



Research Article

# Sustained Traction Technique is a Safe and Feasible Approach to Peritoneal Dialysis Catheter Removal: Experience of a Single Surgeon

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## Abstract

**Background:** The use of Peritoneal Dialysis (PD) catheters is an attractive option for many patients who require dialysis. These PD catheters are most commonly placed with a standard minimally invasive technique. However, multiple techniques can be applied to remove these catheters. At our institution, under a single surgeon, we perform PD catheter removals in the operating room under mild to moderate sedation. Sustained traction is applied to the PD catheter until the catheter is released from the cuffs and easily slides off with both the superficial and deep cuffs left behind. In the event of catheter breakage, general anesthesia is induced and the PD catheter will then be removed in the usual open approach. The objective of this study was to determine if the pull technique can be safely employed for PD catheter removal with no increased complication rate.

**Methods:** A case series study was performed at a community teaching hospital. Thirty-one patients underwent PD catheter removal from July 2017 to December 2021 for any indication. Ten patients had their PD catheter removed secondary to peritoneal dialysis-related infections (32%), 12 patients had their PD catheter removed due to mechanical failure. Postoperative infection rate and complication rate after removal of PD catheter using the sustained traction technique was measured.

**Results:** There were no postoperative infections necessitating cuff removal due to a retained cuff after removing the PD catheter in our patient cohort. The mean time for catheter removal with the sustained traction technique was 4 minutes. Only one patient required general anesthesia and conversion to open removal technique due to catheter breakage as the patient had an extension tubing with additional connection (3%).

**Conclusion:** Our series shows that the sustained traction technique can be safely employed for PD catheter removal under minimal sedation with no increased complication rate.

**Keywords:** Peritoneal Dialysis; Catheter Removal; Sustained Traction

## Introduction

The use of Peritoneal Dialysis (PD) catheters is an attractive option for many patients who require renal replacement therapy. Patients with end-stage renal disease usually have multiple co-morbidities and are at higher risk for bleeding and wound complications associated with surgery as well as general anesthesia. Peritoneal Dialysis (PD) catheters are generally inserted via a standard minimally invasive technique, yet, there are multiple techniques employed to remove PD catheters, however, there is no consensus on an optimal technique [1,2]. The PD catheters used at our institution are Covidien Argyle swan neck two cuff catheters [model number 8888414011] [3]. The distal or deep cuff is implanted in the preperitoneal space at the entry into the abdomen and the proximal or superficial cuff in the rectus muscle. The superficial cuff secures the catheter in place and the

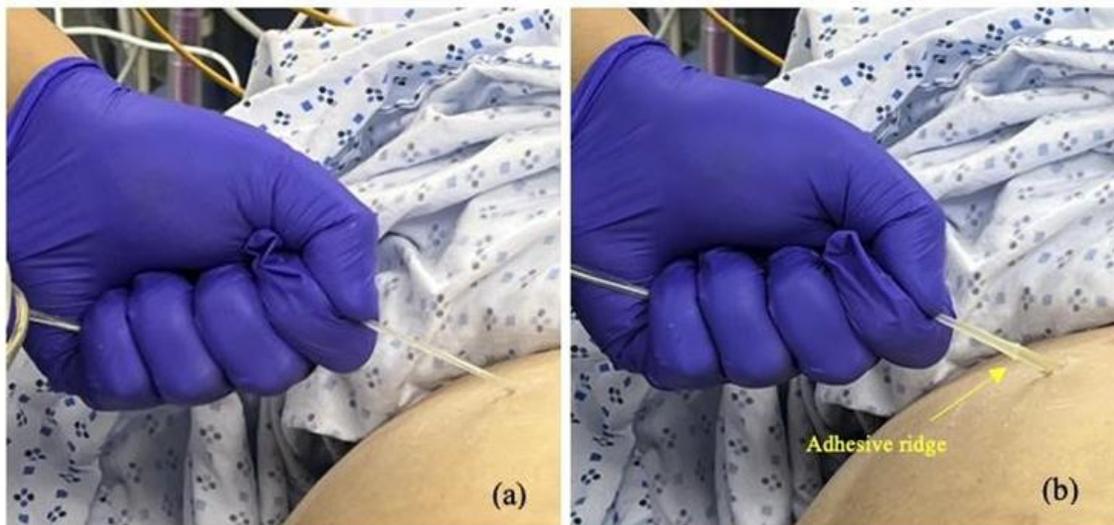
deep cuff functions as a barrier to infection. The conventional technique for removal of PD catheters involves complete dissection of the cuffs from the surrounding tissue with two separate incisions at the site of the cuffs. This procedure can be relatively involved and due to its invasiveness, requires general anesthesia [2,4]. At our institution, we employ a novel method for PD catheter removals. Sustained traction is applied to the PD catheter until the catheter is released from the cuffs and easily slides off with both the superficial and deep cuffs left behind. This technique requires only minimal sedation. In the event of catheter breakage, general anesthesia is induced and the PD catheter will then be removed using the standard open approach.

### Material and Methods

A case series study was performed at a community teaching hospital by a single surgeon. The objective of our study was to determine if the pull technique can be safely employed for PD catheter removal with no increased complication rate or infection rate. The primary outcome for our study was post-operative infection rate after removal of PD catheter using the non-invasive technique. Secondary outcomes included complication rate and use of different techniques.

The major steps regarding the sustained traction technique for PD catheter removal are as follows (Fig. 1):

1. The external portion of the PD catheter is grasped with two hands and sustained horizontal traction is applied. This is continued until the catheter yields and the first residual adhesive ridge is visualized. This is the site of the intramuscular dacron cuff that has been sheared off of the catheter due to the sustained traction
2. Once the first adhesive ridge is visualized, sustained traction is then re-initiated until the catheter yields for a second time, at which point a second residual adhesive ridge, representing the preperitoneal cuff, is visualized
3. At this point, both dacron cuffs have been sheared off and there are no further attachments holding the catheter in place. The catheter is then removed and inspected for its integrity. The exit site is then inspected for hemostasis and a dry dressing is applied



**Figure 1:** Sustained traction technique for PD catheter removal. (a) Sustained traction is applied to the silicone PD catheter. (b) Residual adhesive ridge is visualized after the superficial cuff has been sheared off the catheter.

### Results

Thirty-one patients underwent PD catheter removal between July 2017 and December 2021 for any indication. Ten patients had their PD catheter removed secondary to peritoneal dialysis-related infections (32%) and 12 patients had their PD catheter removed due to mechanical dysfunction or failure. The remaining nine patients transitioned to hemodialysis due to personal preference. PD catheter placement and removal interval was ten days to 58 months.

No postoperative infections were identified that were associated with a retained cuff after removing the PD catheter. Patients were followed for a total of one year after PD catheter removal to evaluate for a cuff related infection. Furthermore, no patients necessitated cuff removal in our cohort. One patient had cellulitis around the catheter site after removal, which was treated with oral antibiotics. The mean time for catheter removal in patients that only underwent PD catheter removal without any additional procedure was identified to be  $4.07 \pm 2.18$  minutes. Three patients underwent additional procedures in addition to the PD catheter

removal thus were excluded from the meantime calculation. Only one patient required general anesthesia and conversion to open removal technique due to catheter fracture as the patient had an extension tubing with an additional connection. Post PD catheter removal, 26 patients (83.87%) transitioned to hemodialysis (Table 1).

Characteristics		Percentage (%)
<b>Total Patients</b>	31	-
<b>Age (years)</b>	56.47 ± 17.48	-
<b>Male</b>	14	45
<b>Female</b>	17	55
<b>Intraoperative Complication</b>	1	3.23
<b>Conversion to open</b>	1	3.23
<b>Mechanical issue resulting in removal</b>	12	38.71
<b>PD related infection resulting in removal</b>	10	32.26
<b>Transition to hemodialysis for personal reasons</b>	9	29.03
<b>Positive catheter tip culture</b>	3	9.68
<b>Preop antibiotics given</b>	16	51.61
<b>Postop antibiotics for peritonitis</b>	4	12.9
<b>Post removal cuff infection</b>	0	0
<b>Post removal infection</b>	1	3.23
<b>Post removal Hemodialysis</b>	26	83.87
<b>Comorbidities:</b>		
<b>Congestive heart failure</b>	10	32.26
<b>Coronary artery disease</b>	8	25.81
<b>Diabetes</b>	15	48.39
<b>Atrial fibrillation</b>	5	16.13
<b>Chronic obstructive pulmonary disease</b>	3	9.67
<b>Hypertension</b>	28	90.32
<b>Preoperative Medication:</b>		
<b>Anticoagulation</b>	6	19.35
<b>Antiplatelet</b>	15	48.39
<b>Antihypertensive</b>	31	100
<b>Oral hypoglycemic</b>	7	22.58
<b>Insulin</b>	7	22.58

**Table 1:** Characteristics of the study cohort.

## Discussion

Many surgeons still employ the conventional method of PD catheter removal with the dissection of both cuffs from their beds under general anesthesia. Although the sustained traction technique garners more attention, physicians continue to be concerned about infection rates and catheter removal complication rates with this method because of the cuffs remaining embedded [5]. Two studies using the sustained traction method reported a high infection rate for retained cuffs of 24.2% and 29%, respectively [6,7]. These findings may be the foundation of the hesitancy and concern about using the sustained traction method to remove PD catheters. However, subsequent studies of this technique have shown more promising results. Quiroga, et al., conversely showed success with the pull technique with one superficial cuff infection out of 57 retained cuffs in a 31-patient cohort [3]. Our study continues to build on the literature put forth by Quiroga, et al., among others, to show that the sustained traction method is an effective and safe technique for removing PD catheters [1-3]. In this series, we show no infections related to a retained cuff after PD catheter removal, regardless of the indication for removal. Furthermore, we show a short operative time of 4.07 minutes, which demonstrates its cost-effectiveness and decreased risk for anesthesia-related complications due to minimal sedation and analgesia. Furthermore, the lack of incisions reduces recovery time and post-operative pain compared to those undergoing the conventional technique for PD catheter removal [4].

## Conclusion

This study established that this noninvasive technique for removal of peritoneal dialysis catheters does not increase post-operative infection rates while minimizing operating room time and anesthesia-related complications. The low infection and complication rates underscore the sustained traction method's reliability and potential as the preferred approach for PD catheter removal. We believe providers can confidently offer this technique, knowing it combines safety, efficacy and patient comfort. The sustained traction technique represents a viable and safe alternative in the management of PD catheters providing similar patient outcomes and enhanced quality of care and should be the preferred method of removal.

## Conflict of Interest

The authors declare that there is no conflict of interest.

## Free and Informed Consent Term

The patient authorized the publication of the article.

## Availability of Data and Materials

Data is custodied by the author and can be released on trust.

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