A Novel Technique to Treat Hydrothorax in Peritoneal Dialysis: Laparoscopic Hepato-diaphragmatic Adhesion

KEY WORDS: Hydrothorax; complications; laparoscopy.

One of the possible complications of continuous ambulatory peritoneal dialysis (CAPD), although rare, is the development of hydrothorax, which has been reported in 2% of all patients on peritoneal dialysis (PD) (1). Typically, CAPD-related hydrothorax has an acute onset, with respiratory distress. Chest radiography shows right-sided pleural effusion in about 90% of cases (2).

The presence of pleuroperitoneal communication has been identified as the most common reason (among others) explaining hydrothorax in PD. The management of CAPD-related hydrothorax has been extensively reviewed (2,3). Conservative nonsurgical treatments based solely on PD interruption or interruption combined with chemical pleurodesis [pleural instillation, through a thoracic drain, of various sclerosing agents such as talc, tetracycline, autologous blood, fibrin glue, or a hemolytic streptococcal preparation (OK-432)] have been advocated (2). Surgical approaches range from an open repair, through a thoracotomy, of the diaphragmatic defects, to a minimally invasive video-assisted thoracoscopic surgical technique, with or without complementary chemical

or mechanical pleurodesis (2). Considering that the cause of fluid migration to the thorax is limited to a diaphragmatic defect, we proposed to close it using the adhesive properties of surgical meshes placed through a minimally invasive laparoscopic approach, which allowed for visualization and treatment of the defect from the abdominal side.

METHODS

Patients developing a CAPD-related hydrothorax were identified from a prospective database created in February 1991 and perpetuated from that time forward at the Nephrology department. Diagnosis was confirmed by the typical clinical course and chest radiography. These patients were referred to the Digestive Surgery department [usually involved in the implantation and surgical follow-up of the CAPD catheters (4)]. Once informed consent was given, the patients were treated using the laparoscopic approach.

Surgical Procedure: Antibiotic prophylaxis was administered at the time of the anesthetic induction (1 g cephalosporin). Patients were placed in a Trendelenburg position. Insufflation was performed directly through the PD catheter. A 10-mm trocar was inserted above the umbilicus into the abdomen. A 3CCD high-quality camera [or, more recently, a high-definition (HD) camera (Karl Storz Endoskope, Tüttlingen, Germany)], combined with a 10-mm optic, was introduced to guide the positioning of two further 5-mm trocars on the right and left sides, 5 cm below the rib arch. Exploration of the diaphragm was then carefully performed to identify the diaphragmatic defect. A 10×15-cm mesh of knitted polypropylene filaments (Ethicon, Cornelia, GA, USA) was cut to precisely overlap the hepato-diaphragmatic area. The mesh was introduced through the 10-mm trocar, placed over the defect, and fixed to the diaphragm using helical fasteners (ProTack: Covidien, Élancourt, France).

RESULTS

Of 523 patients (315 men, 208 women) who underwent PD for renal failure between February 1991 and September 2010, 6 (3 men, 3 women) were referred to the surgical unit for management of right-sided CAPD-related hydrothorax. Mean time on PD before the onset of hydrothorax was 20.3 ± 16.4 (standard deviation) weeks. A diaphragmatic defect was identified in all patients. The mean operating time was 35 ± 8.36 minutes. Postoperative pain was mild, with a low analgesic requirement (paracetamol 1 g three times daily), and no patient had to use major analgesics or opioids. Oral feeding was resumed the evening of the surgery. Patients restarted PD 3 weeks after surgery. Of the 6 treated patients, 2 (33.3%) experienced a recurrence of hydrothorax and were switched to hemodialysis. In the remaining 4 patients (66.6%), PD was successfully resumed after 3 weeks, and the postoperative course was uneventful.

DISCUSSION

Hemodialysis and PD for the treatment of end-stage renal disease are equivalent in terms of long-term outcomes and life expectancy (5), but PD carries a number of advantages for the patient's quality of life and implies a substantial cost savings (5). The most frequent CAPD-related complications, such as peritonitis or catheter exit-site infections and abdominal hernia, can be serious and even life-threatening (6). Hydrothorax during PD appears uncommon. Our reported rate of 1.14% (6/523) over a 20-year period is comparable to rates reported elsewhere in the literature (1). We have advocated the use of laparoscopy to manage complications of CAPD catheters since 1992 (4). Consequently, we considered a laparoscopic approach from the abdominal side for the treatment of the diaphragmatic defect causing hydrothorax in these patients. That approach is less painful than an approach using thoracoscopy or thoracotomy (7).

Thanks to the high-quality vision offered by 3CCD cameras (and, more recently, HD cameras), identification of the diaphragmatic defect was always possible. In regard to the position of the gap at the reflection line of the triangular ligament over the liver, we imagined that a dense adhesion between the liver and the diaphragm could solve the problem. Because fibrin glue does not offer sufficient adhesive properties, we used the adhesive effect of a surgical mesh commonly used to treat abdominal wall hernia (8). Experimental data show that, compared with other commercially available prosthetic mesh grafts, polypropylene meshes may produce more intense adhesion (9). We used this drawback to our advantage to close the hole from the "right" side.

Possible severe, but rare, complications related to the placement of a surgical mesh include bacterial contamination, with consequent peritonitis and hollow viscus erosions. The management of mesh infections remains a major challenge (10) and often requires surgical excision if conservative antibiotic treatment fails. In our technique, the risk of infection is presumably reduced given that the mesh is totally covered and becomes encapsulated by a fibrotic reaction in approximately 3 weeks, thus avoiding any contact with the bowel.

In addition, to reduce the risk of prosthesis slippage and possible bowel erosions, the mesh was trimmed to fit along the peritoneal reflection on the triangular ligament so as to be smaller than the liver and was then secured to the diaphragmatic surface using tack-like fasteners.

The problem with left-side hydrothorax (a rare occurrence, accounting for fewer than 10% of cases) is that the mesh would inevitably come into contact with the stomach or the colon, hampering the use of a non-absorbable mesh. A valid option to extend our technique to a left-side hydrothorax would be the use of an absorbable mesh. But such considerations may be debatable because of the small number of cases to be managed.

Two patients had early recurrence of hydrothorax after resumption of PD. Because of their poor condition, they were not proposed for thoracoscopic exploration and were switched to hemodialysis treatment. These failures might be explained by the presence of an accompanying missed defect or by insufficient adhesion between the mesh and the liver.

CONCLUSIONS

This new and original technique to treat CAPD hydrothorax was successful in 66.6% of cases and allowed for the reintroduction of PD after 3 weeks. It is feasible and less invasive than a thoracic approach. It also does not hamper the possibility of a thoracoscopic secondary approach.

DISCLOSURES

The authors declare that they have no conflicts of interest to disclose.

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doi:10.3747/pdi.2010.00297