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Treatment of Pleuroperitoneal Hernia in the Newborn —with Special Reference to Cardiorespiratory Disturbances

(pleuroperitoneal hernia/newborn/cardiorespiratory care)

AKIO ENDO[a], MASAKATSU INOUE[b], and NORIO SHIMIZU[b]

[a] *Department of Surgery, Shimane Medical University, Izumo 693 and*
[b] *Department of Surgery, Tottori University School of Medicine, Yonago 683, Japan*

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Pleuroperitoneal hernia is the type of congenital diaphragmatic hernia most frequently seen by the clinician. The operative mortality rates are high, particularly in the newborn and extensive cardiorespiratory embarrassment is involved. The prognosis of pleuroperitoneal hernia is closely related to pre- and postoperative cardiorespiratory conditions. The relationship of this entity to the fetal circulation is emphasized.

Treatment of neonatal pleuroperitoneal hernia usually requires emergency surgery and pre- and postoperative cardiorespiratory care is a major factor in the prognosis. We report herein the treatment and prognosis of 5 newborn with pleuroperitoneal hernia.

CASES

From 1978 to 1981, 5 children with neonatal pleuroperitoneal hernia were treated in the First Department of Surgery, Tottori University School of Medicine. These five newborn had a normal birth weight (Table I).

Initial symptoms in the neonates were cardiorespiratory embarrassment including cyanosis and dyspnea. The hernia was located in the Bochdalek foramen, on the left in all patients. In 2 of the 5 patients, congenital cardiovascular anomalies and patent ductus arteriosus were also evident.

The methods used for surgical repair are shown in Table II : transabdominal reduction and closure of the hernia opening were carried out in all five patients and thoracic drainage was performed as required. Hernia sac was detected in only one patient.

The two operative deaths (Cases 2 and 3) were the newborn who died 29 and 39 hours after operation with cardiorespiratory embarrassment.

A brief description is made of these five patients.

Case 1 : A newborn with an Apgar score of 6 suddenly became cyanosed. Groan and hypercapnea was noted later : left Bochdalek foramen hernia was diagnosed by chest X ray. The surgery was carried out on the fourth day

TABLE I. *Cases of Neonatal Pleuroperitoneal Hernia*

Case No.	Age (1)	Sex (2)	Delivery Weight (g)	Delivery Morbidity (3)	Initial symptom	Location (4)	Preoperative complication	Combined malformation
1	4d	M	3100	A.S. 6	Tachypnea cyanosis	L	Respiratory & circulatory disturbances	(−)
2	3.5h	M	3105	Neonatal asphyxia (grade II) A.S. 3	Gasping cyanosis	L	Respiratory & circulatory disturbances	PDA (15mm)
3	5h	M	3340	A.S. 4	Tachypnea cyanosis	L (total defect)	Respiratory & circulatory disturbances	Atresia ani cardiovascular anomalies
4	7h	M	3050	A.S. 7	Tachypnea cyanosis	L	Respiratory & circulatory disturbances	Meckel's diverticulum mesenterium communae
5	36h	F	3460	A.S. 8	Tachypnea	L	Respiratory distress	(−)

(1) Age ; the time interval between delivery and operation
h : hours, d : days
(2) Sex ; M : male, F : female
(3) Morbidity ; A.S. : Apgar Score
(4) Location ; L : left

TABLE II. *Cases of Neonatal Pleuroperitoneal Hernia*

Case No.	Operative method (transabdominal)	Size of defect (cm)	Sac	Postoperative complication	Prognosis
1	(First) Reduction and closing of hernia opening (Second) Small intestine resected	4.0×3.0	(−)	Fistula formation of small intestine	Good
2	Reduction and closing of hernia opening and left thoracic drainage	3.0×5.0	(+) Incomplete	Respiratory & circulatory distubances	Died (29 hours later)
3	Reduction and closing of hernia opening and left thoracic drainage Cut back operation (atresia ani)	5.0×6.0	(−)	Respiratory & circulatory disturbances	Died (39 hours later)
4	Reduction and closing of hernia opening and left thoracic drainage Appendectomy	4.0×5.0	(−)	(−)	Good
5	Reduction and closing of hernia opening and left thoracic drainage	2.0×3.0	(−)	Meteorism	Good

after birth. Intestinal fistula occurred postoperatively and such was repaired by intestinal resection 50 days after the initial operation.

Case 2 : A newborn with an Apgar score of 3 and grade II neonatal asphyxia underwent endotracheal intubation because of cyanosis and respiratory distress immediately after birth. He was placed in an incubator under conditions of 100 % humidity and 38 % oxygen. The vital signs were body temperature 35.4°C, respiration rate 60/m, pulse rate 148/m, blood acidity

6.90, $PaCO_2$ 50 mmHg and transcutaneous oxygen pressure ($TcPO_2$) 38 mmHg. Left diaphragmatic hernia was diagnosed from findings on chest and abdominal films. Surgical repair of a pleuroperitoneal hernia was done three and a half hours after birth following the correction of respiratory acidosis and infusion of plasma products. Ninety minutes after the termination of the surgery, the $TcPO_2$ was 50 mmHg. Left thoracic drainage was maintained with a negative pressure of 4 to 5 cm H_2O.

Endotracheal controlled respiration with the Bird respirator was handled by IMV, frequent tracheal aspiration. The $TcPO_2$ was 28 to 34 mmHg about three hours after operation.

The chest film taken 20 hours after operation revealed an atelectasis and patient died 29 hours after the operation. At autopsy the entire left lung showed an atelectasis, was atrophic, a dark violet color and smaller by one third than right lung. The right lung except for the middle lobe was also atelectatic. Size of the patent ductus arteriosus (PDA) was 1.5 cm. These occurrences contributed to the causes of low $PaCO_2$ level (Fig. 1).

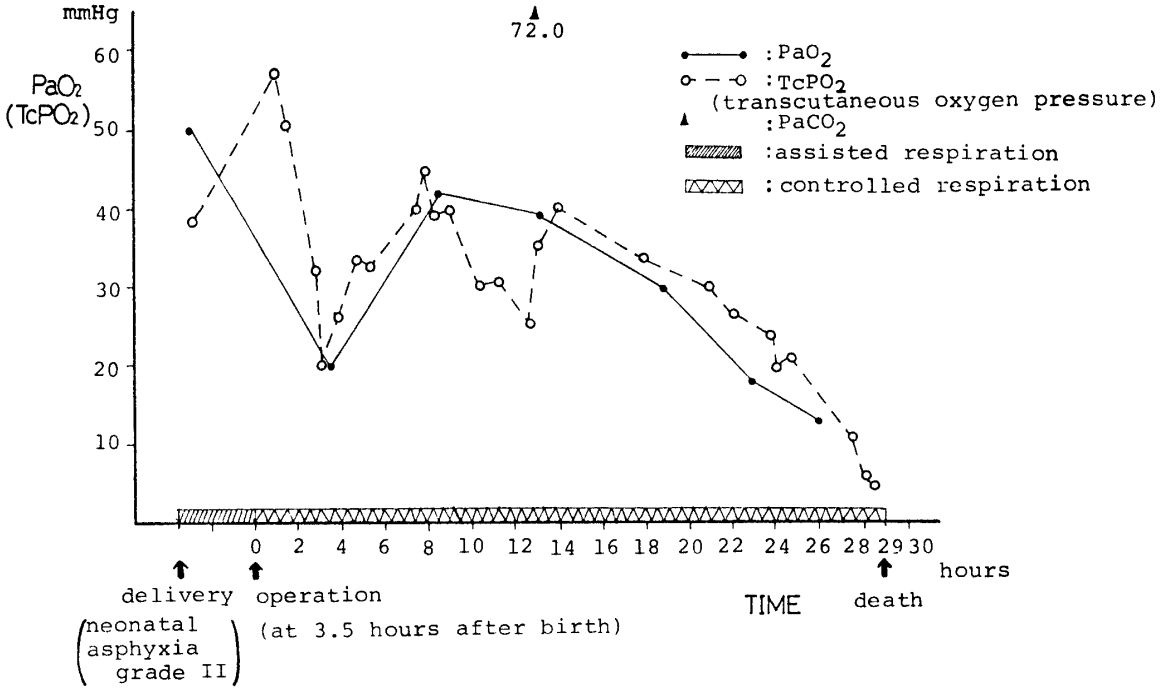

Fig. 1. Clinical changes of PaO_2 ($TcPO_2$) in case 2.

Case 3 : A newborn with an Apgar score 4 was delivered by Caesarean section. He underwent endotracheal intubation and was placed in an incubator with 60% oxygen because of dyspnea and cyanosis immediately after birth. On physical examination, low muscular tonus, right shifting of heart apex, divided scrotum and low type atresia ani were noted. Left diaphragmatic hernia was diagnosed by chest films (Fig. 2) and surgery was done five hours after birth.

The blood gas analysis after operation was $PaCO_2$ 68—100 mmHg and

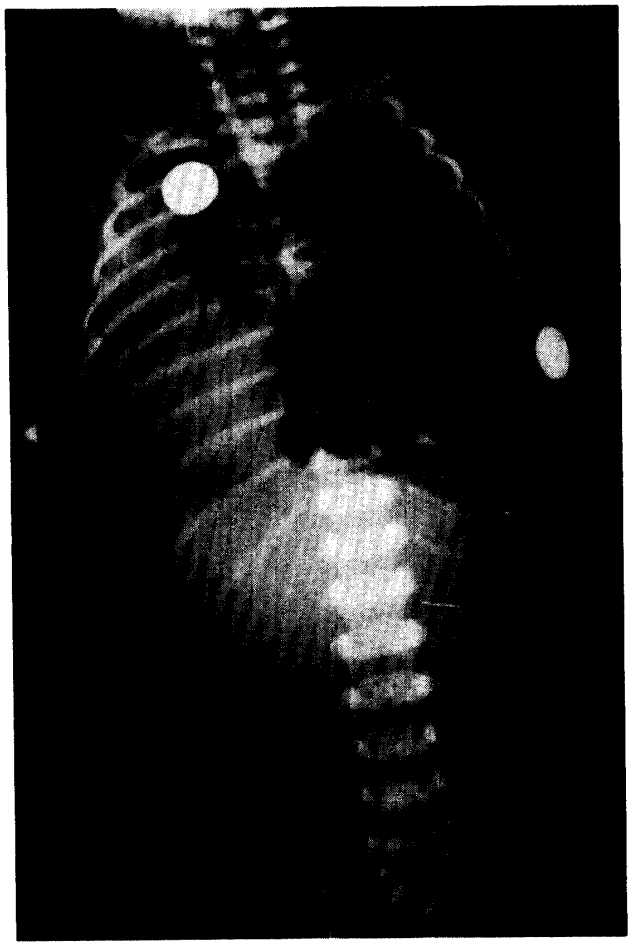

Fig. 2. Roentgenogram.
(Case 3, Preoperation)

PaO_2 18—23 mmHg. The chest film taken fifteen hours after operation showed an left atelectasis and pneumothorax (Fig. 3). The patient died 39 hours after operation because of cardiorespiratory disturbances.

At autopsy, hypoplastic left lung, congestive right lung and severe cardiovascular anomalies such as the outflow of aorta from right ventricle and the pulmonary artery branching from aorta were noted.

Case 4 : A newborn with an Apgar score of 7 had tachypnea, cyanosis and retraction of the chest wall immediately after birth. Heart sound was auscultated on the right chest and weakness of breathing sound was noted on the left lung. Left diaphragmatic hernia was diagnosed from findings on chest films. Preoperative PaO_2 was maintained with the pressure over 60—70 mmHg.

Surgical repair was done. Endotracheal respiration was handled by CPAP and respiratory conditions progressed stably. The patient was discharged 14 days later.

Case 5 : A newborn with an Apgar score of 8 had the symptoms of respiratory distress and cyanosis when crying. Because left breathing sound was weak, chest films were taken and a diagnosis made. Phototherapy was

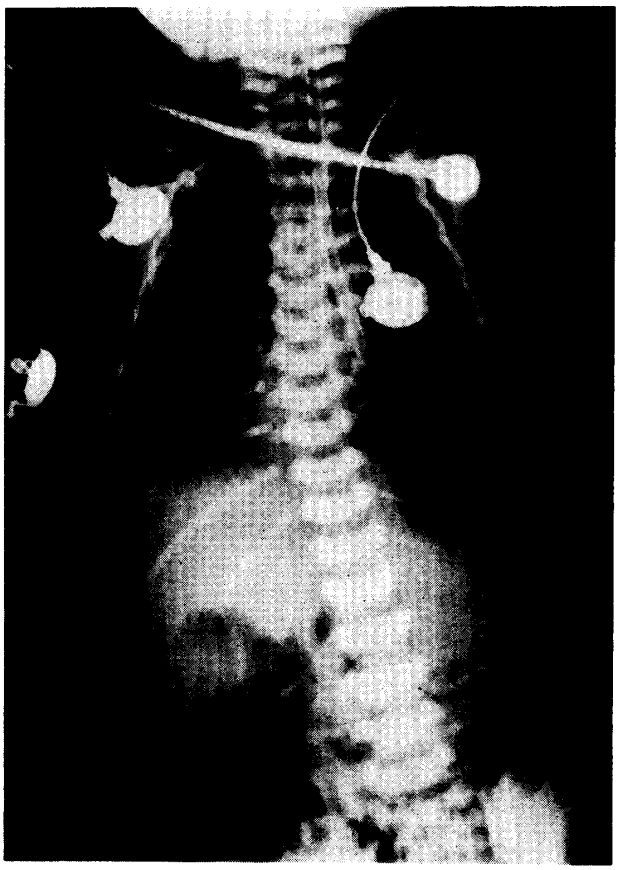

Fig. 3. Roentgenogram.
(Case 3, 15 hours postoperatively)

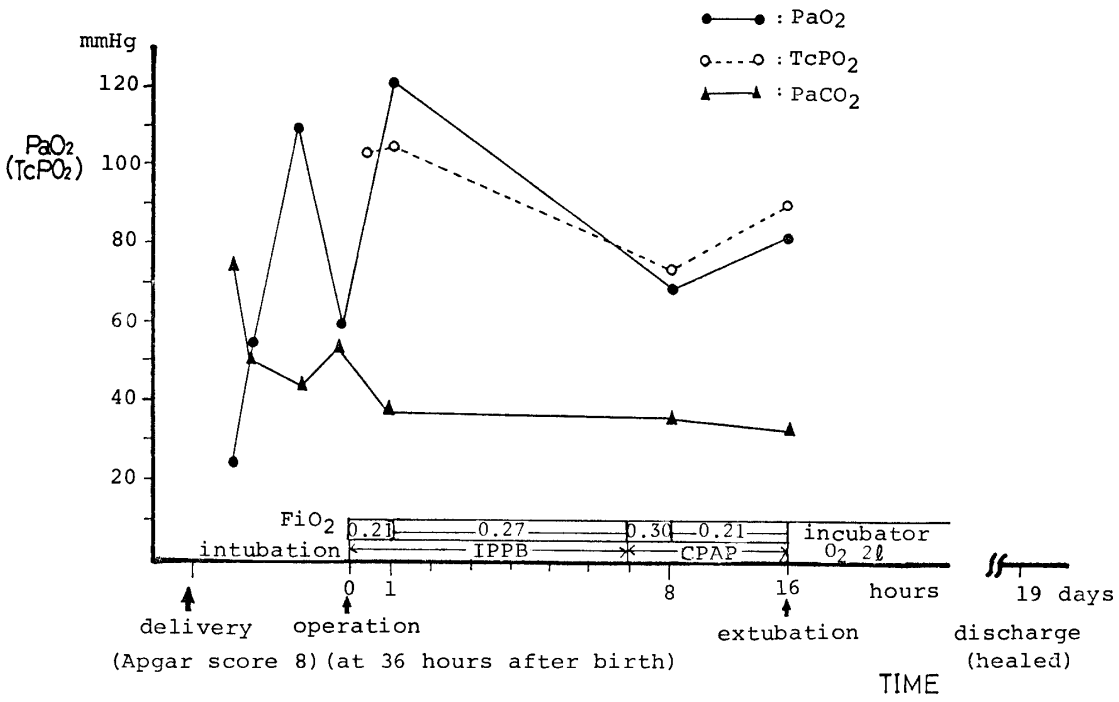

Fig. 4. Clinical changes of PaO_2 ($TcPO_2$) in case 5.

given on the third day after birth because of hyperbilirubinemia. The patient was healthy and discharged 19 days later with the body weight of 3,298 g (Fig. 4).

DISCUSSION

Pleuroperitoneal hernia is always accompanied by acute cardiorespiratory distress and immediate surgery is mandatory in these cases (1—3).

Reports of cases of neonatal pleuroperitoneal hernia have been on the increase in Japan since Suruga *et al.* (4) reported successful surgical repair in 1958. The operative result closely related to the severity of the associated cardiorespiratory disturbance. The cardiorespiratory disturbance was influenced by the following factors : time of occurrence after birth, birth weight and combined anomalies. Young (5) reported 100 cases of this disease in children under one year of age, and found that the operative mortality was 61 % in cases when the operation was done within 24 hours after birth ; Nakahara *et al.* (6) reported the mortality rate of 71 % in patients with the same condition (7 cases). The survival rate reported by Yano *et al.* (7) was 50—60 per cent. In 1974, Ishida (8) collected the reports made in Japan and concluded that : the operative mortality of patients undergoing surgery within 72 hours after birth was 31.6 %, while the rate in those operated on later was 19.2 %. Nakahara *et al.* (6) reported that the mortality rate was 14.3 % in those operated over 24 hours after birth. In generally, the occurrences within 72 hours (1, 9, 10) after birth and patients with a preoperative $PaCO_2$ over 60 mmHg (11) indicated a poor prognosis.

Most of the neonatal cases and severe symptoms are related to a Bochdalek hernia ; these symptoms include cyanosis, dyspnea and dextrocardia as described by Moore *et al.* (12). A definite diagnosis was made after evidence of a depressed abdomen, weak or diminished respiration sounds in the affected lung and chest roentgenography. Contrast medium study was usually not done because of the danger of aspiration and for economics of time. The differential diagnosis includes congenital heart disease.

The important factors in the treatment of neonates are to maintain an open, an adequate airway, oxygen supply, maintenance of optimal body temperature and air humidity in the incubator, and an adequate infusion of fluids to correct respiratory and metabolic acidosis. Corrective surgery should be carried out as soon as possible. Respiratory relief by endotracheal intubation often leads to a good prognosis (5). Early operation to relieve the lung compression and mediastinal shifting also contributes to a good prognosis. The surgical approach is usually through the abdomen and additional gastrostomy and chest tube drainage are also effective. The ipsilateral lung which was usually compressed by the hernia was grossly atrophic and atelectatic ; histologically, the alveola was scanty and limited. To improve the lung condition, negative pressure suction through the chest tube, using a pressure of about -10 cm H_2O is required. According to Ohara *et al.* (13),

assisted respiration such as continuous positive aspiration pressure (C. P. A. P.) or intermittent mandatory volume (I. M. V.) using a respirator is beneficial for the atelectatic lungs. Intensive respiratory assistance to support both of the lungs is most important.

One of the leading causes of death is the progressive hypoxia. Recently, prescription (14) of a vasodilator such as tolazoline (6, 15, 18) and the ligation of patent ductus arteriosus (16, 17) proved to be effective. In addition to the respiratory assistance, attention to the circulatory system is important for a good prognosis.

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