endemic pharyngitis at a rate similar to that of group A beta-hemolytic streptococcus, with a reported incidence of about 10% [4,7]. Therefore, in addition to group A streptococcus, *F. necrophorum* should be considered when adolescent patients present with pharyngitis. Recently, more cases of MRSA-associated Lemierre's are now being reported, which we found in our study population [5,6]. Currently, there is no rapid diagnostic test available to identify *F. necrophorum* pharyngitis [7]. When pharyngitis does not improve as expected with typical antibiotic coverage (within 3–5 days) and unilateral neck swelling develops, physicians should consider an expanded differential diagnosis for uncommon infectious sources [4]. This should include suppurative complications (peritonsillar abscess and the Lemierre syndrome), group A, C, or G streptococcal pharyngitis, infectious mononucleosis, and acute HIV infection [4]. Diagnostic imaging, including cervical and thoracic CT and/or ultrasound should be considered. If the patient has bacteremic symptoms, it has been suggested to treat either with a combination of penicillin and metronidazole, or with clindamycin alone to target *F. necrophorum* and streptococcal infections [4]. If MRSA is isolated, antimicrobial regimens must be adjusted accordingly.

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Emergency physicians and nurses can provide percutaneous cardiopulmonary support in emergency departments

To the editor,

The therapeutic benefits of extracorporeal cardiopulmonary support have been demonstrated in patients with cardiac arrest, cardiogenic shock, and pulmonary embolism [1-4]. Under most circumstances, extracorporeal cardiopulmonary support requires well-trained and fast-reacting cardiovascular surgeons and perfusionists to perform a cardiopulmonary bypass. However, it is difficult to equip a 24-h on-call team with at least a cardiovascular surgeon and a perfusionist in most health care facilities, which confines the application of extracorporeal cardiopulmonary support to emergent conditions.

Percutaneous cardiopulmonary support (PCPS) was introduced as an alternative to extracorporeal cardiopulmonary bypass and became a useful procedure because of its portability, rapid priming, and ease of handling [5]. In the emergency department of our institution, we developed a protocol with EP- and EN-operated PCPS, which consisted of education programs and ultrasound-guided placement of PCPS. We described this protocol and verified its efficiency in the emergency department.

A total of 33 EPs, 24 residents, and 114 ENs were present in the emergency department of Chi-Mei Medical Center to provide medical services. First, an experienced cardiovascular surgeon and a perfusionist were invited to our emergency department to demonstrate the cannulation and operation of PCPS. Then, we held workshops and seminars about PCPS and related videos on PCPS on social media among the group of EPs and ENs. Additionally, we debriefed all participants in the emergency department after each implementation and operation of PCPS.

From August 2016 to September 2017, the EPs conducted 7 attempts to apply PCPS (Capiox EBS, Terumo, Japan) on critical patients in the emergency department. At least 3 EPS and 3 ENs constituted a team. The EPs used ultrasound (SonoSite Edge II, Japan) to identify the positions of the common femoral artery and vein of each patient. Next, they performed a percutaneous puncture to obtain vascular access and thread a guidewire through. Another EP used ultrasound to scan the patient's femoral artery and inferior vena cava to determine the position of the guidewire (Fig. 1A). Once the position of the guidewire was confirmed, the operating EP inserted arterial or venous catheters (arterial: 15 F, venous: 18 F) (Fig. 1B). The positions of the catheters were further documented by the EP using an ultrasound after placement. At the same time, the ENs began priming and preparing the PCPS machine and recorded details of the PCPS implementation. Afterward, the arterial and venous catheters were connected to the PCPS machine, which initiated an extracorporeal circulation.

Four male and 3 female patients, aged from 16 to 75 years, underwent PCPS during the 13-month study period. The first patient was a drowned woman who had been resuscitated for 38 min and regained a detectable pulse. With the exception of the first patient, the other 6 all died from cardiovascular diseases (3 from myocardial infarction, 2 from myocarditis, and 1 from pulmonary embolism) and underwent PCPS in states of cardiac arrest. The times for cardiopulmonary resuscitation and implementation of PCPS in these patients were 56.6 ± 34.8 and 44.6 ± 14.1 min (average ± standard deviation), respectively. After the implementation of PCPS, 4 patients required blood transfusions to restore intravascular volume and maintain adequate PCPS function. Serum lactate levels were obtained in 5 patients and the average level was 13.3 mmol/L (range: 5.9 to 22.8).

PCPS was implemented successfully in 6 patients in the emergency department, yielding an 85.7% success rate. Only 1 patient who could not be cannulated and another patient who underwent PCPS therapy died in the emergency department. An additional 2

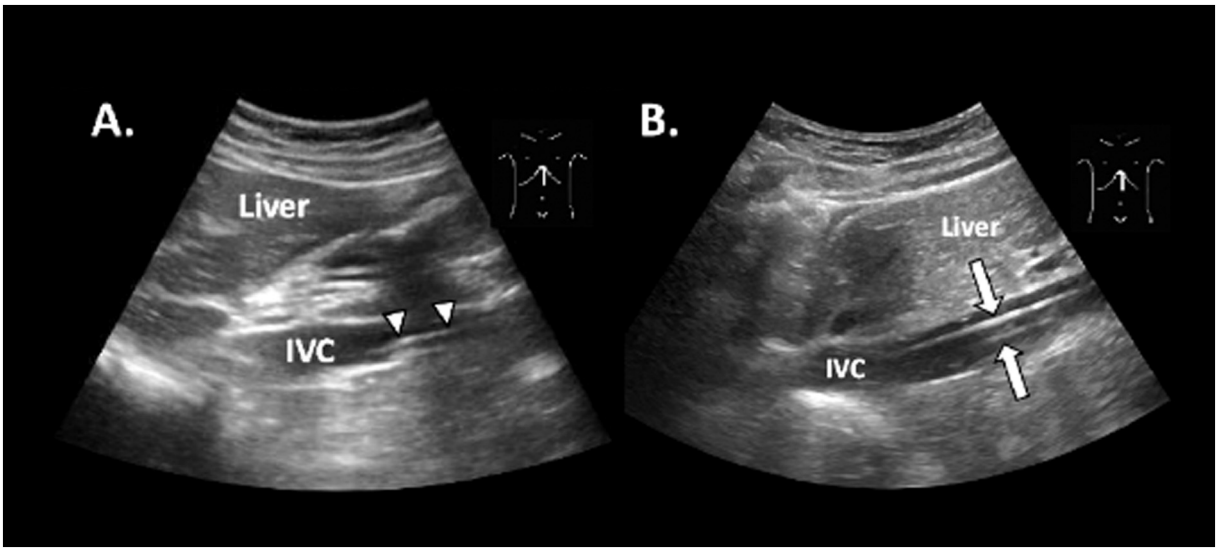

Fig. 1. Ultrasound images. A: The arrowhead indicated a guidewire in the inferior vena cava. B: The arrow indicated an 18F venous catheters in the inferior vena cava.

patients died in the intensive care unit (ICU) within 3 days. Three patients survived after PCPS therapy (survival rate: 42.9%) and underwent thrombolytic therapy or cardiac catheterization for their specific causes of cardiac arrest (Table 1). The average hospital stay, ICU stay, PCPS days, and ventilator days were 22.7, 15.3, 4.3, and 11.0 days, respectively. All surviving patients had favorable neurologic outcomes (Cerebral Performance Category scale of 2) 3 months after hospital discharge. Two complications—1 radial artery tear caused by the cardiac catheterization and 1 of diabetes insipidus—presented in the surviving patients.

We conducted this protocol and revealed that EPs and ENs could successfully operate PCPS after training. This protocol in emergency department achieved a high success rate in implementing PCPS, even in difficult conditions; that is, most implementations were conducted in a state of cardiac arrest. Although the sample size in our study was small, we believe that rapid application of extracorporeal cardiopulmonary support in our emergency department may provide therapeutic benefits. Studies in Taiwan and Japan indicated a favorable neurologic outcome of survival after PCPS (Cerebral Performance Category scale of 1 or 2; Tsai vs. Shirakabe: 100.0% vs. 85.7%) [6]. The results demonstrated the potential of PCPS to serve as an effective resuscitative method in patients in cardiac arrest or cardiogenic shock states.

Table 1
Demographic data, diagnoses, time for CPR and PCPS, and prognoses of all patients.

Sex	Age	Diagnosis	CPR time	PCPS time	Prognosis
F	44	Drowning	38	41[a]	Died (ICU[c])
M	**61**	**Pulmonary embolism**	**41**	**44**[b]	**Alive**
M	**52**	**Myocardial infarction**	**11**	**18**[b]	**Alive**
M	75	Myocardial infarction	110	67[b]	Died (ED[d])
M	**19**	**Myocarditis**	**50**	**31**[b]	**Alive**
F	73	Myocardial infarction	97	73[b]	Died (ED)[e]
F	16	Myocarditis	49	38[b]	Died (ICU)

The survived patients were presented with words in bold.
[a] PCPS in hypotensive state (MAP 60 mm Hg).
[b] PCPS in cardiac arrest state.
[c] Intensive care unit.
[d] Emergency department.
[e] Failed in cannulation.

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