Figure 1. Chest roentgenogram. The arrow points toward an abnormal prominence along the left cardiac border in the region of the main pulmonary artery.

adhesions were lysed; the pericardial defect was widened and a left atrial appendectomy was performed. The defect was finally closed with a flap of mediastinal pleura.

Following surgery the patient remained hypotensive. This required infusion of vasopressor drugs. Moreover, he developed bilateral lower lobe atelectasis which responded well to nasotracheal suction and intermittent positive pressure breathing. On the twelfth postoperative day he was discharged. He has been observed for four years without any cardiorespiratory symptoms.

Discussion

The clinical and laboratory findings of our patient were similar to those of previously reported cases. The first diagnostic clue was provided by a chest x-ray film which revealed an abnormal prominence in the region of the pulmonary area (Fig 1). Herniation of the left atrial appendage was suggested by fluoroscopy and angiocardiography and confirmed by a diagnostic left pneumothorax (Fig 2).

Although there have been three deaths attributed to herniation of the left ventricle (plus left atrium in one case) through large pericardial defects, we are unaware of any reported deaths due to herniation of the left atrial appendage. Since strangulation of the left atrial appendage is a potential hazard, as exemplified by the present case, we concur with Fosburg and co-workers' recommendation of the prophylactic closure of partial pericardial defects.

References


The Use of Spontaneous Ventilation with Constant-Positive Airway Pressure in the Treatment of Salt Water Near Drowning*

Kenneth L. Glasser, M.D., Joseph M. Civetta, M.D., and Remigio J. Flor, M.D.

Constant-positive airway pressure with spontaneous ventilation was successfully used in treatment of a patient who had suffered near-drowning in salt water. The patient was able to maintain adequate respiratory mechanics, although oxygenation without end-expiratory pressure was severely impaired. The rapid improvement in arterial oxygenation obviated the need for mechanical ventilation in this patient. It is suggested that the simplest modality of effective therapy should be used in such patients.

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Treatment of Salt Water Near Drowning

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Table 1—Arterial Blood Gas Determinations in Patient Nearly Drowned from Salt Water

<table>
<thead>
<tr>
<th>Time, Hr</th>
<th>CPAP</th>
<th>FIO₂*</th>
<th>PaO₂</th>
<th>PaCO₂</th>
<th>PH</th>
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<tr>
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<tr>
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<td>70</td>
<td>27</td>
<td>7.47</td>
<td>-3.0</td>
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</tbody>
</table>

*FIO₂ of 1.0 used to establish a constant baseline.

Reversing pulmonary injury is of paramount importance in the successful treatment of salt water near drowning. Although mechanical ventilation with positive end-expiratory pressure has been used successfully, the following case illustrates the application of the simpler modality, constant-positive airway pressure (CPAP), alone in a selected case of salt water near drowning.

CASE REPORT

An 82-year-old man was transported to the emergency room within a half hour of successful resuscitation after near drowning in the ocean. The duration of submersion could not be determined, but the patient was unresponsive on removal from the water. He responded within minutes to artificial ventilation with supplemental oxygen. The initial evaluation in the emergency room revealed that the patient was alert and agitated. Vital signs included: heart rate 90/min, blood pressure 150/80 mm Hg, and respiratory rate 20/min. Coarse rhonchi and fine rales with a few scattered wheezes were heard throughout both lung fields. Arterial blood gas determination at that time was (concentration of inspired oxygen

![Figure 1](image1.png)

**Figure 1.** Chest x-ray film on admission to hospital. Note severe bilateral pulmonary edema.

![Figure 2](image2.png)

**Figure 2.** Sequential arterial oxygen tension drawn from 100 percent oxygen breathing for 15 min. Note dramatic initial rise and improvement seen with constant-positive airway pressure after sampling, FIO₂ was lowered such that arterial oxygen tension remained in range of 60–80 torr.

[FIO₂ = 0.21]; arterial oxygen pressure, (PaO₂) 34 torr; arterial carbon dioxide pressure (PaCO₂), 33 torr; pH, 7.38, (Table 1). X-ray findings were compatible with noncardiogenic pulmonary edema (Fig 1). Serum osmolarity was 325 mOsm/liter; serum sodium, 155 mEq/liter; serum potassium 3.5 mEq/liter; hemoglobin, 17.6 gm/100 ml; and hematocrit 51 percent.

Endotracheal intubation was accomplished using the nasal route. Two ampules of sodium bicarbonate were given and repeated arterial blood gas analyses obtained. The results showed (FIO₂ = 0.21) PaO₂ 34 torr, PaCO₂ 33 torr, and pH 7.38. His respiratory rate was now 28/min. On a T-tube circuit supplied with 100 percent oxygen, arterial blood gas analysis revealed the PaO₂ at 105 torr, PaCO₂ 29 torr, and pH 7.39. Evaluation of his mechanics of ventilation included an inspiratory pressure of —60 cm H₂O and a vital capacity in excess of 1,500 ml.

Treatment with spontaneous ventilation and constant-positive airway pressure was instituted. Adjunct therapy included: fluid and electrolyte correction, intermittent positive pressure breathing (IPPB), chest physiotherapy, and steroids (dexamethasone 8 mg every eight hours). Over the first 12 hours inspired oxygen tension was progressively decreased, while arterial oxygen tension increased. In Table 1, values for

![Figure 3](image3.png)

**Figure 3.** X-ray film findings on third hospital day. Notice essentially clear lung fields.

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comparative purposes were obtained at $\text{FIO}_2 = 1.0$. There was progressive improvement, with narrowing of the difference of the calculated alveolar and measured arterial oxygen tensions with and without CPAP (Fig 2).

After 72 hours, repeated laboratory studies disclosed: serum osmolality, 288 mOsm/liter; serum sodium, 141 mEq/liter; serum potassium, 3.5 mEq/liter; and hematocrit, 46.4 percent. He was able to generate a vital capacity in excess of 1,500 ml and an inspiratory pressure less than $-50$ cm of $\text{H}_2\text{O}$. Respiratory rate was 20/min and vital signs remained stable. At this time it was elected to discontinue intubation. Arterial blood gas levels, while patient was breathing room air, were $\text{PaO}_2$ 57 torr, $\text{PaCO}_2$ 27 torr, end pH 7.44. One hour following extubation ($\text{FIO}_2 = 0.21$) the $\text{PaO}_2$ level had risen to 70 torr, $\text{PaCO}_2$ was 27 torr, and pH 7.47 (Fig 3). The remainder of his hospital course was uneventful. He was discharged two days after extubation.

**DISCUSSION**

Recent case reports have attested to the benefit of positive end-expiratory pressure (PEEP) in association with mechanical ventilation in the treatment of near-drowning.1 The data presented here emphasize applicability of still another mode of therapy in situations when the vital capacity and inspiratory force remain near normal: constant-positive airway pressure with spontaneous ventilation. This system2 allows one to simplify treatment in the near-drowning patient if the only impairment is in arterial oxygenation. Its mechanism would appear to involve expansion of collapsed alveoli with increase in functional residual capacity as well as aiding in the clearing of pulmonary edema. In situations in which adequate oxygenation is impaired without concomitant impairment of ventilatory ability, this simplified modality of therapy is worthy of consideration.

**References**


**Resolution of an Iatrogenic Coronary Artery Thromboembolus**

Balkrishan Agarwal, M.D.; Mizra M. Ashraf, M.D., F.C.C.P.; David M. Coles, M.B.; and Dennis A. Bloomfield, M.B., F.C.C.P.

A patient with an iatrogenic coronary thromboembolus, sustained during selective left coronary catheterization is presented. The embolus was identified by angiography and its complete resolution was documented in the same manner three months later. Despite chest pain and elevation of the cardiac enzymes, the electrocardiogram showed only nonspecific changes and the absence of macroscopically identifiable infarction was demonstrated at thoracotomy. Thromboembolization may be a more common cause of complication with the Judkins technique than generally realized but may be compatible with complete recovery and be avoided by special catheterization practices.

Selective coronary angiography, particularly the use of the Judkins technique, carries with it the highest complication rate of all commonly practiced adult catheterization techniques.3 Death from coronary catheterization is seldom an outcome of arrhythmia alone but is almost always the result of myocardial infarction during the procedure. Even greater in number than these fatal complications are those instances of infarction associated with eventual recovery. While the etiology in this latter group can only be surmised, embolization from a thrombus at the catheter tip, hemorrhage into or dislodgment of atheromatous material, prolonged catheter obstruction of a stenotic lesion, dissection of a coronary vessel, contrast material allergy or spasm secondary to catheter manipulation have been incriminated. Despite the paucity of proved cases in the literature, thromboembolism is generally considered to be the most common cause.4

There are no reports of confirmed resolution of emboli in the coronary circulation although such a possibility has generally been held to exist. This report concerns a patient who sustained an embolus during coronary angiography and in whom resolution of the thrombus, with limited myocardial damage, was demonstrated by subsequent angiography.

**Case Report**

The patient was a 59-year-old woman who complained of progressive dyspnea and mild chest pain on exertion. She had known of a heart murmur for some years. She was found to have a blood pressure of 120/70 mm Hg, sinus rhythm 75 per minute, respirations 16 per minute and a normal temperature. The cardiac findings were typical of mitral stenosis with mild mitral insufficiency. The cardiogram showed right bundle branch block and the chest x-ray examination demonstrated enlargement of the left atrium and the main pulmonary artery, together with Kerley's B lines. The patient was treated with digitalization and diuretics but showed no symptomatic improvement over the course of the subsequent four months. Cardiac catheterization with a view to mitral valve surgery was then undertaken. The study showed normal right atrial pressure, moderate right ventricular systolic hypertension (50 mm Hg), a mean left atrial pressure of 28 mm Hg and normal left ventricular and aortic pressures. Cardiac output was 3.7 liters per minute. The mitral regurgitant fraction was 0.26 and the functional diastolic mitral valve area was calculated at 1.4 cm². Left ventricular and aortic root angiography was performed without incident with the use of a Cordis "pigtail" No. 7 catheter which had been introduced by the Seldinger technique from the right femoral artery. Coronary angiography was considered to be indicated because of the patient's age, the symptom of chest pain on exertion, and the electrocardiographic finding of bundle...