学 位 論 文 の 要 旨

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学　位　論　文　名　Effective Use of the Hybrid Emergency Room System in the Treatment of Non-Traumatic Critical Care Diseases

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論 文 内 容 の 要 旨

INTRODUCTION

The hybrid emergency room (ER) is an emergency department equipped with a self-propelled computed tomography (CT) and angiography system. The hybrid ER can provide initial care, resuscitation, CT imaging, endovascular treatment, and emergency surgery, including damage control surgery (DCS), without transferring the patient. We reported that treatment in the hybrid ER contributed to a reduction in blood transfusion doses in patients with severe trauma. However, although several reports have demonstrated the effectiveness of the hybrid ER for trauma conditions, only a few case reports have demonstrated its usefulness for non-traumatic critical diseases. In this observational cohort study, we aimed to identify endogenous diseases that may benefit from treatment in the hybrid ER.

MATERIALS AND METHODS

We retrospectively reviewed the clinical characteristics of patients with non-traumatic conditions treated in a hybrid ER between August 2017 and July 2022 at our institution. Patients who underwent surgery, endoscopy, or interventional radiology (IR) in the hybrid ER were selected and pathophysiologically divided into a bleeding and non-bleeding group. The rate of shock or cardiac arrest, blood transfusion, and death within 24 h of admission or in-hospital death were compared among the groups using Fisher’s exact test. Multivariable logistic regression analysis was performed to confirm the relationships among in-hospital mortality, transfusion, and

hemorrhagic conditions in patients who underwent endoscopy and IR. This study protocol was approved by the Research Ethics Committee of Shimane University on September 27, 2021 (approval number 20210624-1).

RESULTS AND DISCUSSION

Among the 2,561 patients treated in our hybrid ER between August 2017 and July 2022, 1,996 trauma and burn patients were excluded from this study. During the same period, 161 hospitalized patients were treated in the hybrid ER. In total, 726 patients with endogenous disease (426 men and 300 women; median age: 72 years, interquartile range: 54–84 years) were included in this study. Gastrointestinal hemorrhage was the most common cause (117 cases, 16.1%), followed by acute abdomen (116 cases, 16.0%) and intra-abdominal infection (112 cases, 15.4%). Among the 726 patients with non-traumatic conditions treated in a hybrid ER system, 50 (6.9%) experienced cardiac arrest at or before admission to the hybrid ER, 301 (41.5%) were in shock, 126 (17.4%) received blood transfusions, 42 (5.8%) died within 24 h of admission to the hybrid ER, and 141 (19.4%) died in the hospital. Emergency surgery was performed in 39 patients (7 in the bleeding group and 32 in the non-bleeding group). Significantly more blood transfusions were administered in the bleeding group (71.4% vs. 18.8%, P = 0.01); there were no significant differences in the rate of shock or cardiac arrest, death within 24 h, or in-hospital death between groups. Endoscopy was performed in 122 patients (80 in the bleeding group and 42 in the non-bleeding group). The bleeding group had a significantly higher rate of shock or cardiac arrest (87.5% vs. 66.7%, P=0.008) and rate of blood transfusion (62.5% vs. 4.8%, P< 0.0001); there was no significant difference in death within 24 h and in-hospital death between groups. IR was performed in 100 patients (68 in the bleeding group and 32 in the non-bleeding group). Significantly more blood transfusions were administered in the hemorrhage group (67.7% vs. 12.5%, P<0.0001); there was no difference in the rate of shock or cardiac arrest, death within 24 h, or in-hospital death between groups. Multivariable analysis in patients who underwent endoscopy showed a trend toward more in-hospital deaths in non-hemorrhagic conditions than in hemorrhagic conditions (odds ratio=3.8, 95% confidence interval: 0.88–17, P=0.073); however, no significant relationship with in-hospital death was observed for any of the adjusted variables.

This study showed that the hybrid ER may be suitable for patients with shock or CA requiring endoscopic or IR hemostasis. Meanwhile, there may be little benefit for diseases that do not require hemostasis, such as sepsis, even if the patient is in septic shock. For CA, severe pulmonary embolism, and myocardial infarction that would require extracorporeal cardiopulmonary resuscitation, the number of patients in this study was too small to determine the effectiveness of treatment in the hybrid ER. We identified various endogenous diseases that might benefit from treatment in the hybrid ER to limit the target diseases and improve the effective use of

the limited medical resources of the hybrid ER.

The hybrid ER can be used for performing CT imaging, endovascular treatment, and emergency surgery including DCS without transferring the patient, making it more effective for prompt diagnosis and treatment of hemodynamically unstable patients. Hemodynamic instability in endogenous diseases can be caused by various factors, such as hemorrhage, sepsis, and obstructive shock. Gastrointestinal bleeding, acute abdomen, and intra-abdominal infection accounted for most non-traumatic cases treated in our hybrid ER in the last 5 years, with the total number of these cases reaching approximately 50% of the non-trauma cases. Rapid identification of the bleeding point and prompt hemostatic treatment are particularly important in hemorrhagic shock due to gastrointestinal bleeding. Approximately 80% of patients undergoing endoscopy or IR in the hybrid ER presented with shock, most of them with hemorrhagic conditions. Although patients with hemorrhagic conditions were administered significantly more blood transfusions than those with non-hemorrhagic conditions, no significant difference in prognosis was observed. Further, although patients who underwent endoscopy in the bleeding group presented with significantly greater shock and received more blood transfusions, multivariable analysis showed a non-significant trend toward improved prognosis in the group with hemorrhagic conditions. These results could be attributed to prompt hemostatic treatment in the hybrid ER, as well as appropriate transfusion strategies. Prompt initiation of transfusion is a common strategy in trauma care. Moreover, approximately 60% of patients administered transfusions received emergency transfusions in the hybrid ER; therefore, adaptation of these appropriate transfusion strategies to endogenous disease may also have been effective. Thus, for endogenous diseases, the hybrid ER may contribute to the treatment for hemorrhagic conditions that require hemostasis by endoscopy or IR.

CONCLUSION

The hybrid ER can simultaneously provide rapid diagnosis; appropriate treatment; and resuscitation, including blood transfusion, without transferring the patient. For non-traumatic conditions, hybrid ERs may be effective in the treatment of critical patients, especially for those with hemorrhagic conditions requiring endoscopic or IR hemostasis. Further studies are needed to establish the efficacy of the hybrid ER for these diseases.