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The Effect of an Anti-adhesion Agent in Continuous Ambulatory Peritoneal Dialysis (CAPD) Catheter Insertion Operation

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Purpose: Continuous ambulatory peritoneal dialysis (CAPD) is an important method of performing renal replacement therapy in patients with chronic renal failure. A significant complication of CAPD is malfunction of the catheter because of catheter adhesion that leads to catheter malposition. So we evaluated the effect of an anti-adhesive agent called Guardix-Sol®.

Methods: We prospectively evaluated the clinical results of 78 patients who had received CAPD catheter insertion from Sep. 2007 to May 2009. A test group of 34 patients used the anti-adhesion agent and a control group of 44 patients did not use it. All the procedures were standardized and performed by a single surgeon.

Results: The patients consisted of 49 males and 29 females. The common reasons for CAPD insertion were diabetic nephropathy (47 patients) and hypertension (20 patients). Fifteen patients needed reposition operations during their postoperative course, which were done under spinal anesthesia. Out of 15 patients, 3 were from the test group (Guardix-Sol® group) and 12 from the control group (P=0.0526). All the repositioned patients had a malpositioned catheter because the greater omentum had adhered to the catheter, except for one patient in each group (P=0.0315).

Conclusion: Using an anti-adhesive agent for CAPD insertion is an effective method to reduce the incidence of greater omental adhesion. So the rate of reoperation cases for catheter repositioning is decreased. **(J Korean Surg Soc 2010;78:71-76)**

Key Words: Continuous ambulatory peritoneal dialysis (CAPD), Anti-adhesive agent, Malposition

INTRODUCTION

Clinically introduced in 1976 as an alternative means of dialysis, continuous ambulatory perioneal dialysis(CAPD) has widely been used all across the world (*1*) and in Korea since 1981. (*2*) CAPD is preferred, in effectively curing the chronic renal insufficiency, by those who intend to dialyze on their own, while maintaining blood pressure level and imbalance in getting rid of bodily waste, demanding less moisture and restrictions in food intake and retaining renal function. *(3-6)*

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Controlling side effects specific to peritoneal dialysis is the key to success in CAPD as this may affect survival rate of catheter and from time to time demands suspension of dialysis or re-catheterization, due mostly to cardiological shunt and the accompanied functional problems and peritonitis. With the functional problems accompanied by cardiological shunt accounting for 31.5% (*7*), this Study is to determine efficacy of anti-adhesive agents upon catheterization (Guardix-Sol®, Hanmi, Seoul, Korea).

METHODOLOGY

1) Patients

A total of 81 patients having received catheterization for a period commenced on Sept., 2007 and ended May, 2009 has been studied, exclusive of a total of three patients deceased due to internal diseases. With 34 patients assigned to the Experimental Group and 44 patients to the Control Group for a prospective study, this Study has drawn comparison of the re-catheterization rate conducted due to dysfunction in catheterization and has been screened by the Ethical Review Board.

2) Materials

Made of sodium hyaluronate (HA) and sodium carboxymethylcellulose (CMC), colorless, transparent and highly viscose, Guardix-Sol® (Hanmi, Seoul, Korea) was used in analysis under this Study. Comprised of 1,3- linked N-acetyl-D-glucosamine and 1,4-linked D-glucuronic acid, HA is a natural anionic polysaccharide observed in connective tissue, skin, cartilage, hyaline and synovia, all of which are polymeric, hydrophil and visco-elastic and lubricant when the surface of mucous membrane gets coated. Being an anionic polysaccharide, and an extensively hydrophil cellulose-derivative, glucosidic hydroxyl is the carboxymethylized material. With various content unit available, Guardix-Sol® of 1.5g active ingredient contents was used.

3) Methodology

6-hour fasting was conducted as a pre-treatment means, followed by urination immediately prior to surgery to control the volume of bladder to the minimum, unless it's in emergency. Local anesthesia was generally conducted, with those having experienced hypogastric surgery undergone general anesthesia for laparoscopic surgery. Subjects underwent adhesiotomy if needed, followed by CAPD-catetherization, In case of re-operation due to synechia, spinal anesthesia was conducted in re-fixation upon incision down the cutting line for CAPD. For CAPD-catheterization, subjects were induced to take supine position, followed by disinfection of abdomen and incision by 2-3 cm depth underneath the belly button for exposure of the peritoneal cavity. Followed by this was application of Guardix-Sol® 1.5 g of CAPD-catheterization, induced to be led into the pelvic cavity (Fig. 1, 2A), radioscopy in confirmation of catheter position (Fig. 2B), rinsing of catheterization by physiological saline 100 ml, fixation of catheters on the perioneal area, determination of the transcutaneous tunnel on the left and inferior side of abdomen and between hypoderm and rectus abdominis.

Fisher's exact test in SPSS V14.0 was used for statistics, with statistical significance determined at $P < 0.05$.

Fig. 1. The Guardix-sol Application. The continuous ambulatory peritoneal dialysis catheter.

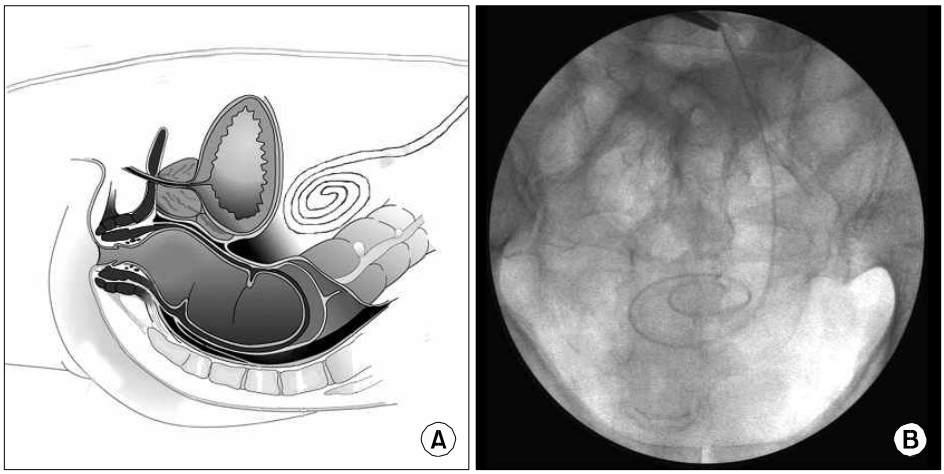

Fig. 2. (A) The continuous ambula- tory peritoneal dialysis cath- eter tip is located in the Douglas pouch. (B) The flu- oroscopic view shows a properly placed continuous ambulatory peritoneal dialy- sis catheter in pelvic cavity.

Table 1. Patient characteristics

	Test group (n=33)	Control group (n=45)	P-value
Mean age (yrs)	60.4 (22~86)	58.4 (24~83)	
Sex (M : F)	20 : 13	29 : 16	0.7330
Diagnosis			
CKD3*	0	1	
CKD4	2	0	
CKD5	31	44	0.3904
Cause			
Diabetes mellitus	19	28	0.6834
Hypertension	9	11	0.7809
Lupus nephritis	2	2	0.7530
IgA GN†	1	1	0.8263
Other GN	1	1	0.8263
Unknown	1	2	0.7522

*CKD = chronic kidney disease; †GN = glomerulonephritis.

Table 2. Postoperative complications

	Test group (n=33) (%)	Control group (n=45) (%)	P-value
Catheter malposition	3 (9)	12 (27)	0.0526
Adhesion malposition	2	11	0.0315
Simple malposition	1	1	
Catheter related peritonitis	5 (15)	10 (22)	0.4403
Catheter insertion site	1 (3)	1 (2)	
Wound infection	0	1 (2)	

RESULTS

49 male patients and 29 female patients comprised a total of 78 patients, with mean 59.3 years of age and most commonly suffering from diabetic nephropathy and high blood pressure. Of those having suffered chronic renal disease, the greater part of them were diagnosed as CKD5, save for on CKD (chronic kidney disease)3 case and two CKD4 case (Table 1). According to laparoscopy, one subject from the Experimental Group and four subjects from the Control Group have underdone abdominal surgery. Subjects from the Experimental Group and the Control Group were observed by 299.3-day term and 390.1-day term. A total of 3(9%) subjects from the Experimental Group and 12 (27%) of subjects from the Control Group have undergone re-surgery due to dysfunction of catheter. A total of 5 (15%) subjects from the Experimental Group and 10 (22%) of the Control Group have suffered catheter-related peritonitis, with one subject from each Group suffering from leakage from the catheterized part. Infection was manifested by one subject from each Group (Table 2). Upon reception of CAPD, it took 7.0 days for the Experimental Group and 8.6 days for the Control Group to observe translocation, with 76.3 days, affected largely by one subject having taken 193 days, and 29.7 days for the Experimental Group and the Control Group took since translocation for re-surgery. Simple X-ray was applied in confirmation of the translocation, followed by re-observation on Week 0, Week 1 and on a monthly basis thereafter and extraordinary observation upon catheter dysfunction. Reason for extensive period taken since translocation for re-surgery is that translocation does not mean immediate loss of catheter function and conservative treatment followed the transfer to the institution. Having applied heparin-rinsing and enema as conservative treatment, the institution observed that 13 cases (17%) manifested synechia on the flank of the catheter, followed by translocation of

Fig. 3. The simple abdomen X-ray shows a continuous ambula- tory peritoneal dialysis catheter malposition.

the tip of catheterization moved to the upper abdomen for dysfunction, with 2 cases (3%) having manifested dysfunction regardless of synechia (Fig. 3).

No statistical significance was observed between the Groups in terms of gender and cause of disease. Dysfunction upon translocation of catheter was manifested more severely by the subjects from the Experimental Group than those from the Control Group, with statistical significance (P=0.0315)(Table 1, 2).

CONSIDERATION

Since Ganter introduced perioneal dialysis back in 1923, 20 years earlier than the conventional blood dialysis, the high rate of complications has kept perioneal dialysis left unpopular due to punctures.(*8*) Having been introduced by Popovich et al (*1*) back in 1976, CPAD was further developed by Oreopoulos et al in 1978 as they introduced dialysate replacement method using a plastic bag (*6*). With simple operation and hemato-dynamic stability, CAPD is applicable to the greater part of the chronic renal failure patients, with those having defective blood vessel, pediatric patient, dialysis, severe high blood pressure, ostomies, hernia, recurring diverticulitis, lipidemia, adrenocortical hormones and other immunosuppressants prevented from undergoing CAPD.(*3*) In the long-run, success in CAPD is determined by the survival rate of catheter, especially being the intra-abdominal catheterization of CAPD where the type of catheter and relevant devices, method of catheterization, surgical experience and skillfulness and post-surgical management all come into play.(*10*) Failure of catheterization is mostly occurred by leakage of dialysate around the catheter, infection around catheter, inappropriate dialysate and discharge, translocation of abdominal cavity and peritonitis. The greater part of complications save for infection takes place due to translocation of abdominal cavity.

Both ventrotomy and percutaneous catheterization may serve, with the laparoscopic surgery gaining popularity while no specific surgical methodology is observed to be superior to another. Demanding no surgical process in the operation room, percutaneous catheterization might affect intra-abdominal catheterization and give rise to intra-abdominal impairment.(*11*) While CAPD catheterization, as reported, may reduce complications relevant to catheterization, such as translocation and closure, a patient must undergo general anesthesia.(*12*) With chronic renal failure patients having various underlying disease, risks are always imposed to put the patient under general anesthesia, not to mention expensive laparoscopic equipment. With less risk imposed upon anesthesia, catheterization via ventrotomy might be able to decently design the route of catheterization as desired, while controlling intra-abdominal damages to the minimum. In this connection, this Study has applied CAPD catheterization under local anesthesia, save for 5 subjects having synechia.

Allon et al(*13*), based upon analysis of 11 different reports, reported that 1-22% of improper catheterization is due to translocation and closure of catheter, while Moreiras Plaza et al(*7*) reported that 31.5% of them should undergo de-catheterization. Among other reasons of translocation and closure, catheters and catheter holes getting intertwined, post-peritonitis synechia for empty space in dialysate and clogged catheter holes due to pressures out of surrounding organs count. According to O'Regan et al(*14*), Bierman et al (*15*) and Joung et al(*16*), catheterization occurs in the first few weeks and synechia can effectively be prevented by injection of heparin as a preventive measure. In any patient struggling with dialysate drainage, it was reported that injection of streptokinase 5,000 U into catheter successfully extended survival rate of catheter. As for this Study, one subject from the Experimental Group and nine subjects from the Control Group have manifested translocation of catheter in a month, with another subject from the Experimental Group manifesting in 36 days, the other subject from the Experimental Group and 3 subjects from the Control Group manifesting the translocation.

The greater part of the previous studies related to Guardix-Sol were about spinal surgery, ENT surgery or thyroidal surgery, deemed effective for most of the cases. Lee et al(*17*) studied, in the white rats with abdominal and cecal abrasions, the mix proportion of Guardix-Sol□, comprising hyaluronate (HA) and carboxymethylcellulose (CMC), while the simple HA/CMD mixture not as efficacious as Guardix-Sol but obviously superior to the Control Group. Having so far been reported about animal models, use of Guardix-Sol have barely been studied for application to human. In this connection, this Study has conducted a study of Guardix-Sol□ in prevention of catheter defects, coming up with the result that the Experimental Group subjects have, with statistical significance, had less catheter defects (P=0.0315).

Post-surgical synechia gives rise to some of the most common post-surgical complications such as enterocleisis, chronic pains and infertility, not to mention increased rate of enterobrosia. (*18,19*) With synechia being a big-time socio-economic burden and keeping the patients hospitalized for extensive period of time, various preventive measures against synechia have been studied and put to use, one of which is Guardix-Sol□, an efficacious anti-synechia means for decrease in re-operation. With the long-term tracing demanded so far, further studies in improving survival rate of catheters are in dire need.

CONCLUSION

With the survival rate of catheter being one of the most important matters for patients of CAPD and catheter defects and peritonitis being the major causes, keeping catheter synechia to the minimum and managing catheterization well are deemed crucial to control infections to the minimum, not to mention training and education for patient compliance. In this connection, this Study has drawn comparison between the Control Group subjects and the Experimental Group subjects, the latter of which have manifested less catheter defects by synechia, signifying that use of anti-synechia agent helps improving the survival rate of catheters.

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