The Turkish Journal of Pediatrics 1998; 40: 151-158

PERSISTENT DIFFUSE PERITONITIS IN CHILDREN*

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SUMMARY: Karagüzel G, Tanyel FC, Şenocak ME, Büyükpamukçu N, Hiçsönmez A. (Department of Pediatric Surgery, Hacettepe University Faculty of Medicine, Ankara, Turkey). Persistent diffuse peritonitis in children. Turk J Pediatr 1998; 40: 151-158.

In adults, persistent diffuse peritonitis (PDP) having a special microbiologic spectrum is now defined as a distinct intraabdominal infection because of its aggressive clinical course. Considering also other types of peritonitis, this study was performed to determine characteristics of childhood PDP in regard to clinical picture, microbiologic features, treatment and outcome. Classification of 175 patients with peritonitis showed that nine patients had primary peritonitis and 121, 37 and eight patients had secondary peritonitis, PDP, and intraabdominal abscess, respectively. rates of host defense affecting disease, extra-appendicular origin, and mortality were markedly higher in the PDP group. However, polymicrobic and anaerobic infection rates were lower in the PDP group than those of the secondary peritonitis group. While 26 of 37 patients with PDP underwent surgical interventilon, the remaining 11 patients were managed by conservative measures. In the PDP group, mortality was 18 percent for conservatively and 23 percent for surgically treated patients. Being of young age, presence of an accompanying disease and fungal growth increased the mortality. The results indicate that PDP is a distinct type of peritonitis in children as well as in adults. In addition, accurate identification of these patients may prevent some unnecessary operations and improve survival by the choic of more conservative treatment plans. *Key words: peritonitis, intraabdominal infection, conservative surgery.*

Because of its high morbidity and mortality, peritonitis is still one of the most important therapeutic problems in medical practice. In recent years, to achieve more effective treatment with low morbidity and mortality, new classification and stratification systems for intraabdominal infections have been recommended[1-3].

From these studies, peritonitis is suggested to progress into persistent diffuse peritonitis (PDP) in some patients who are unable to control an infection either because of poor host defense mechanisms or highly virulent pathogens[4, 5]. PDP, also known as tertiary peritonitis, has a different microbiological spectrum and its treatment is a controversial issue, although more aggressive management has been advocated in adults[6, 7].

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In English literature, we could not find any clinical study on childhood PDP. Our impression is that the definition and characteristics of childhood PDP, and the aspects differentiating it from other types of peritonitis, are not clear. The present study was planned in order to elucidate these unclear points of childhood peritonitis.

Material and Methods

One hundred and seventy-five patients diagnosed with peritonitis from 1988 to 1993 were retrospectively evaluated in this study. Diagnosis of peritonitis was established with the presence of at least two of three criteria including clinical background, microbiological studies, and operative findings. Fever, abdominal pain, vomiting, failure to pass stool and findings of acute abdomen on physical examination constituted clinical background of the diagnosis. Microbiological data included aerobic, anaerobic, and fungal cultures. During laparotmy, presence of purulent fluid or fibrin plaques in the peritoneal cavity together with an edematous and fragile peritoneal surface were regarded as operative diagnostic features. According to the following criteria modified from Wittmann's classification[3], the patients were grouped as primary peritonitis, secondary peritonitis, PDP, and intraabdominal abscess.

The patients who had peritonitis originating from a suspected extraperitoneal source (intraperitoneal origin was excluded by laparotomy) were included in the primary peritonitis group. The secondary peritonitis group was established from the patients who had peritonitis resulting from an apparent intraabdominal source proven operatively, such as perforation of the gastrointestinal tract, leakage of an anastomosis of penetrating abdominal trauma. The patients with prolonged peritonitis (beyond 15 days) who were under conservative treatment (intestinal resting, intravenous nutrition and antibiotics) constituted the PDP group. Patients with intraabdominal abscess confirmed by ultrasonography and/or computed tomography were regarded as having localized peritonitis and included in the classification as a distinct group.

All charts of the patients were further reviewed to find clinical characteristics, type of management, clinical course, and outcome. Accompanying diseases, anatomical sources of peritonitis and causative microorganisms were also noted and compared. Statistical analyses were performed using chi-square and Fischer's exact tests (p value of less than 0.05 was considered statistically significant).

Results

While nine (5%) of the 175 patients fulfilled the criteria to be included in the primary peritonitis group, 121 (69%), 37 (21%), and eight (5%) patients fulfilled the criteria for the secondary peritonitis, PDP and intraabdominal abscess groups, respectively (Table I).

Table I: Age (mean ± SD) and Sex Distribution of 175 Patients with Peritonitis (F: Female, M: Male)

	1-28 Days		29 Days-12 Months		13 Months and Up	
Groups	n	Age (Day)	n	Age (Month)	n	Age (Year)
Primary peritonitis (n = 9, F = 4, M = 5)	–	–	–	–	9	10.0 ± 3.71
Secondary (n = 121, F = 70, M = 51)	7	4.43 ± 3.15	12	5.83 ± 3.04	102	9.69 ± 3.81
PDP (n = 37, F = 20, M = 17)	6	20.17 ± 4.88	11	5.18 ± 3.09	20	9.60 ± 4.62
Intraabdominal abscess (n = 8, F = 4, M = 4)	–	–	1	5	7	5.71 ± 3.55

The ratio of boys to girls was 1.3 and the average age was seven years at the time of diagnosis, with a range of one day to 19 years. There was no significant difference among the groups for sex distribution ($p > 0.05$). Primary peritonitis was not seen in the newborns and infants. The majority of the patients with secondary peritonitis (84.3%) and intraabdominal abscess (87.5) were older than one year of age. However, about half (46%) of the patients with PDP were younger than one year of age and this difference was statistically significant ($p < 0.001$). In primary peritonitis, microbiological results revealed no growth in four patients, E.coli in three patients, and Streptococcus in two patients. Major pathogens were E. coli, Klebsiella, Proteus, Bacteriodes and Fusobacterium in secondary peritonitis, with the rate of 18.2 percent of no growth. Pseudomonas and Staphylococcus were the main pathogens responsible for PDP (Table II).

Table II: Subgroups of Patients with PDP According to Microbiological Data

Subgroups	No. of Patients	%
PDP with low-grade pathogenic bacteria*	(20)	(54)
Pseudomonas	10	
Staphylococcus	6	
Enterococcus	3	
Other**	4	
PDP with fungi	(3)	(8)
Candida	3	
PDP without pathogen	(14)	(38)
Total	37	100

* 23 microorganisms were identified in 20 patients.
** 2 streptococci, one E. coli Propionibacterium.

Polymicrobial and anaerobic infection rates in the PDP group were 8.1 and 5.4 percent respectively. However, these rates were 37.2 and 19 percent, respectively in the secondary peritonitis group, and 12.5 and 25 percent, respectively, in the intraabdominal abscess group. Both differences were statistically significant ($p < 0.001$). There was no polymicrobial or anaerobic growth in patients with primary peritonitis, and the number of sterile culture results was significantly lower in secondary peritonitis than in the primary peritonitis, PDP and intraabdominal abscess groups ($p < 0.05$).

Besides microbiological data, anatomical sources also showed differences between secondary peritonitis and PDP. While appendicular origin was the most common in the secondary peritonitis group, PDP most commonly originated from the colon (Table III). Furthermore, an accompanying disease was more common in primary peritonitis (44.4%) and PDP (27%) than in secondary peritonitis (7.4%) and intraabdominal abscess (0%) (Table IV). These differences were statistically significant ($p < 0.005$).

Table III: Anatomical Sources of Secondary Peritonitis and PDP

	Secondary Peritonitis		PDP	
Sources	n	%	n	%
Stomach and duodenum	4	3.3	1	2.7
Jejunum and ileum	11	9.1	10	27.0
Appendix	92	76.0	4	10.8
Colon	10	8.3	12	32.5
Other*	4	3.3	3	8.1
Unknown**	–	–	7	18.9
Total	121	100.0	37	100.0

* Biliary and pancreatic origins.
** Non-operated patients.

Table IV: Accompanying Diseases in Patients with Primary Peritonitis and PDP

Accompanying Disease	No. of Patients	%
Primary peritonitis (n: 9)	(4)	(44.4)
nephrotic syndrome	2	22.2
liver pathology	1	11.1
urinary infection	1	11.1
Persistent diffuse peritonitis (n: 37)	(10)	(27.0)
non-Hodgkin's lymphoma	4	10.8
leukemia	3	8.1
IgM deficiency	1	2.7
Henoch-Schonlein purpura	1	2.7
chronic renal failure	1	2.7

Analysis of the charts indicated that conservative treatment (parenteral nutrition, nasogastric decompression and combined antibiotic therapy-a penicillin derivative, an aminoglycoside and one of ornidazole, metronidazole or clindamycin) was initially tried in all patients with PDP. Antibiotics were changed according to the clinical status and sensitivity reports. If fever, leukocytosis, abdominal tenderness or findings of intestinal obstruction persisted or worsened during conservative treatment, patients underwent surgical intervention.

Twenty-six (70%) patients with PDP underwent operations to overcome the diffuse peritoneal inflammation. In these patients, peritoneal drainage, lavage or debridement was done in various combinations. Peritoneal drainage was employed in 23 patients and it was maintained postoperatively through Penrose, sump or hemovac drains. Peritoneal lavage using isotonic saline was performed only intraoperatively in 21 patients. Peritoneal debridement was applied to 10 patients in a limited manner to remove gross debris, necrotic tissues, and fibrin plaques by minor surgical trauma. The remaining 11 (30%) patients with PDP were managed by conservative measures. Four of them had persistent diffuse postoperative peritonitis and the remaining seven patients had PDP of unknown origin (4 with malignant disease and 3 newborns with necrotizing enterocolitis). Presence of a high risk for anesthesia or a life-threatening extraabdominal pathology contributed to the selection of conservative management in these patients.

Mortality rates were 0.0 percent in primary peritonitis, 9.5 percent in secondary peritonitis, 22 percent in PDP, and 12.5 percent in intraabdominal abscess groups. The difference between mortality rates of secondary peritonitis and PDP was significant ($p < 0.05$). Eight patients died in the PDP group and all had sepsis in conjunction with generalized failure of host defence or multiple system-organ dysfunction consisting of renal, hepatic, pulmonary or cardiovascular failure. The highest mortality was seen in the newborn period (50%) and followed by existence of an accompanying disease affecting host defense (40%). Mortality of fungal PDP was 33 percent, PDP of infancy 27 percent and low-grade pathogen-originated PDP 25 percent. Survival was the best in older children (10%) and aseptic PDP (14%). Additionally, although the difference was not significant ($p > 0.05$), the patients treated with a non-operative approach had a lower mortality (18%) than those surgically treated (23%).

Discusion

When the above-mentioned results were considered, it could be proposed that PDP has different clinical characteristics and outcomes than other types of peritonitis. Age distribution, accompanying diseases and anatomical sources were considerably different in patients fulfilling the criteria of PDP and mortality was also higher in the PDP group. Therefore, as have some authors dealing

with adulthood peritonitis, we also claimed that PDP constitutes a specific group of childhood peritonitis. Critical reviews of the topic support that secondary peritonitis is the most common type of intraabdominal infections, followed by primary peritonitis[5, 8]. From our paper, PDP replaces primary peritonitis and becomes the second most common type of peritonitis. This is an important finding from nosologic and epidemiologic perspectives. However, we are unable to compare our data because there has been no previous study concerning this subject in children.

It is generally possible to differentiate primary peritonitis from secondary through typical clinical, diagnostic and operative findings. However, the border between secondary peritonitis and PDP is not always obvious in some of the patients. Besides the microbiological data presented herein, persisting clinical findings of peritoneal inflammation is the basic feature for PDP[4, 9]. While the microbiological criteria of PDP are defined well in adult patients, definition of the persistence is not clear. Our experiences on peritonitis support that the criterion of 15 days is an acceptable period for persistence. In such cases, the correct and early prediction of PDP is important because failure to diagnose carries an increased morbidity and mortality. Furthermore, some patients with PDP may not initially require an urgent operation as do those with secondary peritonitis, and conservative treatment may be sufficient in these critically ill children. Consequently, a correct diagnosis may prevent some unnecessary operations for PDP.

Supporting our findings, microbiological data pertaining to the patients with secondary peritonitis show high anaerobic and polymicrobial infection rates[5, 10, 11]. On the other hand, PDP has a different microbiologic spectrum. S.epidermidis and antibiotic-resistant Gram-negative microorganisms (Pseudomonas, Enterococcus, etc.), rather than E. coli and B. fragilis which are typical in the early phase of the disease, have been identified from adult patients with PDP[4, 5]. Nevertheless, the microbiological spectrum of PDP has not yet been clearly documented in children. Because we used the criteria of adulthood PDP, our study has a limited contribution on the microbiology of PDP. Therefore, it would be better if microbiological characteristics of childhood PDP were clarified by prospective studies.

Candida is infrequently identified as a primary pathogen of intraabdominal infections, but it has become recognized as a prominent pathogen under broad spectrum antibiotic and immune depressant therapy[5, 8]. Additionally, fungal peritonitis has a morbid or mortal course[12]. In our series, although the number of patients with fungal peritonitis was relatively small, fungi were responsible for the highest mortality when the causative microorganism was considered. In contrast, PDP without pathogens had a better survival rate than the other two subgroups. In this regard, a more competent immune system may prevent the growth of pathogens and may play a role in the better survival rate of these patients.

Surgical management of PDP is another controversial topic. Some aggressive therapeutic alternatives, including continuous peritoneal drainage and lavage, radical peritoneal debridement, open abdomen and planned abdominal reexplorations, have been advocated to treat patients with PDP[13-15]. In addition to the surgical procedures, broad spectrum antimicrobial therapy that is effective on all possible microorganisms has been recommended in the management of PDP[16, 17]. While our policy on antibiotherapy agreed with this conventional practice, our surgical choices remained more conservative than recommended ones. Despite this conservative approach, our results related with mortality were somewhat better than in adults who had been subjected to more aggressive therapeutic modalities. Recently, some reports in favor of more conservative surgery have been published[18, 19]. Such equivocal results require further studies to determine the ideal treatment method of childhood PDP.

To evaluate both severity of peritonitis and prognosis, various scales such as Peritonitis Index Altona, Acute Physiology Score and especially Acute Physiology and Chronic Health Evaluation Score (APACHE II or III) have been used in adult patients[1, 5, 20, 21]. Considering these scales, establishment of a modified system for children may provide a more rational approach to childhood peritonitis. Although we did not use a scoring system, our study supported that mortality risk of PDP is higher in younger infants, in the existence of an additional disease affecting host defense and in fungal origin. Current experiences with neonatal infection suggest that survival is now significantly better as a result of skillful neonatal intensive care[22]. However, poor prognosis has been reported for neonatal peritonitis, and PDP still carries a high mortality risk in younger infants because of the underdeveloped immune system[23].

Since it has a special clinical picture, PDP also looks like a different type of peritonitis in children, such as it is defined in adults. Identification of these cases from the patients with prolonged peritonitis and use of therapeutic modalities including more conservative measures may decrease mortality risk. Finally, we hope that our preliminary experience presented here will call to mind some overlooked points about childhood peritonitis and stimulate prospective clinical studies on the subject.

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