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# **Neonatal Peritonitis**

# By

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Neonatal peritonitis has been observed in 25 cases in the last 5 years. Of the underlying conditions, perforative peritonitis was the most frequent (13 cases), then ischaemic necrosis, haematogenous infection, gastroschisis, and meconium peritonitis. In 10 cases the birth weight was over 2500 g; 15 were premature infants, 10 of them under 2000 g weight. Eleven infants survived, 14 died.

Neonatal peritonitis, a condition characterized by RICKHAM [9] as one of the most fatal diseases in the newborn period, has a very high mortality rate. Low, COOPER and COSBY [7] could collect only 100 cases from the world literature until 1949, but since then several authors [1, 2, 6, 9, 10] have dealt with the condition, so that the number of reported cases has increased in the last two decades and so has the number of successfully treated patients.

## AETIOLOGY

As regards its origin, two groups of neonatal peritonitis may be distinguished.

(i) Chemical. Its predominant form is meconium peritonitis, but prenatal gastroschisis and peritonitis accompanying a ruptured exomphalos may also be grouped here. These two conditions are followed by bacterial superinfection in the postnatal period, especially when there is a prolonged interval between birth and surgical intervention.

(ii) Bacterial. Its main causes are, gastric or intestinal perforation, perforated appendicitis, necrotizing enterocolitis, ischaemic intestinal necrosis. The secondary form is due to haematogenous changes originating chiefly from septicaemia or a septic focus located anywhere in the organism.

#### DIAGNOSIS

Clinical and radiological diagnosis of neonatal peritonitis is usually simple in full-term babies, whereas in prematures we must be reckoned with a number of problems. The most frequent clinical symptoms and signs are shock, increasing abdominal distention, vomiting, obstipation or sometimes diarrhoea, and hypothermia. All these may become manifest shortly after birth. Evaluation of the changes in body temperature and leucocyte count is more reliable in the case of full-term than in the case of premature infants. In the latter even the characteristic clinical symptoms are mostly masked. Body temperature is usually under 36 °C, and the leucocyte count below 8000.

In a significant number of the cases the radiological examination offers much help. Even a simple abdominal X-ray will show the free air in the abdominal cavity, an absolute indication for surgery since it indicates a perforation and at the same time it may be a proof of peritonitis. Intestinal pneumatosis also supports the presence of peritonitis but in the majority of cases it is impossible to demonstrate this sign.

# MANAGEMENT

If the clinical picture and the laboratory and radiological results point to peritonitis, surgery is the only way of treatment. In doubtful cases a diagnostic laparotomy has to be performed. The risk of the intervention is justified, considering the following facts.

(i) Practically, surgery presents the only effective means to save the patient.

(ii) In a significant part of the cases the characteristic radiological and clinical signs develop late. It is therefore justified to risk an early operation.

(iii). An early operation is generally followed by an undisturbed postope-

Author and year	Num- ber of cases	Survivors	Mortal- ity rate	
Rickham, 1955	17	10 (58.8%)	41.2	
Calvani et Lotti				
1962	12	3 (25%)	75	
Fonkalsrud				
et al. 1962	172	39 (22%)	78	
Birtch et al				
1967	99	38 (38%)	62	
Vinz et al.				
1967	27	3 (18%)	82	

rative period and the sooner the abdominal fluid is examined bacteriologically, the sooner can be antibiotic treatment be started.

Preoperatively, or in emergency cases, the correction of the state of shock, the elimination of fluid and electrolyte disturbances, and the control of hypothermia are of major importance. Postoperatively, it is necessary to institute nasogastric suction, to provide fluid and electrolytes, to ensure adequate oxygenisation, and to administer broadspectrum antibiotics.

#### Prognosis

In spite of a prompt and adequate surgical management, the prognosis is poor, the mortality rate being high, especially in premature babies with a low birth-weight (see Table I).

# PRESENT SERIES

In the last 5 years we have treated 25 cases of primary neonatal peritonitis, besides those cases where the

TABLE I

Causes of peritonitis	Total	Full-term	Premature	Survivors	Died
Spontaneous perforation of the stomach	2	1	1 (1900 g)	1	1
Idiopathic intestinal perforation	2	2	-	2	_
Ischaemic intestinal necrosis	3	3			3
Primary haematogenous perforation	2	1	1 (1900 g)	1	1
Perforated appendicitis	4	-	4 (1300–2100g)	3	1
Perforated necrotizing enterocolitis	5	_	5 (950—1700g)	1	4
Gastroschisis	5	2	3 (2200—2400g)	3	2
Meconium peritonitis	2	1	1 (2100 g)		2
Total	25	10	15	11	14 (56%

TABLE II

peritonitis developed as a postoperative complication due to anastomosis leakage or rupture of the wound and intestinal prolapse.

Among the neonates there were only 10 full-term babies with a birthweight over 2500 g, the other 15 were prematures, 10 of them under 2000 g. Eleven children survived the condition and 14 died (Table II) showing a mortality rate of 56 %.

Our experience with the different forms of peritonitis was as follows.

Spontaneous gastric perforation. We have observed two cases. The first was a premature baby born with 1900 g; he was operated upon 4 hours after the diagnosis of perforation and survived without any complications. The second case was that of a baby born at term. She was referred to our service too late and died 8 days later of diffuse purulent peritonitis and septicaemia.

A precipitating factor was a previous gastric X-ray examination with barium contrast material performed in an other hospital. At operation the abdominal cavity was filled with barium meal that had leaked through the wide gastric perforation.

Idiopathic intestinal perforation. This condition had given rise to peritonitis in two patients. The true cause remained unknown in both cases. In the first one, the perforation occurred in the ileum, while in the other case, in the sigmoid colon. In both cases only a simple suture of the perforation was performed with a decompressive double-barrel colostomy in the second case. Both neonates survived.

Ischaemic intestinal necrosis. Ex-

tensive ischaemic intestinal necrosis without perforation occurred in 3 patients. At operation there was diffuse peritonitis in all the three cases. Ischaemic necrosis had developed after septicaemia in the first, after exomphalos repair in the second, and after a volvulus caused by ileal atresia and clamped vitello-intestinal duct in the third case. In this group, all the three infants died after intestinal resection. At autopsy there was grave diffuse purulent peritonitis in all the three cases: this maintained the toxic state and finally led to death.

Primary haematogenous peritonitis. This condition is rare in neonates; we had two such patients. The first baby, who survived, was a full-term infant and suffered from omphalitis before the development of peritonitis, thus there might exist a close relationship between the two septic conditions. The second case was that of a premature baby whose primary haematogenous peritonitis was due to septicaemia, the patient died after surgery.

Perforated appendicitis. We observed and operated upon 4 cases of perforated appendicitis. All were premature infants; 3 weighed less than three pounds at birth. Their age was between 6 and 17 days at the time of the operation. In one patient, peritonitis occurred in the form of a localized pericoecal abscess, while in the other three cases the peritonitis was diffuse. Three patients survived the operation. In the fourth case, autopsy revealed pneumonia and meningitis [4].

Perforated necrotizing enterocolitis. This acute inflammatory lesion of the intestines is one of the gravest diseases of premature babies. Intestinal obstruction, peritonitis and perforation of the small and large intestines are found, with the perforation usually in the ileocoecal region. and the condition is without exception accompanied by septicaemia. In view of the grave septic state, the hazards of an extensive surgical intervention are great and must be avoided as far as possible. Keeping this in mind, only a suture of the perforation, or when the pathological changes are more extensive, i.e. localized to a longer intestinal segment. instead of resection, exteriorization of the diseased small or large intestine should be made.

There were 5 such cases in our material. The operation was performed under local anaesthesia and in spite of this precaution of the 5 babies only one premature infant with a birth weight of 950 g survived. On the 7th postoperative day a stercoral fistula developed, but it closed spontaneously in a few days. Two other cases survived the operation and died on the 15th and 25th day, respectively, after surgery. The cause of death was suppurative meningitis in both patients. No signs of peritonitis were found at autopsy [3].

*Gastroschisis*. Of five such cases, three were prematures and two fullterm infants. One infant had two additional atretic segments on the small intestine. The state of this infant was too poor to allow a surgical

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intervention and he died a few hours after admission. Four were operated upon. According to Moore's classification [8], the change was of the antenatal type in two cases, of the intermediate type in one, and of the perinatal type in one case. Three patients survived the operation, one died with intracranial and intraspinal haemorrhages [5].

Meconium peritonitis. This form of displaying peritonitis, an abnormal communication the between bowel and the peritoneal cavity, develops usually during intra-uterine life and rarely in the early postnatal period. If the communication between bowel and peritoneal cavity remains open after birth, bacterial superinfection may occur and result in a true purulent peritonitis. Two cases of meconium peritonitis were operated upon; both died after surgery.

## DISCUSSION

From the reports on neonatal peritonitis it is obvious that in most cases the surgical intervention seems to be hopeless. Data reported from various paediatric surgical services confirm this belief (Table I). As compared with them, our experience with a survival rate of 44 % seems to be rather satisfactory and indicates the necessity and importance of a surgical intervention. It goes without saying that the results collected in Table I include cases of the last one or two decades when the methods of surgical management and postoperative therapy, especially of premature infants, were not so well developed as they are now.

From our observations, two conclusions have been drawn.

(i) From the aetiological point of view there is a close connection between necrotizing enterocolitis and perforated appendicitis in premature infants. The two conditions are of the same character, the only difference being in the extent and intensity of the pathological state. In the case of a perforated appendicitis, the process is localized within the vermiform appendix, causing only a slight and not extensive injury, while in necrotizing enterocolitis the changes are more serious and involve both the small and the large intestine. This view is supported by two facts. One is that both pathological changes were accompanied by septic symptoms such as pneumonia, otitis and/or meningitis. And second, in most instances the peritonitis had been preceded by same similar pathologic change such as an early rupture of the amniotic membranes, etc. Finally, our last case supplied the most decisive evidence. All the significant clinical and radiological signs of necrotizing enterocolitis had developed in this premature patient. At operation a perforated appendix and a pericoecal abscess and, in addition, several necrotizing centres on the wall of the ascending colon and hepatic flexure could be seen. After appendectomy, the necrotic parts of the bowel wall were sutured and the abdominal cavity was drain-

ed. In spite of the prompt surgical intervention and a massive antibiotic therapy, the baby died on the 5th postoperative day.

(ii) A prompt surgical intervention may be effective even in poor-risk infants. Success depends principally on early diagnosis, the choice of the simplest but most effective surgical

method (simple suture of the perforation, exteriorization of the involved intestinal segment, drainage of the peritoneal cavity, etc.), together with the control of shock, the adequate administration of oxygen, of colloid and electrolyte solutions, and the maintenance of normal body temperature.

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