Tunneled central venous catheters in a gynecologic oncology service: operative and short-term complications

J.P. Geisler[1], *M.D.*; R.E. Buller[2], *M.D., Ph.D.*; K.J. Manahan[1], *M.D.*

[1]*Indiana Women's Oncology, St. Vincent Hospitals, Indianapolis, IN*
[2]*Division of Gynecologic Oncology, Holden Comprehensive Cancer Center, University of Iowa, IA City (USA)*

Summary

Purpose: To determine the difference in the immediate complication rate between placement of long-term central venous catheters (LTCVCs) by the percutaneous versus jugular venous cutdown method. *Method:* Case lists were examined to determine the number of LTCVCs placed during the designated time period. Medical records, operative reports, and chest roentgenograms were examined to extract pertinent information. Immediate complications included complications occurring in the operating room until 30 days postoperatively. Complications included misplacement of the catheter requiring an adjustment or a repeat procedure, pneumothorax, hydrothorax, or hemothorax, operative site or tunnel infection, and line migration requiring removal. *Results:* Five hundred and one patients had LTCVCs placed during the period of this study. This included 399 totally implantable venous access devices (TIVADs) and 102 free access venous access devices (FAVADs) with 163 placed percutaneously into subclavian veins and 338 placed by cutdown into jugular veins. There was a significant increased risk in the overall immediate complication rate for the percutaneous placement compared to venous cutdown ($p < 0.001$). Also, pneumothorax was more common with the percutaneous approach compared to the venous cutdown approach ($p < 0.001$). *Conclusions:* Immediate complications, especially pneumothorax, were more common when placing catheters by the percutaneous approach as compared to the venous cutdown approach.

Key words: Implanted catheters; Central venous catheters; Gynecologic oncology, Percutaneous; Venous cutdown.

Introduction

Over 20,000 gynecologic cancer patients per year will require chemotherapy for treatment of their malignancies. As Roy *et al*. found over three decades ago, many of these patients will need long-term central venous catheters (LTCVCs) for convenience and ease of administration [1]. The long-term side-effects of these catheters are well documented [2, 3]. Minassian and colleagues showed that thrombotic complications were much less common when low-dose prophylactic anti-coagulation was utilized [4]. They further showed that the overall rate of long-term complications was lower by venous cutdown as compared to percutaneous access [4]. Minassian did not find any long-term differences in comlication rates between totally implantable venous access devices (TIVADs) and a free-access venous access device (FAVADs); however, Gleeson and colleagues at the Moffitt Cancer Center found that FAVAD had a higher rate of complications [4, 5].

Mirro *et al*. found that there was not a significant difference in long-term catheters placed by the percutaneous approach as compared to cutdown, but TIVADs had fewer complications than FAVADs [6]. Furthermore, there is conflicting data as to whether the internal jugular or subclavian approach has a lower risk of complications including thrombosis [7, 8]. However, the percutaneous approach to the internal jugular can be associated with unique complications such as carotid puncture, stroke, and Horner's syndrome [9-12]. Although long-term complication rates are known, it is not known whether differences in short-term complications differ between the percutaneous subclavian approach and the internal jugular cutdown method.

The purpose of this study was to retrospectively determine whether operative and short-term complications were more common by the percutaneous or cutdown approach and to secondarily see if differences existed between TIVADs and FAVADs.

Materials and Methods

The operative records, roentgenograms, and case lists were examined for the period July 1, 1997 to December 31, 2003 to extract all cases of tunneled LTCVC placed by the Gynecologic Oncology Service at St. Vincent Hospital, Indianapolis and the Univeristy of Iowa Hospitals and Clinics. The types of catheters used were as follows: TIVAD (Port-a-Cath®, Sims Deltec Inc., St. Paul, MN; BardPort®, Bard Access Systems, Salt Lake City, UT) and FAVAD (Hickman®, Bard Access Systems, Salt Lake City, UT).

All LTCVCs were placed and removed by the Gynecology Oncology Service. No perioperative antibiotics were used. Initally, povidone-iodine solutions were routinely used for skin preparation unless otherwise contraindicated until January 2002 when a chlorhexidine-based preparation became standard. With the percutaneous method, postoperative roentgenograms in the operative suite were used for evaluation of placement. Internal and external jugular venous cutdown was performed through a supraclavicular incision on the appropriate side with direct access to the vein through a venotomy. Postoperative roentgenograms in the operative suite were used for evaluation of placement initially and fluoroscopic examination has been used more recently. TIVADs were routinely sewn to the pectoralis fascia to prevent line migration or rotation/flipping of the hub.

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Results

From July 1, 1997 to December 21, 2003, 501 LTCVCs were placed (Table 1). This included 399 TIVADs and 102 FAVADs with 163 placed into subclavian veins percutaneously and 338 placed into jugular veins by the venous cutdown method. The type of placement was at the surgeon's discretion. On the anatomic left side, 92.5% of the catheters were placed percutaneously as opposed to 13.9% catheters on the right side ($p < 0.001$). The anatomic side influenced type of catheter used. For instance, on the left, 66 of 120 (55.0%) catheters were TIVADs while on the right side 333 of 381 (87.4%) catheters were TIVADs ($p < 0.001$). The choice of method (percutaneous vs cutdown) also influenced type of catheter used. Ninety-five of 163 (58.3%) percutaneously placed catheters were TIVADs while 304 of 338 (89.9%) catheters placed by cutdown were TIVADs ($p < 0.001$). Table 1 documents the perioperative complications. The rate of total complications, as well as the rate of three specific complications (pneumothorax, line malposition/migration, and operative site infection) was examined. Overall complications were highest with the percutaneous approach ($p < 0.001$). Pneumothorax was significantly more common by the the percutaneous approach as compared to cutdown ($p = 0.001$).

Table 2 presents the complications associated with the placement of LTCVC by type of catheter used. Again the rate of total complications, as well as the rate of three specific complications (pneumothorax, line malposition/migration, and operative site infection) was examined. No differences were found in short-term complications based on the type of catheter (all $p > 0.05$) (FAVAD or TIVAD) used.

Table 1. — *Complications within 30 days of surgery by approach.*

Procedure	Total complications	p value	Pneumothorax	p value	Op site infection	p value	Line migration/ malposition	p value
Percutaneous n = 163	19		6		3		10	
		< 0.001		< 0.001		0.013		0.013
Cutdown n = 338	2		0		0		2	

Table 2. — *Complications within 30 days of surgery by type of catheter.*

Type of catheter	Total complications	Pneumothorax	Op site infection	Line migration/ malposition
FAVAD* n = 102	7	1	2	4
TIVAD** n = 399	21	5	1	8

* Free access venous access device; **Total implantable venous access device; All p values > 0.05.

Discussion

Minassian and colleagues found that long-term complications such as thromboembolic events and infection were more common with the percutaneous approach as compared to cutdown [4]. This study found that the rate of the most worrisome short-term complication, pneumothorax, was more common by the percutaneous approach as compared to cutdown again documenting the safety of this approach.

In gynecologic oncology patients, the percutaneous approach has been shown to have a low rate of complications [13]. Nelson *et al*. found the rate of pneumothorax to be 4.3%, similar to the 3.7% found in the present series. Ruesch and colleagues found, in intensive care patients, that the pneumothorax rate in percutaneously placed catheters was less than 2% (subclavian or internal jugular) in experienced hands [14]. Although these rates are low, they are still much higher than the rate of pneumothorax by cutdown (0.0% in the present series).

Di Carlo *et al*. demonstrated the safety of the cutdown approach in their case series [15]. The jugular veins were only used in one of 346 patients. All of their patients had malignancies although not specifically gynecologic malignancies. The documented rate of both short- and long-term complications in their patient population was only 1.8% (not including malposition/migration) compared to a short-term complication rate of 0.6% in this series.

Two separate series from our services have now demonstrated lower complication rates with the venous cutdown versus the percutaneous approach. Although both series were retrospective, they covered different time periods and demonstrated that the cutdown approach was superior both in short-term and long-term complication rates.

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Address reprint requests to:
J.P. GEISLER, M.D.
Indiana Women's Oncology
Division of Gynecologic Oncology
St. Vincent Hospitals
8301 Harcourt Road, Suite 201
Indianapolis, IN (USA)
e-mail: jgeisler@indianawomensoncology.com