Peritonitis in Acute Peritoneal Dialysis in a University Hospital

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Abstract

Objective : Although acute peritoneal dialysis is a useful procedure, peritonitis is often a complication. When the patient is mainly at risk of peritonitis is controversial. The purpose of this study was to find the incidence time of peritonitis, the infecting microorganism, and risk factors.

Design : A retrospective study

Patients : 118 cases of acute peritoneal dialysis in 93 patients were included in this study.

Method : Data were collected from medical records.

Results : Overall, the peritonitis rate was 36.45 per cent. The peritonitis rate rose following the duration of dialysis from 11 per cent on the first day to 21 per cent on the third day, although the difference was not statistically significant. Gram-negative bacilli were predominant, at 81.6 per cent. *Acinetobacter baumanii* and *Enterobacter cloacae* were the two most common organisms (23.7 and 21.1% respectively). There was a significantly higher male to female ratio in the peritonitis group than the no-peritonitis group (3.33:1 and 1.2:1 respectively, p=0.028).

Conclusion : There was a high peritonitis rate in acute peritoneal dialysis. The most common microorganisms were gram-negative bacilli, *Acinetobacter baumanii* and *Enterobacter cloacae.* The risk factor was male sex. Duration of dialysis of more than 2 days tended to increase the risk of peritonitis.

Key word : Peritonitis, Acute Peritoneal Dialysis

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Peritoneal dialysis is a simple procedure needing neither a specialist nor complex equipment. The advantages over hemodialysis include avoidance of systemic anticoagulants and hemodynamic stress. However, it takes longer because of low metabolic and electrolytes clearance.

The main obstacle of this procedure is the occurrence of peritonitis which, for intermittent peritoneal dialysis, has been reported at from 1-12 per cent[1-3]. Maxwell et al[4] reported that the risk of peritonitis increased after 48-72 hours of treatment and suggested that acute peritoneal dialysis should be kept under this time. This was supported by the studies of Schwartz et al[5] and Chamberlain et al [6]. However, Valeri et al[7] differed, saying that the highest risk of peritonitis was within the first 48 hours of treatment, after which the risk decreased and stabilized for up to 15 days of treatment.

At our institution the authors perform acute peritoneal dialysis frequently because of a shortage of hemodialysis machines and staff, and sometimes it is of longer duration than recommended. The peritonitis rate was rather high by observation, so the authors felt we should determine the actual rate, microorganisms involved and risk factors should be determined.

METHOD AND PATIENTS

The results of acute peritoneal dialysis in all patients from 1 April 1998 to 30 April 1999 were retrospectively reviewed. The data were collected from the medical records, and included age, sex, diabetes mellitus, sepsis at the time of procedure, type of renal failure, indication for dialysis, doctor performing access, dialysate leakage, number of additive drugs, duration of dialysis, number of repeats of dialysis, hospital days before start of dialysis, and microorganism(s) isolated from dialysate culture.

All peritoneal dialysis accesses were acute catheter type done in the ward using the (JMS peritoneal dialysis administrative set, Japan Medical Supply(s), PTE). The dialysate fluid used was 1.5 per cent perisolution A. Each cycle usually took 1 hour with volume of dialysate 1-1.5 liters and duration of treatment 48-72 hours. Drugs, such as heparin, glucose and potassium, were added to the dialysate fluid if indicated. The wound dressing was not changed unless it was wet with blood or dialysate leakage.

Peritonitis was diagnosed if at least one of the following criteria was met: 1) peritoneal fluid effluent white blood cell count was more than 100/ μL with >50 per cent polymorphonuclear leukocytes, or 2) a positive peritoneal fluid effluent gram stain or culture.

Statistical analyses was performed using SPSS for Window V.9. Mean ± standard deviation or number with percentage were shown for descriptive statistics. Chi-Square and Kruskal-Wallis were used to compare the differences between the groups for the qualitative data as appropriate. *T*-test was used to compare mean for the quantitative data. $P< 0.05$ was considered to be statistically significant.

RESULTS

There were 118 procedures in the 93 cases of acute peritoneal dialysis during the study period. Nine procedures were excluded because of a very short treatment duration of less than 12 hours, leaving data from 109 procedures to be analysed. There were 39 procedures with peritonitis and 70 procedures without, giving an overall peritonitis rate of 36.45 per cent. Peritonitis was diagnosed by effluent cell count in 15 (13.76%), culture positive for bacteria in 2 (2.51%), and both in 22 (20.18%). Peritonitis was diagnosed on the first, second, third, fourth and sixth day of the procedure at 11, 11, 21, 25 and 100 per cent, respectively. However, there was no significant difference in the peritonitis rate between these days.

The basic data of patients with and without peritonitis is shown in Table 1. There was no difference in age, diabetes mellitus, sepsis at the time of procedure, renal failure type, indications for dialysis, dialysis cycles and hospital days before the start of acute peritoneal dialysis between the two groups. There was a significantly higher male to female ratio in the peritonitis group (3.33:1) than the no-peritonitis group (1.2:1).

All 24 positive dialysate cultures showed bacteria. There were one, two and three microorganisms of 14, 6 and 4 specimens respectively. Gram-negative bacilli accounted for 81.6 per cent which were *Acinetobacter baumanii* (23.7%) and *Enterobacter cloacae* (21.1%). The bacteria isolated from dialysate are shown in Table 2.

Risk factors that were studied are shown in Table 3. Most of the doctors performing the access were medical residents, (82%), but there was no difference in the peritonitis rate between medical and surgical residents. There was a higher peritonitis rate in procedures with zero or three additive drugs,

Table 1. Basic data comparing procedures with and without peritonitis.

Data	Procedures with peritonitis (n=39)	Procedures without peritonitis (n=70)
Age (yrs)	54.03 ± 14.78	51.66 ± 18.92
Sex (M/F)	30/9	39/31*
DM (%)	10 (25.64)	12 (17.14)
Sepsis (%)	23 (58.97)	48 (68.57)
Chronic renal failure (%)	18 (50)	22 (32.83)
Uremia (%)	36 (92.31)	67 (95.71)
Pulmonary edema (%)	14 (35.9)	35 (50)
Hospital days before start	6.5 ± 6.7	5.6 ± 6.1
Dialysis cycles	56.79 ± 20.60	55.74 ± 16.61

* p=0.028

Table 2. Bacteria isolated from dialysate.

Microorganism	Number	Per cent
Gram-nagative	31	81.6
Acinetobacter baumanii	9	23.7
Enterobacter cloacae	8	21.1
Pseudomonas aeruginosa	4	10.5
Acinetobacter junii	2	5.3
Klebsiella pneumoniae	2	5.3
Escherichia coli	2	5.3
Citrobacter freundii	2	5.3
Acinetobacter lwoffii	1	2.6
Enterobacter agglomerans	1	2.6
Gram-positive	7	18.4
Staphylococcus epidermidis	2	5.3
Enterococci	2	5.3
Staphylococcus aureus	1	2.6
Alpha-streptococcus non gr.D	1	2.6
Corynebacterium spp	1	2.6

but the difference was not significant. Repeated acute peritoneal dialysis did not increase the peritonitis rate. After two procedures, the risk of peritonitis could not be tested because of the low number of procedures in each group.

DISCUSSION

The present study showed a high incidence of peritonitis compared to other studies[1-3,8,9]. This may be due to different criteria for defining peritonitis. Peritonitis was usually diagnosed when there were 2 of the following criteria:(a) peritoneal symptoms or signs, (b) a peritoneal fluid effluent WBC count greater than 100/μL with >50 per cent polymorphonuclear leukocytes, (c) a positive peritoneal fluid effluent gram stain or culture. Fever was not used because about half of the procedures had sepsis before starting the procedure and most cases had no fever. The peritoneal effluent was examined every day, which may have been too early to detect changes in the white blood cell count before abdominal pain or cloudy fluid occurred. However, when the usual criteria for peritonitis was used, the rate decreased from 36.45 per cent to 20.18 per cent, but was still higher than other studies[1-3].

Most microorganisms were gram-negative bacilli, as in other studies[8,9]. This indicated hospital-acquired infection, as the main bacilli were *Acinetobacter baumanii* and *Enterobacter cloacae*. The organisms found were different from the studies of Sutcharitchan and Niwatchai[8] and Lawhapensaeng, Fongcome and Chaiwong[9], which found the most common organisms to be *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*. This may be the effect of a different environment.

The main risk factor of peritonitis was a long duration of dialysis[4-6]. It was also found that the peritonitis rate rose after 2 days, however the difference was not statistically significant. This may have been the effect of a small sample size. These results suggest that a long duration of dialysis increases the risk of bacterial contamination; however, this is contradicted by the report of Valeri et al[7], which showed the peri-operative time to be the highest risk of bacterial contamination. So further study is needed.

Other possible risks of bacterial contamination include the doctor performing access, dialysate

Table 3. Incidence of peritonitis with each risk factor.

Factors (cases/total)	Peritonitis rate	%
Doctors performing access		
Medical resident	31/89	34.83
Surgical resident	8/20	40
Number of drugs added		
0	5/10	50
1	17/50	34
2	10/33	30.30
3	7/16	43.75
Number of performed procedures (times)		
1	31/87	35.63
2	7/18	38.89
3	1/2	50
≥4	0/2	0

* The difference between groups in each parameter was not significant, $p>0.05$.

leakage, repositioned catheter and manipulation of dialysate before use. However the authors did not find certain possible risk factors such as the doctor performing access, number of additive drugs, and number of procedures. The number of additive drugs seemed to increase the risk and this may contaminate the dialysate. But there was no difference in the rate of peritonitis among procedures with different numbers of additive drugs. In this way, the present study supported the study of Valeri et al[7]. This should indicate that manipulation of dialysate before use was not the route of bacterial contamination because of good aseptic technique. Dialysate leakage occurred in only one episode of dialysis, and should not be considered a serious risk of peritonitis.

The present data showed that repeated procedures, if indicated, did not increase the risk of peritonitis, although the number of repeat procedures was rather low. Bacterial contamination should not increase with repeated procedures.

Other possible risk factors were the access type and sterile technique. The authors used the acute catheter type, which has no cuff to protect bacterial contamination from the skin, and the open-drainage system. As shown by Valeri et al[7]. the incidence of peritonitis is less with the chronic catheter type, double-cuff Tenckhoff catheter, or closed-drainage system, so the effect of surgical technique, catheter type and drainage system should be considered to be risk factors for bacterial contamination and peritonitis. This should be tested further. Currently, the authors suggest restricting acute peritoneal dialysis to less than 72 hours with the acute catheter.

Interestingly, a higher peritonitis rate in male patients was found, but there was no explanation for this.

In conclusion, the rate of peritonitis during acute peritoneal dialysis was high and male preponderance was found. Duration of dialysis of more than 2 days may increase the risk of peritonitis. Repeated procedures could be performed with no increased risk of peritonitis. The most common organisms involved were gram negative bacilli.

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การติดเชื้อในช่องท้องจากการฟอกเลือดทางช่องท้องแบบเฉียบพลัน

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วัตถุประสงค์ : การฟอกเลือดทางช่องท้องแบบเฉียบพลันมีประโยชน์มากในเวชปฏิบัติ ภาวะติดเชื้อในช่องท้องเป็นปัญหาแทรกซ้อนที่สำคัญ ระยะเวลาที่เสี่ยงต่อการติดเชื้อยังไม่แน่ชัด การศึกษานี้เพื่อหาอุบัติการณ์และปัจจัยเสี่ยงของการติดเชื้อในช่องท้องในการทำฟอกเลือดทางช่องท้องแบบเฉียบพลัน

รูปแบบการศึกษา : การศึกษาเชิงพรรณาแบบย้อนหลัง

ผู้ป่วย : การทำฟอกเลือดทางช่องท้องแบบเฉียบพลันทั้งหมด 118 ครั้งจากผู้ป่วย 93 ราย

วิธีการศึกษา : เก็บข้อมูลจากเวชระเบียนผู้ป่วยใน

ผลการศึกษา : โดยรวมมีอัตราการติดเชื้อในช่องท้องร้อยละ 36.45 อุบัติการณ์ของการติดเชื้อในช่องท้องเพิ่มขึ้นจากร้อยละ 11 ในวันแรกของการทำเป็นร้อยละ 21 ในวันที่สามของการฟอกเลือด อย่างไรก็ตามอัตราการติดเชื้อในช่องท้องไม่แตกต่างกันอย่างมีนัยสำคัญ เชื้อที่พบมากที่สุดคือเชื้อแบคทีเรียทรงแท่งติดสีแกรมลบ คิดเป็นร้อยละ 81.6 โดยเชื้อที่พบบ่อยที่สุดคือ *Acinetobacter baumanii* (ร้อยละ 23.7) ในผู้ป่วยที่มีการติดเชื้อในช่องท้องมีสัดส่วนของผู้ชายต่อผู้หญิงมากกว่ากลุ่มผู้ป่วยที่ไม่มีการติดเชื้อในช่องท้องอย่างมีนัยสำคัญทางสถิติ (อัตราส่วน 3.33 ต่อ 1 และ 1.2 ต่อ 1 ตามลำดับ, p=0.028)

สรุปผลการศึกษา : อุบัติการณ์ของการติดเชื้อในช่องท้องในการทำฟอกเลือดทางช่องท้องแบบเฉียบพลันถือว่าสูง เชื้อที่พบบ่อยเป็นเชื้อแบคทีเรียทรงแท่งติดสีแกรมลบ ปัจจัยเสี่ยงคือเพศชาย การฟอกเลือดทางช่องท้องที่นานกว่า 2 วันมีแนวโน้มจะเพิ่มอัตราการติดเชื้อในช่องท้อง

คำสำคัญ : ภาวะติดเชื้อในช่องท้อง, การฟอกเลือดทางช่องท้องแบบเฉียบพลัน

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