ANALYSIS OF HOSPITALIZATION AFTER PERITONEAL DIALYSIS CATHETER IMPLANTATION

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◆ **Background:** Implantation of the peritoneal dialysis catheter (PDC), usually an elective procedure, may necessitate unexpected hospitalization and even transfer to intensive care due to the multiple comorbidities and inherent instability of the end-stage renal disease patient. Information on hospitalization after PDC implantation is limited and details about the reason for hospitalization are lacking.

◆ **Methods:** We performed a cohort study in consecutive patients who underwent PDC implantation at a single institution from September 2007 to September 2013. Clinical characteristics of enrolled patients, technique of the implantation procedure, and all-cause unexpected hospitalization and morbidity within 14 days after implantation were analyzed.

◆ **Results:** Excluding the patients with pre-arranged admission, a total of 246 patients receiving 252 PDC implantations during the 6 years were studied. After 39 procedures (15.5%), patients had an unexpected hospital stay or re-admission due to operative complications (33.3%), worsening of disease (35.9%), or a single-night hospital stay for observation (30.8%). Compared with discharged patients, the patients with unexpected hospitalization were older ($p = 0.001$), experienced higher rates of previous episodes of heart failure ($p = 0.006$) and heart disease ($p < 0.001$), had more use of general anesthesia (GA) ($p = 0.046$), underwent more added procedures during the implantation ($p = 0.02$), and had more episodes of flow obstruction and peritonitis after implantation ($p = 0.012$ and $p < 0.001$, respectively). Using a multivariable logistic regression, we showed that age, cardiac morbidity, use of general anesthesia, PDC flow problems and peritonitis after implantation were independent predictors of all-cause unexpected hospitalization.

◆ **Conclusions:** For the first time, our study analyzed the predictors of unplanned hospitalization after PDC implantation and identified the salient risk factors. Increased focus to identify patients at greatest risk for hospitalization, evaluation of processes of care, and implementation of preventive strategies may be helpful to reduce unplanned hospitalization after catheter insertion.

Peritoneal dialysis (PD) is an established and well-known technique for renal replacement therapy in patients with end-stage renal disease (ESRD). The advantages of PD include better preservation of residual renal function, longer patient survival in the first few years, better quality of life, and greater cost-effectiveness compared with hemodialysis (1–4).

For a PD program to succeed, peritoneal dialysis catheter (PDC) implantation must be timely and associated with a minimum of morbidity. Successful implantation of the PDC remains challenging due to patient comorbidities and inherent instability (5–6). The rapid change in the patient's condition after implantation may necessitate hospitalization and even transfer to an intensive care unit (ICU).

In addition, the reported incidence of complications remains high despite improvements over time in catheter quality and implantation technique (7–10). The main acute complications related to PDCs after implantation include flow obstruction, infection, leakage of dialysate, bleeding, and visceral perforation.

For patients initiating chronic dialysis, the highest risk for morbidity and mortality occurs in the first weeks of treatment (11). There are limited data regarding the worsening of disease and all-cause hospitalization after PDC implantation and specific risk factors that predispose patients to PD catheter-related morbidity. To identify such variables, we performed a cohort study in patients undergoing PDC implantation at a single institution over a 6-year period.

MATERIALS AND METHODS

SUBJECTS

This study was a prospective cohort study supplemented by additional retrospective data and carried out at the PD program of the University Health Network. All consecutive patients who received PDC implantation from September 2007 to September 2013 were recruited. We identified 304 patients who underwent at least 1 catheter insertion. All patients received 2-cuff, swan-neck coiled Tenckhoff catheters, and prophylactic antibiotics were routinely given peri-operatively. With the exception of the blind insertions at the bedside, all PDC implantation was done in the operating room or in the radiology department.

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Patients whose condition was stable in the following several hours left hospital the same day. Patients and their caregivers were trained by PD nurses with a standard initial training program. All the patients were followed up for 3 months after PDC implantation.

TECHNIQUE OF PDC IMPLANTATION

The techniques for PDC implantation included laparoscope, open surgical dissection, fluoroscopic Seldinger technique, and blind Seldinger technique. The choice of technique was mainly determined according to the patient's condition and clinical circumstances. Blind insertion was done by the nephrologists and fluoroscopic insertion by an interventional radiologist. Most of the patients were referred to a surgeon and anesthetist who decided whether the catheter would be inserted by laparoscope or open dissection and under general anesthesia or local anesthesia. All the laparoscopic insertions were done by one designated general surgeon. For timely initiation of PD therapy, the external limb of the PDC was exteriorized at time of implantation. For PDC insertion in advance of anticipated need, the catheter was embedded under the skin (12).

ALL-CAUSE HOSPITALIZATION AFTER PDC IMPLANTATION

We evaluated all-cause hospitalization within 14 days after PDC implantation. This included 1) worsening of comorbidity after PDC insertion, such as acute pulmonary edema, 2) unexpected events after PDC insertion, such as myocardial infarction or respiratory failure, and 3) acute complication of the procedure itself, such as bleeding, visceral perforation, disruption of the dialysate flow, peritonitis, or leakage of dialysate, necessitating admission. Pre-arranged admission for initiating dialysis due to advanced uremia before PDC implantation was not included in this analysis. Mortality or transfer to the intensive care unit (ICU) or cardiac care unit (CCU) within 14 days after implantation was also recorded.

Each PDC implantation was recorded in a database, including the patient's age, gender, primary etiology of ESRD, presence of diabetes, body mass index (BMI), prior abdominal surgery, comorbidity, previous transplantation, use of corticosteroid and/or immunosuppressive agent, and the latest blood tests measured before implantation (such as serum albumin, hemoglobin, urea nitrogen (urea) and creatinine). The comorbidities taken into account were cardiovascular disease, cerebrovascular disease, and chronic pulmonary disease. The previous abdominal surgeries considered were appendectomy, hernia repair, Cesarean section, cholecystectomy, hysterectomy, laparotomy, nephrectomy, previous PDC implantation, and renal and liver transplantation. The information on PDC implantation included the technique of insertion, type of anesthesia, added procedures during surgery, operative complication (bleeding, perforation of viscera) and PD catheter complication (flow obstruction, peritonitis, leakage of dialysate).

STATISTICAL ANALYSES

Statistical analysis was performed with SPSS for Windows software version 18.0 (SPSS Inc., Chicago, IL, USA). Continuous data that are normally distributed are referred to as parametric data and data that are not normally distributed as non-parametric data. Parametric data are presented as mean $\pm$ standard deviation. Non-parametric data are presented as median values with their interval from the 25th to 75th percentile. Categorical variables were expressed as a percentage or ratio. Patients' data were compared using chi-square test for categorical variables and *t*-test or the Kruskal-Wallis H test for parametric and non-parametric continuous variables, respectively. A multivariate logistic regression model was used to identify risk factors to all-cause unexpected hospitalization. Odds ratios (ORs) and 95% confidence intervals (CI) were calculated. For all analyses, statistical significance was reached with a 2-tailed *p* value of < 0.05 .

RESULTS

A total of 304 patients received a PDC implantation 310 times during the 6 years. In 58 procedures, patients were admitted before implantation due to clinical deterioration or serious comorbidity and were excluded from our analysis. For the remaining 246 patients who received 252 PDC implantation procedures, the demographic and clinical characteristics are shown in Table 1.

The average age was 60.27 ± 16.25 years (range: 18–92) and 51.2% were male. Diabetes and primary glomerulonephritis were the 2 main causes of primary renal disease. Nearly half of the patients (46.0%) had previous abdominal surgery. Most of the procedures were performed by laparoscopy (88.5%), and only 30 procedures (11.9%) were implantation of buried catheters.

COMPARISON BETWEEN HOSPITALIZED AND NON-HOSPITALIZED COHORTS

Patients had unexpected hospitalization after implantation after 39 procedures (15.5%); for the other 213 procedures (84.5%), patients discharged the same day without any admission within 14 days after operation (Table 2). Compared with the discharged group, the group experiencing hospitalization were older (68.2 ± 14.8 vs 58.8 ± 16.1 , $p < 0.001$), had a more frequent history of congestive heart failure (CHF) (25.6% vs 9.9%, $p = 0.006$), and had a greater prevalence of cardiac disease (53.8% vs 25.8%, $p < 0.001$). There were no statistical differences in gender, previous history of transplantation, use of steroid and/or immunosuppressive agents, prevalence of diabetes mellitus, or known pulmonary disease or cerebrovascular disease between the 2 groups.

There were also no statistical differences in BMI, hemoglobin, serum albumin, blood urea nitrogen, or serum creatinine between the 2 groups.

The comparison of PDC implantation procedure and procedure-related information between the 2 groups is shown in Table 3.

TABLE 1
Demographic and Clinical Characteristics of
Included Patients

Variables	Values
No. of PDC implantations	252
Age (years)	60.27±16.25
Sex (male) (<i>n</i> , %)	129 (51.2%)
Primary disease	
Diabetic nephropathy (<i>n</i> , %)	72 (28.6%)
Chronic glomerulonephritis (<i>n</i> , %)	45 (17.9%)
Failed transplantation (<i>n</i> , %)	30 (11.9%)
Hypertension (<i>n</i> , %)	22 (8.7%)
Obstructive nephropathy (<i>n</i> , %)	15 (6.0%)
Lupus nephritis (<i>n</i> , %)	11 (4.4%)
Polycystic kidney disease (<i>n</i> , %)	10 (4.0%)
Amyloid (<i>n</i> , %)	7 (2.8%)
Vasculitis (<i>n</i> , %)	5 (2.0%)
Other (<i>n</i> , %)	24 (9.5%)
Unknown (<i>n</i> , %)	11 (4.4%)
Diabetes (<i>n</i> , %)	106 (42.1%)
Previous transplantation, including kidney, liver, heart, lung, and bone marrow (<i>n</i> , %)	44 (17.5%)
Use of steroid and/or immunosuppressive agent	52 (20.6%)
Previous abdominal surgery (<i>n</i> , %)	116 (46.0%)
BMI (kg/m ²)	25.50 (21.85–31.20)
Implantation method	
Laparoscopy (<i>n</i> , %)	223 (88.5%)
Fluoroscopic (<i>n</i> , %)	19 (7.5%)
Open dissection (<i>n</i> , %)	4 (1.6%)
Blind (<i>n</i> , %)	6 (2.4%)
Buried catheter (<i>n</i> , %)	30 (11.9%)
Hemoglobin (g/L)	106.03±16.03
Albumin (g/L)	37.00 (34.00–40.00)
Urea (mmol/L)	26.16±9.00
Creatinine (μmol/L)	545.49±224.63

PDC = peritoneal dialysis catheter; BMI = body mass index.

There was no significant difference in the type of PDC implantation technique between the hospitalization and discharged group. However, the hospitalization group had greater use of general anesthesia (66.7% vs 49.3%, $p = 0.046$) compared with the discharged group. The added procedures during operation mainly included omentopexy, omentectomy, hernia repair, and adhesiolysis. The hospitalization group had a higher rate of added procedures (43.6% vs 25.4%, $p = 0.020$). However, except for a higher rate of adhesiolysis in the hospitalization group (17.95% vs 7.52%, $p = 0.037$), there was no significant difference in the rate of the other 3 added procedures. Interestingly, the incidence of previous abdominal surgery bore no relation to the incidence of adhesions discovered by laparoscopy and had no statistical impact on unexpected hospitalization. The incidence of PDC flow obstruction and peritonitis were higher in the hospitalization group ($p = 0.012$, $p < 0.001$, respectively). There were only 3 episodes of peritonitis and all of them occurred in the hospitalization

group. The incidence of dialysate leakage was not different between groups.

REASONS FOR HOSPITALIZATION AFTER PDC IMPLANTATION

Thirteen patients were admitted due to operative/catheter complications, including flow obstruction ($n = 5$), visceral perforation ($n = 4$), bleeding ($n = 3$), and peritonitis ($n = 1$). Although there were 3 episodes of peritonitis, 2 were related to bowel perforation and belonged to the visceral perforation. Only 1 episode of peritonitis led to hospitalization and was complicated with urinary retention and temporary dysfunction of the PD catheter. Another 12 patients had a 1-night stay after implantation for observation due to incisional pain ($n = 4$), long duration of procedure ($n = 1$), sleep apnea ($n = 1$), chest pain ($n = 1$), and abdominal pain and other symptoms (nausea, vomiting, dizziness, etc.) ($n = 5$) after implantation. The remaining 14 patients had symptoms of uremia or other comorbidities of which heart failure was the principal manifestation (Table 4).

RISK FACTORS OF UNEXPECTED HOSPITALIZATION AFTER PDC IMPLANTATION

To eliminate the potential effects of other covariates of clinical outcomes, multivariable logistic regressions were applied to adjust for age, gender, diabetes mellitus, previous history of transplantation, previous history of abdominal surgery, type of anesthesia and type of implantation method, added procedures during implantation, adhesiolysis, post-implantation complication (PDC flow obstruction, leak, peritonitis), and cardiac morbidity. Older age, cardiac morbidity and use of general anesthesia were independently associated with all-cause unexpected hospitalization after PDC implantation (OR 1.05, 95% CI 1.02 – 1.08, $p = 0.002$; OR 3.07, 95% CI 1.38 – 6.78, $p = 0.006$; OR 0.27, 95% CI 0.12 – 0.61, $p = 0.002$). Peritoneal dialysis catheter flow obstruction and peritonitis after implantation also were independent risk factors for all-cause unexpected hospitalization (OR 3.32, 95% CI 1.13 – 9.75, $p = 0.029$; OR 8.02, 95% CI 1.25 – 51.44, $p = 0.028$) (Table 5).

MORTALITY AND TRANSFER TO ICU/CCU

Of the 246 patients without pre-arranged hospitalization before PDC implantation, 7 patients were transferred to ICU or CCU after the procedure, and 3 of them were intubated. One patient who was admitted 7 days after implantation died of septic shock 1 month later.

DISCUSSION

In this retrospective study with a total of 252 procedures over 6 years, all the included patients were relatively stable before PDC implantation. Not unexpectedly, we found that there were significant differences in age and prevalence of cardiac disease between the patients with and without

TABLE 2
Clinical Profiles of Hospitalized vs Discharged Patients

Variable	Hospitalization	Discharged	P value
Number of procedures	<i>n</i> = 39	<i>n</i> = 213	
Age (yrs)	68.23±14.78	58.80±16.12	0.001
Male sex (<i>n</i> , %)	22 (56.4%)	107 (50.2%)	0.478
Diabetes (<i>n</i> , %)	21 (53.8%)	85 (39.9%)	0.105
Previous transplantation (<i>n</i> , %)	7 (17.9%)	37 (17.4%)	0.930
Use of steroid/ immunosuppressants (<i>n</i> , %)	7 (17.9%)	45 (21.1%)	0.652
Previous episode of congestive heart failure (<i>n</i> , %)	10 (25.6%)	21 (9.9%)	0.006
Cardiac disease (<i>n</i> , %)	21 (53.8%)	55 (25.8%)	0.000
Pulmonary disease (<i>n</i> , %)	9 (23.1%)	29 (13.6%)	0.129
Cerebrovascular disease (<i>n</i> , %)	7 (17.9%)	19 (8.9%)	0.088
BMI (kg/m ²)	25.00 (22.10–31.60)	25.60 (21.80–31.20)	0.637
Hemoglobin (g/L)	103.03±17.56	106.58±15.71	0.210
Albumin (g/L)	36.50 (30.75–38.25)	37.00 (34.00–40.00)	0.160
Urea (mmol/L)	26.00±8.97	26.19±9.03	0.919
CREA (μmol/L)	516.66±225.89	550.75±224.55	0.391

BMI = body mass index; CREA = creatinine.

TABLE 3
Comparison of PDC Implantation Procedure and Procedure-Related Information Between Hospitalization and Discharged Patients

Variables	Hospitalization	Discharged	P value
Number of procedures	<i>n</i> = 39	<i>n</i> = 213	
Previous abdominal surgery (<i>n</i> , %)	18 (46.62%)	98 (46.0%)	0.987
General anesthesia (<i>n</i> , %)	26 (66.7%)	105 (49.3%)	0.046
Type of implantation			0.612
Laparoscopy (<i>n</i> , %)	33 (84.6%)	190 (89.2%)	
Fluoroscopic (<i>n</i> , %)	3 (7.7%)	16 (7.5%)	
Open dissection (<i>n</i> , %)	1 (2.6%)	3 (1.4%)	
Blind (<i>n</i> , %)	2 (5.1%)	4 (1.9%)	
Added procedures (<i>n</i> , %)	17 (43.6%)	54 (25.4%)	0.020
Omentopexy or omentectomy (<i>n</i> , %)	4 (10.3%)	24 (11.3%)	1.000
Adhesion	9 (23.08%)	28 (13.21%)	0.110
Adhesiolysis	7 (17.95%)	16 (7.52%)	0.037
Hernia repair	4 (10.26%)	19 (8.92%)	0.790
PDC complication			
PDC flow obstruction (<i>n</i> , %)	7 (17.9%)	13 (6.1%)	0.012
Leakage (<i>n</i> , %)	2 (5.1%)	29 (13.6%)	0.138
Peritonitis (<i>n</i> , %)	3 (7.7%)	0 (0.0%)	0.001

PDC = peritoneal dialysis catheter.

hospitalization after PDC implantation. There were also differences in the type of anesthesia, adhesiolysis during operation, PDC flow obstruction, and peritonitis after implantation between the 2 groups.

The patients with hospitalization were older and age was an independent risk factor of unexpected hospitalization. Many older patients starting dialysis have multiple chronic conditions in addition to ESRD (13). As comorbidity, especially cardiac and pulmonary comorbidity, accumulates, the risk of deterioration of disease and hospitalization increases. A

cohort study conducted both in PD and hemodialysis patients also demonstrated old age was a risk factor for morbidity and mortality in the first 2 weeks of dialysis (11).

Not surprisingly, we observed a higher prevalence of cardiac disease in patients with hospitalization. About a quarter of the patients with hospitalization had congestive heart failure previously, and more than half of them had cardiac disease, which is similar to another study in dialysis patients (14). Although well-controlled before implantation, the heart function deteriorated after implantation, probably due to pain, the stress of

TABLE 4
Reasons of Hospitalization after PDC Implantation

	Number	Percentage (%)
Operative/catheter complication	13	33.3
PDC flow obstruction	5	
Perforation ^a	4	
Bleeding ^b	3	
Peritonitis	1	
Single-night stay	12	30.8
Incision pain	4	
Extensive adhesion and lysis for more than 1 hr	1	
Sleep apnea	1	
Chest pain	1	
Abdominal pain or discomfort ^c	5	
Comorbidity related	14	35.9
Heart failure	6	
Respiratory failure	2	
Myocardial infarction	1	
Hypotension	1	
Hyperkalemia	1	
Urosepsis	1	
Multiple comorbidities	2	

PDC = peritoneal dialysis catheter.

^a Perforation: visceral perforation.

^b Bleeding: bleeding more than 500 mL or need of blood transfusion.

^c Abdominal pain: pain inside the abdomen; discomfort: nausea, vomiting, dizziness, etc.

TABLE 5
Logistic Regression Analysis of Risk Factors of All-Cause Unexpected Hospitalization after PDC Implantation

Variables	Adjusted OR	95% CI	<i>p</i> value
Age	1.05	1.02, 1.08	0.002
Cardiac morbidity	3.07	1.38, 6.78	0.006
Anesthesia type	0.27	0.12, 0.61	0.002
PDC flow obstruction	3.32	1.13, 9.75	0.029
Peritonitis	8.02	1.25, 51.44	0.028

PDC = peritoneal dialysis catheter; OR = odds ratio; CI = confidence interval.

the implantation, and elevation of blood pressure. In our study, cardiovascular complications were also the major reason for hospitalization caused by worsening of disease after implantation. Evaluation and monitoring of heart function before PDC implantation can therefore never be overemphasized.

Our study also found that it is not the type of implantation method, but the type of anesthesia that was significantly different between the 2 groups. Considerable controversy surrounds methods of catheter implantation and their impact on technical success. The direct visualized laparoscopic method may presumably lead to better positioning of the catheter,

especially in patients with previous abdominal surgeries. Many studies have demonstrated that none of the 4 implantation modalities exhibits superiority in terms of catheter survival (9–10,15–16). Our data further showed no difference among the 4 implantation modalities in terms of hospitalization rate after operation. However, most of the patients (88.5%) in the present cohort study had the PDC inserted by advanced laparoscopy, so it is difficult to explore the difference of outcome and rate of hospitalization between implantation modalities. Since the type of implantation method may have an impact on outcome analysis, the multivariate logistic regression was adjusted for type of implantation method. The logistic regression also showed that type of implantation method was not associated with unexpected hospitalization.

Except for fluoroscopic and blind Seldinger implantation, general anesthesia was recommended to patients without severe cardiovascular or pulmonary complication both in open dissection and laparoscopy. Use of general anesthesia reduces the peritoneal pain caused by insufflation of gas into the abdominal cavity. However, use of general anesthesia in patients with end-stage renal failure who have severe coexisting medical problems may put them at risk (17). Our logistic regression also showed use of general anesthesia was a risk factor for unexpected hospitalization. Using the laparoscopy technique (18) and with the skilled practice of a general surgeon, we also did some of these implantations under local anesthesia and conscious sedation. There are many studies suggesting that performing laparoscopy under local anesthesia reduces the risks associated with the procedure (17–19). Future studies could be carried out to determine whether use of local anesthesia could decrease morbidity and hospitalization after PDC implantation.

The main added procedures included omentopexy, omentectomy, hernia repair, and adhesiolysis. Our data showed hospitalized patients had more added procedures during implantation, principally adhesiolysis. There were no differences in omentopexy or omentectomy. Omentopexy and omentectomy are laparoscopic techniques and significantly improve the PDC function (20), and our study suggested they did not increase the chance of hospitalization after implantation. There was also no significant difference in hernia repair between the groups. It is interesting that the history of previous abdominal surgery between the 2 groups was similar and the adhesion discovered by laparoscopy also had no significant impact. However, the hospitalization group did have a higher rate of adhesiolysis. During PDC implantation, mild adhesions not preventing the PDC implantation were not treated. Only obvious or severe adhesions were treated, and adhesiolysis produces more damage, which might have led to a higher rate of hospitalization. Keshvari *et al.* suggest that, with the wide use of laparoscopy in PDC implantation, a history of previous abdominal surgery should not be used to judge the eligibility of patients for PD (21). The logistic regression in our study also showed the added procedures or adhesiolysis were not associated with unexpected hospitalization.

None of the other demographics (gender), clinical characteristics (BMI, diabetic status, pulmonary and cerebrovascular comorbidities, previous transplantation, and use of steroid and/or immunosuppressive agent), or blood values were found to be significantly different between the groups.

Complications of the procedure and PDC itself accounted for a third of the total unexpected admissions. Among the early complications of PDC implantation, we found PDC flow obstruction was very predominant in the hospitalization group and was a risk factor for hospitalization. Since a considerable number of obstructions were caused by omental wrapping and catheter tip migration (22–23), the second implantation was necessary, increasing the chance of hospitalization. Peritonitis has been demonstrated in many studies as a major cause of catheter and technique failure in PD patients, both for the present and future catheters (11,23–26). Early peritonitis was very rare after PDC implantation. In our study, episodes of peritonitis were triggered by bowel perforation and temporary dysfunction of PDC due to urinary retention. From our data, early peritonitis after PDC implantation was associated with a high risk of hospitalization. Leakage of dialysate was another common early complication, most often at the insertion site. The use of nightly intermittent PD (NIPD) or temporary cessation of PD therapy (24,25) usually could solve this problem without the need for hospitalization.

The other two-thirds of unexpected admissions were due to patient factors. If there was resolution of pain after an overnight stay, the patients were discharged the next day. One-night stay accounted for 30.8% of unexpected admissions, and most of them just had incisional or abdominal pain or discomfort after implantation and received no particular treatment aside from analgesia. Medical deterioration accounted for 35.9% of unexpected admissions and was cardiac-related in half of the patients.

The mortality in the 246 patients was very low. Only 1 patient died after implantation. The reasons for transfer to ICU/CCU were mainly cardiac or respiratory failure.

This study has some limitations. First, this is a single-center retrospective study with a small sample size of only 252 patients. Second, there was selection bias because most of the patients were recommended to a designated general surgeon who decided on laparoscopy or open dissection. Although there were 4 types of implantation techniques, 88.5% patients had laparoscopy. The multivariate logistic regression model which analyzed the risk factors for unexpected hospitalization was adjusted for the type of implantation method. Third, also due to the wide use of laparoscopy in our study, the generalizability of our findings to centers that seldom or never use laparoscopy to do PDC implantation is limited. Therefore, future studies should be carried out in multiple medical centers with balanced use of the various implantation techniques.

CONCLUSION

Our study is the first to analyze the characteristics of all-cause hospitalization after PDC implantation. We showed

that hospitalization after selected PDC implantation was not rare, occurring in older patients with more cardiac morbidity who had a higher use of general anesthesia and more added procedures, mainly adhesiolysis, during the implantation and had more PDC flow obstruction and peritonitis after the implantation. Age, cardiac morbidity, type of anesthesia, PDC flow obstruction, and peritonitis were the risk factors for unexpected hospitalization. Increased focus to identify patients at greatest risk for hospitalization, evaluation of process of care, and implementation of preventive strategies are all required.

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