive care unit (ICU) or operating room. To minimize the time until a definitive treatment can be provided, direct operating room resuscitation can be performed. In this hospital the ER was closed during the hospital's transition to a coronavirus disease 2019-dedicated hospital, and direct ICU resuscitation for patients with trauma was performed for a short period. To perform effective trauma resuscitation, all ICU beds were reorganized to achieve a modified, experienced nurse: patient ratio (1:2-3) and 2 beds were assigned for trauma ICU resuscitation alone. The equipment for initial resuscitation was installed and ICU nurses received training. Consultations with the hospital administration, nursing, and pharmaceutical departments were completed in advance to avoid formal problems. Conversion of the ICU for direct resuscitation procedures was performed in 4 patients.

Keywords: COVID-19 pandemic, resuscitation, trauma

Introduction

Hospital treatment of patients is typically via the Outpatient Department or Emergency Department. Those patients with mild disease or elective appointments undergo a planned hospitalization via the Outpatient Department, while patients with a critical status present at the Emergency Department and are treated in the emergency room (ER). In cases of severe trauma, well-trained personnel perform the initial assessments within a short period of time using equipment installed in the resuscitation room. After emergency treatment, according to the results of secondary assessments, treatments continue following the appropriate transfer, for example to the intensive care unit (ICU), operating room (OR), or angiography room [1,2]. However, to shorten the waiting time for surgery, direct

OR resuscitation in patients in extremis has been performed, and good results regarding mortality have been reported [3-5]. However, in most cases, the Emergency Department plays an important role in managing patients with severe trauma, and it has a solid position as the gateway for receiving patients, except in cases where surgical intervention is urgently needed, and where direct OR resuscitation may be beneficial. However, ERs close for various reasons, and a lack of beds is probably the most common reason. In this case, our hospital closed the ER whilst preparing for its conversion to a coronavirus disease 2019 (COVID-19)-only hospital in February 2020. The role of treating patients with severe trauma had to be maintained so direct ICU resuscitation was performed. Patients with trauma who were transferred from another hospital went straight to designated ICU beds (bypassing the ER). Patients from the field were not

received by this hospital because the ER was closed. We report 4 cases of direct ICU resuscitation. To the best of our knowledge, this is the 1st report on direct ICU resuscitation in patients with trauma.

Case Report

1. Preparation process

The trauma ICU (TICU) for the direct resuscitation of patients with severe trauma was modified. Two beds near the entrance were designated as the beds where direct resuscitation would be performed and were left empty until required. As in the ER, equipment and items required for resuscitation were arranged so that they were immediately available. Nursing staff were assigned patients according to their experience, and the severity of the condition of the patient arriving at the TICU so that direct ICU resuscitation could begin immediately after nursing bed assignment.

The TICU is a part of a mixed surgical ICU, which includes 21 beds in total, and was intended to have a 1:3 nurse: bed ratio. For patients to receive direct ICU resuscitation, experienced nurses oversaw 2-3 beds including 1 bed for direct resuscitation. In the event of an empty bed due to patient discharge, the empty bed was assigned to a less experienced nurse at a ratio of 1:4

nurse: bed ratio to reduce their workload (Figure 1).

Patients with severe trauma who were transferred from the ER of other hospitals were accepted. After receiving the call, personnel and equipment were prepared, and the related departments were contacted. The patient was registered on the electronic medical record system before the patient arrived at the ICU. Based on the communication with the medical staff from the other hospital, medications were prescribed, and an environment similar to the resuscitation room in the ER was created. When the patient arrived resuscitation was started immediately.

The study protocol was approved by the Institutional Review Board (IRB) of the National Medical Center (IRB no.: NMC-2008-045). Informed consent was waived by the IRB.

2. Case descriptions

Case 1 was a 49-year-old man who was transported to a nearby university hospital 30 minutes after a car accident. Following the initial resuscitation, the patient was transferred for management of traumatic pan-peritonitis caused by bowel perforation. He arrived at this hospital 5.5 hours after the accident. Immediately after receiving notification of his departure from the university hospital, the ICU was notified, patient information was registered, and prescriptions entered before the patient arrived (all in preparation for an immediate resuscitation). The patient bypassed the ER and was immediately admitted to the ICU. After 18 minutes, he was moved to the OR. The injury severity score (ISS) was 19. The diagnoses included jejunal perforation, mesentery laceration, traumatic pneumothorax, lung contusion, and a left tibial plateau fracture. The patient was discharged after 23 days.

Case 2 was a 64-year-old man who visited a university hospital because of a fall in the shower room. Angioembolization was performed 12 hours later due to spleen laceration and hemorrhagic shock. He had intermittent signs of shock with continuous hemorrhage. He was directly transferred to the ICU 19 hours after the injury, and resuscitation was performed. His ISS was 14, which included 6 rib fractures and spleen lacerations. The patient was discharged after 20 days.

Case 3 was a 72-year-old man with a history of malignant melanoma who was diagnosed with shock and hemoperitoneum at a university hospital after being stabbed in the abdomen. He was transferred to this hospital 5 hours 45 minutes later. Prior to transfer, the staff were contacted to prepare for directly admitting the patient to the ICU and preparing for emergency surgery. Immediate resuscitation was performed with positive results in the Focused Assessment with Sonography for Trauma, and emergency surgery started 30 minutes after admission. The ISS was 16, which included superior epigastric artery rupture and omental laceration. The patient was discharged 11 days later in a better condition.

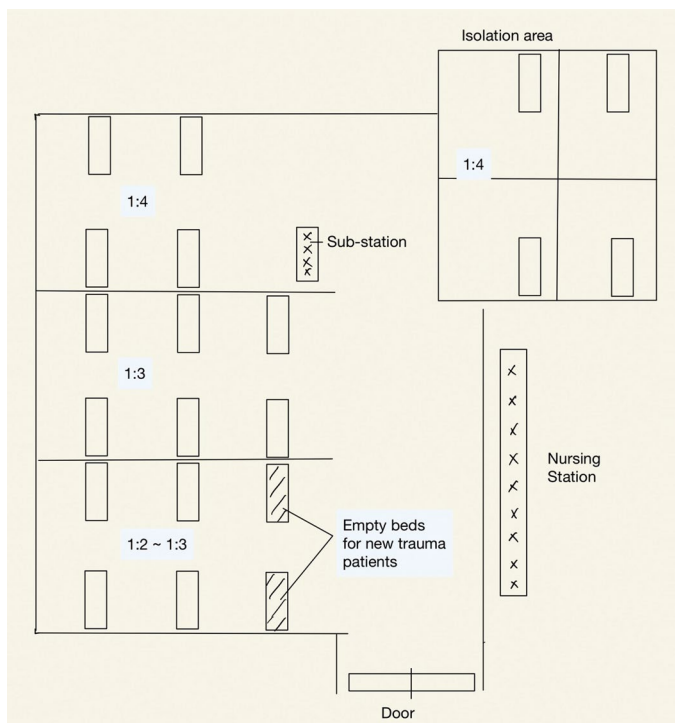


Figure 1. Allocation of nurses in the trauma ICU and the position of beds for patients to receive direct ICU resuscitation. The experienced nurse: patient ratio was 1:2-3 (2 empty beds for patients to receive direct ICU resuscitation). The intermediate experienced nurse: patient ratio was 1:3. The less experienced nurse: patient ratio was 1:4. ICU = intensive care unit.

Case 4 was a 45-year-old male patient who had a car accident and was admitted to another hospital following cardiopulmonary resuscitation at the scene. The patient had experienced hypoxic brain damage, and diffuse cerebral swelling had developed. He was transferred to this hospital 15 hours after injury. He had an impending cardiac arrest at the time of arrival. He was directly admitted to the ICU and immediate resuscitation was performed. The ISS was 33. Brain death occurred, and organ donation surgery was performed on the 24th day of hospitalization.

Discussion

The ER exists for patients who need urgent or emergency medical services. The resuscitation room in the ER is for critically ill patients and provides a space for the optimal treatment of patients with severe trauma. In this area of the ER, there are various devices such as ventilators and ultrasound. Many tools for airway management, circulation management, variable line insertion, irrigation, and dressing are used in primary and secondary resuscitation according to the Advanced Trauma Life Support algorithm. All the necessary equipment is provided in that space which is fully equipped with emergency medication. However, ER closures may occur under special circumstances. At the beginning of the COVID-19 epidemic in South Korea, this hospital was preparing for its conversion to a national, public COVID-19-only hospital, and the ER was closed.

The time from injury to definitive treatment of patients with severe trauma greatly affects the prognosis and preventable death rate, and there are reports of missing the golden time period to treat trauma patients due to an extended stay in the ER [4,6-8]. In trauma patients who need surgery, studies of OR resuscitation were conducted to determine a selective way to reduce the time spent in the ER, and the mortality results were positive [3-5].

For patients with severe trauma who do not require emergency surgery, direct ICU resuscitation could also improve the results by reducing the length of stay in the resuscitation room. This is because a reduced time in the ER is associated with a decline in mortality of patients with severe trauma [9]. The expectation is that the acceptance rate of those patients from the field would increase. However, thus far, there have been few reports of direct ICU resuscitation, probably because the ER is optimized for initial treatment.

In the ICU, medical staff take over the patients' care following sufficient communication and information regarding patients who deteriorate during hospitalization, surgery, or intervention or who have completed initial resuscitation in ER. Therefore, to perform a successful initial resuscitation of severe trauma

patients in the ICU (which has not been common until now), it is necessary to achieve optimal manpower, structural, material, and procedural measures.

For optimal initial trauma resuscitation in the ICU, the nurses in charge require sufficient experience because studies have suggested that the longer the career of the ICU nurse, the more consistent the clinical decision-making is [7,10]. There were 2 empty beds specifically assigned for patients to receive direct ICU resuscitation which were located near to the entrance of the ICU for easy transport. To minimize errors in managing critically ill patients, experienced nurses managed beds at a ratio of 1:2-3, including those trauma beds; ratios of 1:4 were mainly for nurses with less experience, and if the patient was discharged, the bed was included in this group count to minimize the increase in workload for less experienced nurses (Figure 1).

To create an optimal environment for performing an initial resuscitation (as when treating in the ER resuscitation room), patients were registered on the computer during the transfer from another hospital so that the patient was admitted directly to the ICU, bypassing the ER. The prescriptions were filled and instruments and drugs were set up near the bed, and items such as a rapid infusion system, a resuscitative thoracotomy set, and resuscitative endovascular balloon occlusion of the aorta were arranged according to the expected patient's condition. This was performed before the patient arrived, and related personnel were sufficiently informed in advance to enable a smooth resuscitation process. For these assessments, close consultations must be carried out with related departments, such as hospital administration, nursing, and pharmaceutical departments.

There were 4 successful cases of direct ICU resuscitation during the period of ER closure. Therefore, as with OR resuscitation, the experience following direct ICU resuscitation of patients with severe trauma indicates that the significant limitations posed may be overcome. Direct ICU resuscitation may successfully reduce the time spent in the ER and improve mortality rates.

Author Contributions

Study conception: YSH and HSS. Validation: KH. Investigation: YSH and KH. Manuscript writing: YSH and BSY. Manuscript review and editing: YSH and KY.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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Ethical Statement

Not applicable.

Data Availability

All relevant data are included in this manuscript.

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