

RESEARCHES REGARDING THE INCIDENCE OF PERITONEAL CATHETER COMPLICATIONS IN PATIENTS WITH ACUTE KIDNEY INJURY

CERCETĂRI PRIVIND INCIDENȚA APARIȚIEI COMPLICAȚIILOR LA NIVELUL CATETERULUI PERITONEAL LA PACIENȚII CU AFECTARE RENALĂ ACUTĂ

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ABSTRACT | REZUMAT

Peritoneal dialysis is a therapeutic method of renal replacement used successfully in patients diagnosed with acute kidney injury. The ideal peritoneal dialysis catheter for this type of therapy allows both administration and proper evacuation of the dialysis solution, causes minimal subcutaneous losses, and minimises infection, both in the peritoneal cavity and in the subcutaneous tissue. Acute dialysis catheters are most often inserted under local anaesthesia, through a stylet, percutaneously and require immediate heparinization. These catheters are usually straight or curved, with holes at the distal end of the catheter. Acute catheters generally do not have Dacron sleeves to protect the patient against bacterial infection because they are not used for a long period of time and adhesion formation is not required. The study was carried out on a number of 20 patients, divided into 2 batches with different dialysis catheters (B1 Pigtail and B2 Round Blake). In both batches, peritoneal dialysis was performed every 4 hours, and the dialysis fluid was heated to a temperature of 38–39°C. The aim of this study is to determine the incidence of peritoneal dialysis catheter complications and to minimise them. "Pigtail" peritoneal dialysis catheters ensure more efficient fluid exchanges, with the degree of their partial obstruction being minimal due to the shape of the distal end, which is located at the bottom of the Douglas bag.

Keywords: peritoneal dialysis, catheter, dog

Dializa peritoneală reprezintă o metodă terapeutică de substituție renală, utilizată cu succes în cazul pacienților diagnosticați cu afectare renală acută. Cateterul de dializă peritoneală ideal pentru acest tip de terapie permite atât administrarea, cât și evacuarea corespunzătoare a soluției de dializă și determină pierderi subcutanate minime, minimizează infecția, atât în cavitatea peritoneală, cât și în țesutul subcutanat. Cateterul pentru dializă acută se introduce, de cele mai multe ori, cu anestezie locală, printr-un stilet, percutanat și necesită heparinizare imediată. Aceste catetere sunt, de obicei, drepte sau curbe cu orificii la capătul distal al cateterului. Cateterele acute, în general, nu au manșoane de Dacron pentru a proteja pacientul împotriva infecției bacteriene deoarece nu sunt utilizate o perioadă lungă de timp și nu este necesară formarea aderențelor. Studiul a fost realizat pe un număr de 20 pacienți, împărțiți în două loturi cu catetere de dializă diferite (B1 Pigtail și B2 Round Blake). La ambele loturi dializa peritoneală a fost efectuată la fiecare 4 ore, iar lichidul de dializă a fost încălzit la temperatura de 38-39°C. Scopul acestui studiu este de a determina incidența apariției complicațiilor la nivelul cateterului de dializă peritoneală și de a le minimiza. Cateterele de dializă peritoneală de tip „Pigtail” asigură schimburi de fluide mai eficiente, gradul de obstrucție parțială a acestora fiind minim datorită formei capătului distal care se află în fundul de sac Douglas.

Cuvinte cheie: dializă peritoneală, cateter, câine

Peritoneal dialysis is a technique of renal replacement therapy (RRT) dating back to the 1950s. Its essential features are a fixed intraperitoneal volume and rapid, continuous movement of dialysis solution into and out of the peritoneal cavity (2, 3, 7).

Peritoneal dialysis is a therapeutic method of renal replacement, used successfully in patients diagnosed with acute kidney injury. Peritoneal dialysis is a technique whereby the infusion of dialysis solution into the

peritoneal cavity is followed by a variable dwell time and subsequent drainage. During peritoneal dialysis, solutes and fluids are exchanged between the capillary blood and the intraperitoneal fluid through a biologic membrane, the peritoneum (9).

Urea is a small molecular-weight (60 Da) nitrogenous metabolite whose plasma concentration exceeds that of all other uremic solutes. It contributes minimally to the clinical manifestations of uraemia but has remained fundamentally associated with the morbidity and outcome of the uremic syndrome because of its abundance and its link to the metabolism of dietary and endogenous nitrogen (1, 5, 6).

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Peritoneal dialysis is a more affordable and less invasive procedure to gradually eliminate uremic toxins. It can offer temporary support for the kidneys until the recovery of renal function is done or when haemodialysis cannot be used as a basic treatment (10).

In this process, dialysate is instilled into the peritoneal cavity and, through the processes of diffusion and osmosis, water, toxins, electrolytes, and other small molecules are allowed to equilibrate (4).

The ideal peritoneal dialysis catheter for this type of therapy allows both administration and proper evacuation of the dialysis solution, and causes minimal subcutaneous losses, minimises infection, both in the peritoneal cavity and in the subcutaneous tissue (11).

Acute dialysis catheters are most often inserted under local anaesthesia, through a stylet, percutaneously, and require immediate heparinization. These catheters are usually straight or curved, with holes at the distal end of the catheter. Acute catheters generally do not have Dacron sleeves to protect the patient against bacterial infection because they are not used for a long period of time and adhesion formation is not required. There is also an increased risk of bowel perforation during the placement of these catheters.

The intraperitoneal portion of the catheters has numerous side holes at the distal end to allow the free flow of dialysate. The distal end of the peritoneal dialysis catheter can be straight or coiled. The spiral tip can help minimise obstruction (8, 11).

The aim of this study is to determine the incidence of peritoneal dialysis catheter complications and minimise them in order to perform more efficient urea reduction in patients diagnosed with acute kidney injury.

MATERIALS AND METHODES

The study was conducted at the Faculty of Veterinary Medicine in Bucharest for two years.

This study was carried out on a number of 20 patients of different ages, belonging to 6 different breeds (Metis n=9–47%, Bichon Maltese n=4–21%, Pomernian n=2–11%, Dachshund n=2 - 11%, Shih-tzu n=1–5%, Papillon n = 1–5%). The 20 patients were divided into two batches of 10 each (Batch 1 Pigtail, n=10 and Batch 2 Round blake, n=10).

In both batches, the peritoneal dialysis catheter was placed and bandaged by aseptic methods, the dressing being changed after each fluid exchange. Also, in all patients undergoing the study (n = 20), the dialysis fluid was introduced at a temperature between 38 and 39 °C. In order to be able to obtain as faithful results as possible regarding the effectiveness of the catheter, the therapy protocol was the same in the case of both groups.

The dialysis protocol was as follows:

- 1 exchange: 15 ml/kg of liquid was introduced;
- 2nd change: 30 ml/kg of liquid were introduced;
- 3rd change: 45 ml/kg of liquid were introduced;
- 4th change: 60 ml/kg of liquid were introduced;

Then, it was continued at each exchange with 60 ml/kg of liquid. Fluid exchanges were performed four times a day, at 4-hour intervals.

The degree of catheter functioning and the occurrence of complications were monitored: total obstruction (TO), partial obstruction (PO), local inflammation (LI), subcutaneous leaks (SL), infection (I), or without complications (NC), for 10 days. The catheter bandage was replaced daily, and before manipulation, it was disinfected with chlorhexidine 0.5%.

RESULTS AND DISSCUSIONS

Occurring complications were noted, and the permeability of the peritoneal dialysis catheter was assessed in each patient for 10 days, both in batch 1 Pigtail (Table 1) and batch 2 Round blake (Table 2).

In the Batch 1 Pigtail (n = 10), the following complications were observed (Fig. 1), which altered the functioning of the peritoneal dialysis catheter:

- Partial Obstruction (PO), n = 2 (20%);
- Total Obstruction (TO), n = 0 (0%);
- Local Inflammation (LI), n = 2 (20%);
- Subcutaneous Leaks (SL), n = 0 (0%);
- Infection (I), n = 0 (0%);
- Without Complications (NC), n = 6 (60%).

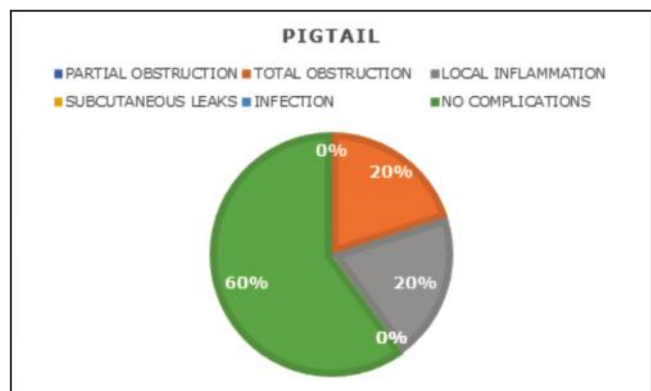


Fig 1. The percentage of complications in Batch 1 Pigtail (n=10) for 10 days

In the Batch 2 Round blake group (n=10), the following complications were observed (Fig. 2), which altered the functioning of the peritoneal dialysis catheter:

- PO, n = 6 (20%);
- TO, n = 0 (0%);
- LI, n = 2 (20%);
- SL, n = 2 (0%);
- I, n = 0 (0%);
- NC, n = 0 (60%).

Table 1
Catheter permeability and function for 10 days in the Batch 1 Pigtail (n=10)

PATIENT NO. 1, B1 PIGTAIL										
100%	100%	100%	99%	98%	97%	96%	95%	92%	90%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 2, B1 PIGTAIL										
100%	100%	100%	99%	99%	99%	98%	98%	98%	97%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 3, B1 PIGTAIL										
100%	100%	100%	98%	98%	97%	95%	95%	90%	90%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 4, B1 PIGTAIL										
100%	100%	100%	95%	92%	90%	85%	85%	84%	80%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 5, B1 PIGTAIL										
100%	100%	97%	95%	95%	90%	90%	90%	90%	90%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 6, B1 PIGTAIL										
100%	100%	98%	98%	95%	94%	90%	85%	85%	85%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 7, B1 PIGTAIL										
100%	100%	100%	90%	90%	90%	90%	90%	85%	85%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 8, B1 PIGTAIL										
100%	100%	100%	99%	99%	97%	97%	95%	95%	95%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 9, B1 PIGTAIL										
100%	100%	100%	95%	90%	90%	90%	90%	85%	85%	
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 10, B1 PIGTAIL										
100%	100%	100%	100%	100%	95%	95%	95%	90%	90%	
1	2	3	4	5	6	7	8	9	10	

Other complications were noted but are not the subject of this study.

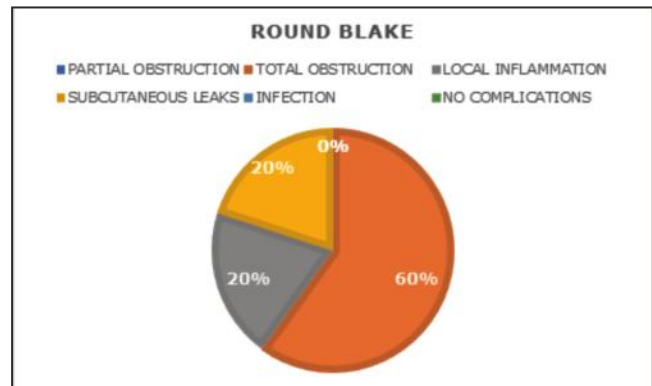


Fig. 2. The percentage of complications in Batch 2 Round Blake (n=10) for 10 days

As more complications occur at the level of the peritoneal catheter, its functioning begins to be deficient, fluid exchanges can no longer be carried out properly. Also, a graphic comparison (Fig. 3) of the functionality of the peritoneal dialysis catheter between the two batches was performed.

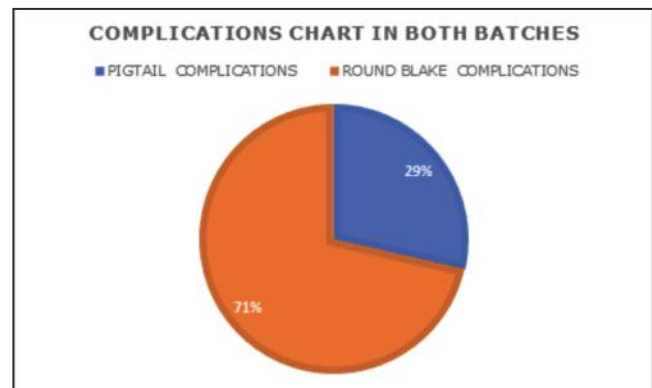


Fig. 3. The percentage of complications in both batches (n=20) depending on the catheter used

Patients in Batch 1 Pigtail (n=10), had a complication incidence of 29%, and those in Batch 2 Round black (n=10), had a complication incidence of 71%.

CONCLUSIONS

Choosing the peritoneal catheter in patients diagnosed with acute kidney injury is the basis of renal replacement therapy. "Pigtail" peritoneal dialysis catheters ensure more efficient fluid exchanges, the degree of their partial obstruction being minimal due to the shape of the distal end which is located in the bottom of the Douglas bag. Both "Pigtail" and "Round Blake" type peritoneal catheters generate minimal inflamma-

Table 2
Catheter permeability and function for 10 days in the Batch 2 Round blake (n=10)

PATIENT NO. 1, B2 BLAKE										
100% - 90% - 85% - 80% - 80% - 75% - 70% - 70% - 65% - 65%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 2, B2 BLAKE										
100% - 95% - 90% - 90% - 80% - 70% - 70% - 65% - 65% - 65%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 3, B2 BLAKE										
100% - 95% - 90% - 90% - 85% - 80% - 75% - 65% - 60% - 60%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 4, B2 BLAKE										
100% - 90% - 90% - 85% - 82% - 82% - 80% - 80% - 74% - 70%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 5, B2 BLAKE										
100% - 97% - 95% - 95% - 95% - 90% - 80% - 80% - 70% - 70%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 6, B2 BLAKE										
100% - 100% - 90% - 90% - 80% - 80% - 70% - 65% - 65% - 60%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 7, B2 BLAKE										
100% - 98% - 93% - 90% - 87% - 80% - 80% - 75% - 72% - 72%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 8, B2 BLAKE										
100% - 80% - 80% - 75% - 75% - 75% - 70% - 70% - 70% - 70%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 9, B2 BLAKE										
100% - 95% - 95% - 95% - 90% - 90% - 80% - 75% - 75% - 73%										
1	2	3	4	5	6	7	8	9	10	
PATIENT NO. 10, B2 BLAKE										
100% - 90% - 80% - 80% - 70% - 65% - 65% - 65% - 60% - 60%										
1	2	3	4	5	6	7	8	9	10	

tory local reactions, which can be represented by the inflammation of the subcutaneous connective tissue. Due to the anatomy of the "Pigtail" type peritoneal catheters, as well as the multiple holes, they ensure 100% permeability by not allowing the peritoneal dialysis fluid to pass from the peritoneal cavity and produce subcutaneous leaks.

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