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A Case of Adult Respiratory Distress Syndrome Associated with Acute Pancreatitis

Shoji HONDA, Toshio FUJIOKA, Takahiro ONO,
Ryusuke SHUTOH, Hideo TERAO and Masaru NASU

Second Department of Internal Medicine, Medical College of Oita

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ABSTRACT : A 52-year-old man was admitted to our department for acute pancreatitis. He developed adult respiratory distress syndrome (ARDS) on the 2nd hospital day, and was treated with respiratory management using positive endexpiratory pressure (PEEP) in addition to pharmacologic therapy for pancreatitis. The treatment was very effective, and he was discharged on the 72nd hospital day.

INTRODUCTION

Adult respiratory distress syndrome (ARDS) is a disease characterized by rapidly increasing pulmonary edema, marked decrease in pulmonary compliance and hypoxia. It is associated with severe infection, trauma, burn, and others. Even with modern therapy its prognosis is grave. In our department a patient with ARDS associated with severe acute pancreatitis was treated with respiratory management using PEEP (Positive Endexpiratory Pressure) in addition to pharmachologic therapy for pancreatitis. It was very effective. Therefore, our case is reported here to help others in the management of this troublesome disease.

CASE REPORT

A 52-year-old man, with a history of heavy drinking and no history of cardiorespiratory or pancreatic diseases, was admitted to the Second Department of Internal Medicine, Oita Medical College for severe abdominal pain and abdominal fullness which appeared after an episode of binge drinking.

Initial examination revealed a body temperature of 37.6°C and tachycardia and tachypnea with the pulse rate of 136/min. and the respiratory rate of 40/min..

Cardiorespiratory examinations were normal. The abdomen was markedly distended and tympanic, with an abscence of bowel sound and no evidence of ascites. There was severe diffuse abdominal tenderness with guarding, particularly in the upper quadrants, but there was no rebound tenderness.

Admission laboratory data (normal values in parentheses) revealed the white blood cell count of 16,800 cells/mm (2950-8970), hemoglobin of 18.8g/d*l* (13.6-17.3), a hematocrit of 56.5% (41.2-52.9), and platelet count of 87,000/mm (136,000-323,000). The serum protein was 5.8g/d*l* (6.3-7.9), the serum bilirubin was 1.7mg/d*l* (0.1-1.1), the SGOT was 123 IU/*l* (11-36), the SGPT was 71 IU/*l* (2-34) and the lactate dehydrogenase was 2228 IU/*l* (212-410). The serum amylase was 269 U/*l* (52-150) consisting of 97.9% pancreatic and 2.0% salivary isozymes, the elastase 1 was 1497ng/d*l* (under 400), the lipase was 280 IU/*l* (10-150), the PSTI was 375ng/m*l* (5.9-22.7) and the CA19-9 was 145 U/m*l* (under 37). The Blood urea nitrogen was 38mg/d*l* (8-21), the serum creatinine was 4.4mg/d*l* (0.7-1.3) and the serum

electrolyte included a calcium of 7.7mg/d*l* (8.2-10.2), a sodium of 129.0mEq/*l* (136-152) and potassium of 6.7mEq/*l* (3.5-5.3). The phosphorus and chloride were within normal limits. The serum C-reactive protein was 54.5mg/d*l* (under 0.3). Arterial blood gas analysis demonstrated a mild hypoxemia with the pH of 7.410, PO_2 of 64.8mmHg, PCO_2 of 27mmHg and oxygen saturation of 93.2%.

A chest X-ray film on admission showed no evidence of pulmonary edema, although atelectasis was noted due to inspiratory insufficiency (**Fig. 1**). The portable KUB film revealed marked small bowel gas (**Fig. 2**).

At the time of admission, the urine output was 10 m*l*/hour because of severe dehydration. Saline solution was administered rapidly at 1000m*l* per hour for 5 hours, with subsequent urine output of 100-150m*l*/hour and improvement of blood urea nitrogen and creatinine by the 7th hospital day. On the 2nd hospital day, rhonchi was auscultated, and a chest X-ray film revealed infiltrative shadows in both lung fields (**Fig. 3**). The patient was treated with oxygen administered at 12*l*/min. by mask, but hypoxemia was aggravated with a pH of 7.355, PO_2 of 60.7mmHg, PCO_2 of 36.4mmHg and oxygen saturation of 90.4%. ARDS associated with acute pancreatitis was suggestged. A naso-endotracheal intubation was performed and oxygen was administered with controlled

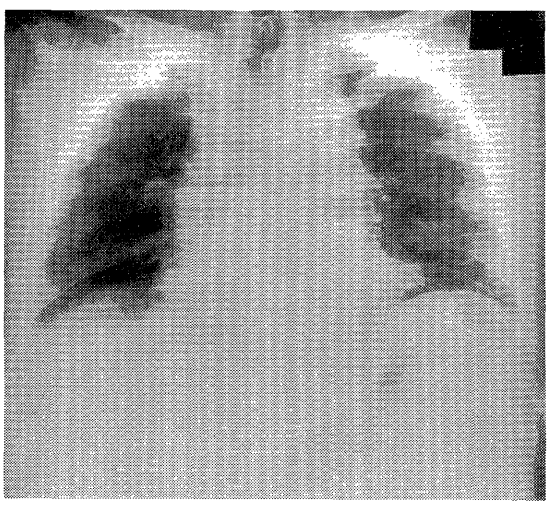

Fig. 1 Portable chest X-ray on admission showing no evidence of pulmonary edema.

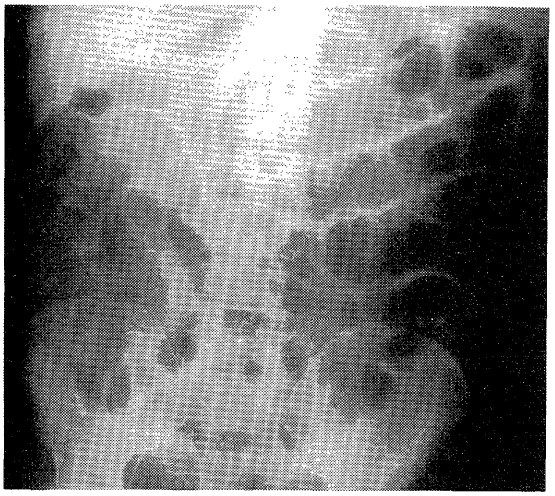

Fig. 2 Portable KUB film revealing marked small bowel gas.

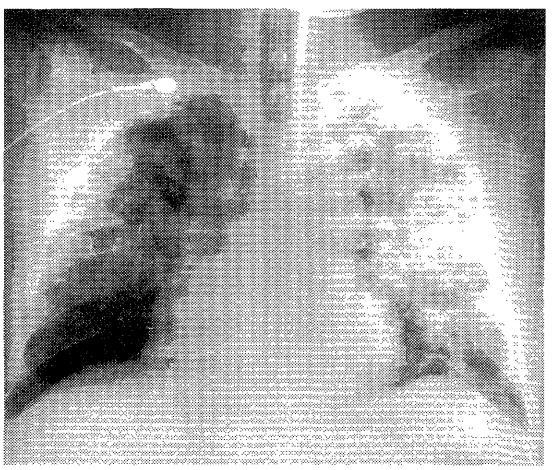

Fig. 3 Two days after admission, chest X-ray film revealed infiltrative shadows in both lung fields.

respiration, but there was no improvement in arterial blood gas with a pH of 7.159, PO_2 of 53.1mmHg and PCO_2 of 69.0mmHg. A Swan-Ganz catheter was inserted and revealed normal pulmonary capillary wedge pressure and cardiac index, confirming the diagnosis of ARDS. He was treated with PEEP followed by an excellent response. The arterial blood gas improved with a pH of 7.258, PO_2 of 74.1mmHg and PCO_2 of 52.8mmHg. Subsequently there was subjective and objective improvement in his condition. He was removed from the respirater

on the 7th hospital day and extubated on the next day.

The therapy with methyl predonisolone was started from the 1st hospital day. For the first three days it was administered in the doses of 1000mg per day, and for the next three days in the doses of 40mg per day. At the same time, the therapy for acute pancreatitis included fasting bowel rest, and intravenous gabexate mesilate, urinastatin and citicoline. The abdominal pain disappeared on the 6th hospital day. On the 49th hospital day, all laboratory values returned to normal and the patient was discharged on the 72nd hospital day.

DISCUSSION

For patients with acute pancreatitis, respiratory complications are very important prognostic factors, Sixty per cent of deaths from acute pancreatitis occur within the first 7 days of illness and are associated with acute respiratory failure[1]. Pitchumoni *et al.* enumerated three groups of pulmonary complications of acute pancreatitis. The first is early arterial hypoxia. The second group consists of atelectasis, pneumonia, pleural effusion and mediastinal abscess. The third is ARDS[2]. ARDS was reported in 1967 by Ashbaugh *et al.* as a grave disease characterized by rapidly increasing respiratory failure, pulmonary edema, marked decrease in pulmonary compliance and hypoxia[3].

Recently it is known as a syndrome with severe hypoxia, diffuse infiltrative shadows in both lung fields, normal pulmonary capillary wedge pressure and low pulmonary compliance. It frequently complicates severe infections, trauma or burns[4~6]. The frequency of ARDS complicating inpatients with severe disease is about 25%[7], and the mortality rate is between 40 and 60 %[8].

Acute pancreatitis with ARDS, first described in 1972 by Interiano *et al.*, is seen in 20% of patients with acute pancreatitis[9]. There are some pathogenetic theories of ARDS in acute pancreatitis, but they are controversial and unclear[2].

The kinin system, activated by active trypsin, may injure pulmonary vessels, or active trypsin may initiate intravascular coagulation with fibrin microemboli involving the pulmonary microcirculation[10]. Elevated levels of phospholipase (lecithinase) have been noted in acute pancreatitis. Increased degradation of lecithin by elevated lecithinase concentrations may be responsible for alveolar collapse in acute pancreatitis[2].

Salil *et al.* studied ARDS associated with acute pancreatitis in adult mongrel dogs and suggested the following mechanism. Macrophages may accumulate and secrete more phospholipase A_2 in the alveoli. The activity of phospholipase A_2 causes a reduction in the recovery of usefull surfactant and an increase in the level of lysolecithin which may act as an anti-surfactant or cellular toxin and be responsible for the development of interstitial alveolar edema and subsequent pulmonary distress[11].

Unbound FFA can be toxic. In acute pancreatitis, pulmonary lipoprotein lipase, activated by an unknown pancreatic factor, causes local release of FFA from triglycerides, and these unbound FFA then injure the capillary alveolar membrane[2, 12].

Recently, neutrophils, macrophages, metabolites of arachidonic acid such as prostaglandin E_2 or thromboxane A_2, or fibrin and fibrin degradation products have been considered as the pathogenetic facters in ARDS. Neutrophils are particularly important and the following pathogenetic theory starts with stress causing neutrophil aggregation and stasis in pulmonary capillaries generated by C5a. Activated neutrophil produces oxygen free radical, metabolites of arachidonic acid or protease. These products injure pulmonary capillary endothelial cells, with a resultant increase in pulmonary endothelial permeability. Consequently, interstitial and alveolar edema, increased pulmonary shunt and decreased PaO are caused. At the same time, the bronchus becomes constricted, with decreased pulmonary compliance and tachypnea[13~18].

ARDS is treated with various therapies in addition to the treatment of the primary disease. Fluid therapy, oxygen therapy, the use of corticosteroid or diuretics and prophylaxis against DIC are performed as indicated[7].

Fluid therapy improves oliguria due to dehydration or shock. In this patient a large amount of intravenous infusion over a short time improved oliguria due to dehydration. However, excess fluid therapy is injurious to the respiratory function and monitoring of pulmonary capillary wedge pressure using a Swan-Ganz catheter is necessary[7].

In ARDS, shunt formation due to stasis causes hypoxia which is not responsive to oxygen therapy. As high concentrations of oxygen cause an increase in alveolar epithelial or pulmonary endothelial permeability[19], PEEP is used in order to raise PaO_2 using an oxygen concentration which will not cause oxygen toxicity. When using PEEP, assisted ventillation may not be necessary, unless hypoventilation or advanced pulmonary edema raises the CO_2 level, in which case ventilatory assistance should be promptly initiated. In this case, nasal cannula, mask, tent and endotracheal intubation with assisted ventilation were not effective in normalizing PaO_2, but the use of PEEP normalized oxygenation.

Usually, corticosteroids have been used in an attempt to prevent endothelial damage, as they inhibit the action of phospholipases[20]. This patient was given high dose corticosteroids in the short period after admission, but its effect is unclear. Recently, steroids have been used only in the early treatment of fat embolism, smoke inhalation or chemical pneumonia, because there is no evidence of their beneficial effects in ARDS after the appearance of symptomes. Usually methyl predonisolone, 30mg/kg every 12 or 24 hours, is given intravenously 1 or 2 times.[7]

In our department, 18 cases of acute pancreatitis have been experienced from 1982. Three cases were severe and 2 cases, including this case, were associated with pulmonary complications (ARDS and pleural effusion). The frequency of ARDS in severe acute pancreatitis is relatively high, and precise diagnosis and agressive respiratory management are necessary.

REFERENCES

1) Renner, I. G., Savage, W. T., Pantoja, J. L. and Renner, V. J.: Death due to acute pancreatitis: a retrospective analysis of 405 autopsy cases. *Dig. Dis. Sci.* **30**: 1005-1018 (1985).
2) Pitchumoni, C. S., Agarwal, N. and Jain, N. K.: Systemic complications of acute pancreatitis. *Am. J. Gastroenterol.* **83**: 597-606 (1988).
3) Ashbaugh, D. G., Bigelow, D. B., Petty, T. L. and Levine, B. E.: Acute respiratory distress in adults. *Lancet.* **II**: 319-323 (1967).
4) Pontoppidan, H., Geffin, B. and Lowenstein, E.: Acute respiratory failure in the adults.: *N. Eng. J. Med.* **289**: 690-698 (1972).
5) Petty, T. L.: Adult respiratory distress syndrome: Definition and historical perspective. *Clin. Chest. Med.* **3**: 3-7 (1982).
6) Hopewell, P. and Murray, J. F.: The adult respiratory distress syndrome. *Ann. Rev. Med.* **27**: 343-356 (1976).
7) Sharma, O. P. and Izumi, T.: ARDS. *Ther. Res.* **8**: 623-633 (1988).
8) Raffin, T. A.: Novel approches to ARDS and sepsis. In: Chernow, B. and Shoemaker, W. C., eds. Critical care state of art, vol. 7. The Society of Critical Care Medicine.: 247-280 (1986).
9) Interiano, B., Stuard, I. D. and Hyde, R. W.: Acute respiratory distress syndrome in pancreatitis. *Ann. Intern. Med.* **77**: 923-926 (1972).
10) Berry, A. R., Taylor, T. V. and Davies, G. C.: Pulmonary function and fibrinogen metabolism in acute pancreatitis. *Br. J. Surg.* **68**: 870-873 (1981).
11) Salil, K. D., Mack, T. S. and Stonewall, M. C.: Effects of experimental acute pancreatitis in dogs on metabolism of lung surfactant phosphatidylcholine. *Biochem. Biophys. Res. Commun.* **145**: 612-618 (1987).
12) Kimura, T., Toung, J. K. and Margolis, S.: Respiratory failure in acute pancreatitis: The role of free fatty acids. *Surgery* **87**: 509-513 (1980).
13) Tate, R. M. and Repine, J. E.: Neutrophils and adult respiratory distress syndrome. *Am. Rev. Respir. Dis.* **125**: 522-559 (1983).
14) Mc Cord, J. M.: Oxygen radicals and lung injury: The state of the art. *Chest* **85**: 35s (1983).
15) Hammerschmidt, D. E.: Leukocytes in lung injury. *Chest* **85**: 16s (1983).
16) Till, G. O., Johnson, K. J., Kunkel, R. and Ward, P. A.: Intravascular activation of complement and acute lung injury dependency on neutrophils and toxic oxygen metabolites. *J. Clin. Invest.* **69**: 1126-1135 (1982).

17) Cochrane, C. G. , Spragg, R. G. and Revak, S. D.: The presence of neutrophil elastase and evidence of oxidation activity in bronchoalveolar lavage fluid of patients with adult respiratory distress syndrome. *Am. Rev. Respir. Dis.* **127**: 27s (1983).
18) Tate, R. M. and Repine, J. E.: Oxygen radicals cause pulmonary edema and vasoconstriction in isolated salt perfused rabbit lungs. *Clin. Research* **30**: 75A (1982).
19) Denker, S. M. and Fanburg, B. L.: Oxygen toxicity of the lung: An update. *Br. J. Anaesth.* **54**: 737-749 (1982).
20) Replogle, R. L., Guzzaniga, A. B. and Gross, R. E.: Use of corticosteroids during cardiopulmonary bypass. Possible lysosomal stabilization. *Circulation* **33**: 86-92 (1966).