

Successful Removal of An Irretrievable Hemodialysis Catheter Stuck in the Central Vein Using a Modified Endoluminal Balloon Dilation Technique: A Case Report

Jacob B Watson, MD, Alan B. Lumsden, MD, Maham Rahimi, MD, PhD
Houston Methodist Hospital, Houston, TX, USA

Introduction

Long-term tunneled hemodialysis catheters (TDC) are used for patients requiring hemodialysis (HD). Long term use of TDCs for HD is associated with increased complications particularly infections, which significantly increases mortality risk compared to using AVFs or AVGs [1].

A common malfunction of TDCs is the formation of a fibrin sheath around the intravascular catheter. The longer TDCs remain in place, the more likely a patient may be to develop a fibrin sheath [2]. The formation of the fibrin sheath is initiated by the coagulation cascade. It comprises fibrin, collagen, and thrombi as a reaction to the foreign material within the body. The formation of this sheath can complicate the removal of the TDC by covering inlet holes of the catheter, disrupting dialysis flow, initiating thrombus formation, or increasing the risk of infection [3].

Multiple surgical techniques are described to aid in the removal of TDCs that fail traditional removal techniques. Surgical cutdown is a good option for catheters that are encased in extensive scar tissue along the tunneling tract. This new incision over the extravascular portion of the TDC allows for blunt dissection along the course of the catheter but does not solve the problems of intravascular fibrin sheath adhesion. Thoracotomy, or the surgical opening of the chest wall, is documented as a last resort for surgeons to remove the catheter as it has the greatest risk of complications and is the most invasive approach. A catheter left in situ is also described in the literature. This involves cutting off the distal end of the catheter while the proximal portion of the catheter remains inside the patient which can act as a nidus for infection or central venous stenosis [4].

Objectives

This case report introduces an endovascular technique that enables the successful removal of a stuck TDC without additional surgical incisions or catheter transection.

Methods

A 69-year-old female Jehovah's Witness with history of end stage renal disease (ESRD) on hemodialysis (via right internal jugular vein Bard 14.5 French x 19cm length tunneled dialysis catheter that had been in place for over 5 years presented with a broken clamp on her TDC arterial line. She was scheduled for TDC exchange in the hybrid operating room.

She was positioned supine. The right neck and chest were sterilely prepped, and she was given local anesthetic. The cuff of the catheter was dissected free from the surrounding tissue using blunt dissection from the catheter exit site of the skin. Stiff 0.035 wire was introduced into the arterial port of the catheter with the wire tip terminating in the inferior vena cava (IVC) to maintain wire access for TDC exchange. However, TDC removal was not possible despite attempts at freeing it by traction from two different physicians. Upon any attempts of catheter retrieval, the patient complained of chest pain. Fluoroscopy showed the catheter tip positioned in the right atrium (Figure 1).

Result

The decision was made to attempt PTA of the TDC due to the risk of the catheter fracture or other possible complications (e.g., central vein injury with bleeding to the mediastinum or heart rhythm disturbances). The 0.035 wire was removed, and two V-18 wires were placed (one through each port of the TDC). A 3x120mm Sterling SL balloon was loaded onto each wire and positioned in the mid-catheter near the jugular-brachiocephalic vein confluence. Both balloons were inflated to nominal pressure simultaneously and deflated after a few seconds. Balloons were advanced in 3-4 cm increments until PTA had been performed to approximately 1 cm past the catheter tip (Figure 2). The catheter was then easily removed over the wire and the TDC exchange was performed successfully (Figure 3).



Figure 1: A Tunneled double-lumen hemodialysis catheter was inserted through the right internal jugular vein into the central vein with the catheter tip in the right atrium



Figure 2: Two 3x120mm Sterling SL balloons inflated inside the lumen of the stuck hemodialysis catheter

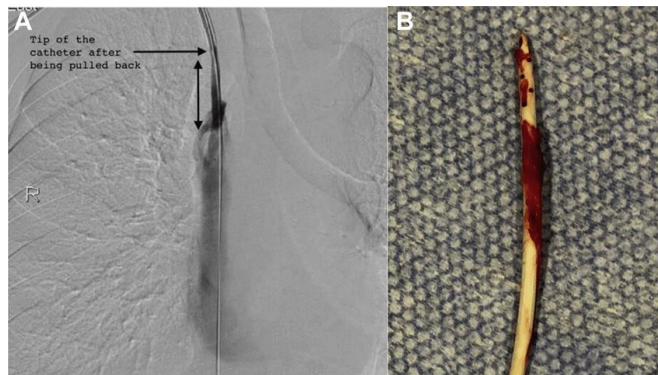


Figure 3: A) A similar case showing remnant fibrin sheath on angiogram after catheter withdrawal. B) Fibrin sheath encasing the catheter tip after removal from central veins.

Discussion

Despite the advantages of this technique, various other techniques are reported in the literature. Another minimally invasive technique is the removal of a fibrin sheath using an excimer surgical laser that is traditionally used to remove pacemakers and implantable cardioverter defibrillator leads. This technique allowed for successful removal in three patients with stuck hemodialysis catheters [5]. Another minimally invasive technique described placing an appropriately sized Vollmar ring around the catheter within the vessel and sliding it up to the fibrin sheath, dislodging the catheter, and then removing the ring and the catheter. This technique was successful in a small case study of 3 patients with stuck central venous catheters [6]. Additionally, the more invasive cutdown method was modified and had reported success. This was performed by releasing the central tunneled catheter, removing the intravascular portion, and then cutting down the intravascular portion. This is in contrast to the traditional method that cuts before removal of the intravascular portion. This result showed a slightly lower complication rate and lower prolonged bleed rate than the conventional cutdown method [7]. Finally, the maximally invasive thoracotomy is what each of these techniques aims to avoid. While it was found to be effective with a 92.3% success rate in a case study of 13 patients [4], this paper aims to show the advantages of balloon assisted removal technique due to its lower risk of patient complications.

Conclusions

Balloon dilation is a simple, safe, and highly effective way to remove incarcerated long-term central venous catheters. This technique is simple and made the procedure more flexible, and possibly less prone to complications, by refraining from cutting the catheter and making additional surgical incisions.

References

1. Chan MR, Yezlin AS. Tunneled dialysis catheters: recent trends and future directions. *Adv Chronic Kidney Dis*. 2009 Sep;16(5):386-95. doi: 10.1053/j.ackd.2009.06.006. PMID: 19695507.
2. Wang L, Jia L, Jiang A. Pathology of catheter-related complications: what we need to know and what should be discovered. *J Int Med Res*. 2022 Oct;50(10):300605221127890. doi: 10.1177/03000605221127890. PMID: 36268763; PMCID: PMC9597033.
3. Watorek E, Golebiowski T, Letachowicz K, Garcarek J, Kurcz J, Bartosik HA, Letachowicz W, Weyde W, Klinger M. Balloon angioplasty for disruption of tunneled dialysis catheter fibrin sheath. *J Vasc Access*. 2012 Jan-Mar;13(1):111-4. doi: 10.5301/jva.5000015. PMID: 21959559.
4. Yongchun H, Hua J, Xiaohan H, Jianghua C, Ping Z. Solutions to stuck tunneled cuffed catheters in patients undergoing maintenance hemodialysis. *J Vasc Access*. 2021 Mar;22(2):203-208. doi: 10.1177/1129729820928163. Epub 2020 Jun 26. PMID: 32588722.
5. Carrillo RG, Garisto JD, Salman L, Merrill D, Asif A. A novel technique for tethered dialysis catheter removal using the laser sheath. *Semin Dial*. 2009 Nov-Dec;22(6):688-91. doi: 10.1111/j.1525-139X.2009.00646.x. PMID: 20017840.
6. Lodi M, Ebrahimi RF, Pezzotti P, Carbonari L. The removal of a stuck catheter: an alternative to Hong's technique. *J Vasc Access*. 2016 Nov 2;17(6):548-551. doi: 10.5301/jva.5000557. Epub 2016 Sep 27. PMID: 27716890.
7. Porazko T, Hobot J, Ziemcik Z, Klinger M. Tunnelled Haemodialysis Catheter Removal: An Underappreciated Problem, Not Always Simple and Safe. *Int J Environ Res Public Health*. 2020 Apr 27;17(9):3027. doi: 10.3390/ijerph17093027. PMID: 32349262; PMCID: PMC7246895.