Intravenous Antibiotics with Adjunctive Lavage in Refractory Peritonitis

Refractory peritonitis is a major cause of peritoneal dialysis (PD) technique failure that requires catheter removal (1). To date, there is no well-proven adjuvant treatment for PD peritonitis when response to antibiotics is suboptimal. In our center, intravenous (IV) antibiotics with adjunctive lavage was offered when pending catheter removal in refractory cases, after we first experienced an unexpected cure in 2010 when such strategy was applied for symptom relief. In the present case series, we present the outcomes of IV antibiotics with adjunctive lavage in severe PD peritonitis.

CASE SERIES

In our center, cefazolin/ceftazidime are empirical antibiotics of choice upon presentation of PD peritonitis and are adjusted subsequently according to microbiology reports. In non-responsive cases, antibiotics escalation is often considered and catheter removal arranged when

deemed refractory, where wait times for the procedure varies depending on operating room availability. From November 2010 to December 2012, there were 13 peritonitis episodes in 12 patients who had received IV antibiotics with adjunctive lavage when pending catheter removal (except 1 who declined the procedure). Lavage was performed by the Baxter HomeChoice automated peritoneal dialysis system (Baxter Healthcare Corporation, Deerfield, IL, USA) with fill volume at 2 L and 2-hour dwell time usually over 48 to 72 hours. Antibiotics were switched from intra-peritoneal (IP) to IV route during lavage and back to the IP route when the usual PD schedule resumed.

Among the 13 peritonitis episodes, there were 2 fungal and 2 tuberculosis cases that had catheters removed as planned. Both tuberculosis episodes were considered culture-negative initially as their culture results were available only after catheter removal. The other 9 bacterial peritonitis cases were our subjects of interest, with patients' details and peritonitis progress shown in Table 1 and Figure 1, respectively. Successful cure was achieved in 6 episodes where catheter removal could be withheld. We need to highlight Patient H, a frail elderly person who declined catheter removal and hemodialysis. Respecting her desire for comfort care, repeated lavage was offered that often resulted in pain improvement and worsened again once cycler was off. Her trend of C-reactive protein (CRP) changes is included in Figure 1, which seemingly paralleled usage of lavage. We decided against further lavage eventually when her general condition was poor and she succumbed.

DISCUSSION

Management options are limited for refractory peritonitis patients who refuse catheter removal or have poor tolerance to hemodialysis. Our strategy of IV antibiotics with adjunctive lavage is controversial since antibiotics are preferably given IP and peritoneal defense might be impaired during lavage (2). With respect to the antibiotics route, studies comparing IP to IV/oral route with the same antibiotics were relatively scarce in the literature and there was a lack of concrete evidence supporting the superiority of the IP route. While IP vancomycin/tobramycin was superior to IV-arm only in gram-positive peritonitis (3), similar effectiveness was found between IP and IV vancomycin in a trial (4), and another fluoroquinolone study favoring the IP route was limited by very high bacterial resistance (5). Lavage may enhance removal of inflammatory cells and bacteria (6) and might account for the better pain control that was consistently seen in our series. Although we did not perform objective

TABLE 1
Patients' Demographics and Details of Peritonitis

	Gender	Age, years	Cause of ESRD	Co-morbidities	PD vintage, years (history of peritonitis)	Causative organism	Microbiology report	
							Susceptible	Resistant
Patient A	Female	28	IgA nephropathy	Hypertension	7 (1)	Pasteurella multocida	Ampicillin Augmentin Co-trimoxazole Tetracycline	Nil
Patient B	Female	81	Hypertension	Gout	5.5 (1)	Escherichia coli	Ampicillin Cefuroxime Gentamicin Co-trimoxazole	Ciprofloxacin
Patient C (1 st episode)	Female	55	Polycystic kidney	Diverticulosis	4.5 (0)	Escherichia coli	Amikacin Cefuroxime Ciprofloxacin Co-trimoxazole	Ampicillin Gentamicin
Patient D	Female	61	Anti-GBM disease	Hypertension	7.3 (2)	Citrobacter	Cefepime Imipenem	Ampicillin Cefotaxime Ciprofloxacin Gentamicin Amikacin Co-trimoxazole
Patient E	Female	55	Diabetes mellitus	Hypertension CAD	5.7 (2)	Escherichia coli	Augmentin Cefuroxime Ciprofloxacin Gentamicin	Ampicillin Co-trimoxazole
Patient F	Female	73	Hypertension	—	6.3 (0)	Escherichia coli	Ampicillin Cefuroxime Ciprofloxacin Gentamicin Co-trimoxazole	Nil
Patient G	Female	73	Hypertension	—	5.1 (3)	Culture negative	N/A	N/A
Patient H	Female	70	Hypertension	Old CVA	8 (5)	Pseudomonas aeruginosa	Ciprofloxacin Piperacillin Sulperazon Gentamicin	Nil
Patient C (2 nd episode)	Female	57	Polycystic kidney	Diverticulosis *Diabetes mellitus	6.5 (1)	Klebsiella	Augmentin Cefuroxime Ciprofloxacin Gentamicin Co-trimoxazole	Ampicillin

ESRD = end-stage renal disease; PD = peritoneal dialysis; IgA = Immunoglobulin A; GBM = glomerular basement membrane; CAD = coronary artery disease; CVA = cerebrovascular accident; N/A = not applicable.

* Diabetes mellitus was diagnosed 6 months after 1st episode of peritonitis in Patient C.

Figure 1 — Progress and outcome of the 9 bacterial peritonitis episodes, with peritoneal PDE leukocyte count (/mm³) in relationship to antibiotics usage and lavage period shown in grey boxes. IP = intra-peritoneal; IV = intravenous; PO = per oral; PDE = dialysis effluent; Dn = peritonitis day; Δ = gram stain result available; $\blacksquare$ = final culture result available; CRP = C-reactive protein.

assessment of pain severity, the CRP reduction during lavage in Patient H might be indicative of improved inflammation. In a previous negative trial on lavage, antibiotics were given IP during lavage without dwell time (7). One potential problem was the uncertainty on antibiotics absorption and clearance, as we lacked robust pharmacokinetic data on IP antibiotics during prolonged continuous rapid exchanges.

Certainly there are arguments against our practice. Firstly, it is possible that the positive outcome might be merely related to changes in antibiotics (especially among the initial 4 cured cases) or due to the delayed response of antibiotics in use. Secondly, lavage might exacerbate peritoneal albumin loss but was not seen among most patients in our series, except Patient H who had hypoalbuminemia requiring parenteral nutrition. Thirdly, attempting lavage might prolong peritonitis duration, resulting in more complications.

To conclude, we reported use of IV antibiotics with adjunctive lavage for refractory peritonitis. Despite the favorable outcomes observed, we need to stress that such a strategy should be considered as 'therapy of last resort' if the catheter could not be removed in a timely fashion, or in a situation where the patient is not a candidate for hemodialysis conversion. Yet, if IV antibiotics with lavage has genuine therapeutic effects especially in severe peritonitis, further clinical trials will be necessary to see whether its earlier application can result in better peritonitis outcome.

DISCLOSURES

The authors have no financial conflicts of interest to declare.

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