

## Research Article

# External jugular venous cut down technique for placement of chemotherapy port and Hickman catheter: a study of 23 cases

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## ABSTRACT

**Background:** Intravenous access devices are an integral part of cancer treatment today as these devices solve the most important problem of venous access for long duration while delivering chemotherapeutic drugs. We used external jugular venous cut down method for insertion of the catheter into central veins in twenty three consecutive patients and studied the outcomes.

**Methods:** We analysed 23 patients who were considered for placement of chemotherapy ports and catheters for various indications. Uniform insertion procedure was followed in all patients. The outcome factors analysed were total operative time, type of anaesthesia, blood loss, and incidence of complications like hematoma and hem pneumothorax, correct placement of the tip, time to start chemotherapy, wound infection.

**Results:** In all the patients, operative time was less than 30 minutes, total blood loss was insignificant which was measured as less than a gauze piece soakage, procedure was comfortably done under local anaesthesia in all the patients, none of the patients had hematoma or chest cavity collections, tip was well placed in superior vena cava except in one where the tip migrated into contralateral brachiocephalic vein, all patients started chemotherapy the next day and there was no wound infection.

**Conclusion:** External jugular venous cut down technique is a very useful easily performed technique with excellent safety profile, very short procedure duration. Hence may be done even by those without a previous exposure to such device placement.

**Keywords:** Chemo port, External jugular cut down, Venous access device, Chemotherapy catheter

## INTRODUCTION

Cancer chemotherapy has progressed rapidly in past few years with newer intensive protocols including bone marrow transplant being made available. Discovery of newer drugs and rescue of cytopenic state by growth factors have made long duration intensive treatment possible with resultant improvement in patient survival a reality. However, not only does chemotherapeutic drug delivery requires long term venous access for following the proper treatment protocol repeatedly but also, many of the chemotherapy drugs themselves are irritants to the

soft tissues including veins there by leading to thrombosis of the vein used. To avoid this problem special devices called as chemotherapy ports and catheters were introduced which may have single or multiple lumen as well as special cuffs to prevent catheter slippage and to inhibit the microorganism invasion into the body. Traditionally, these devices are supplied with a closed percutaneous insertion system which includes the device, large bore needle with provision for guide wire insertion and dilator. The usual site of insertion is subclavian vein and internal jugular vein. Standard insertion procedure involves direct closed percutaneous puncture of the vein

by following Seldinger's technique and traditional landmarks, confirmation of placement by aspiration of blood by a pre-attached syringe and insertion of the guide wire. The tract then is dilated by a blunt dilator over guide wire, dilator is withdrawn with guide wire in situ and catheter is then inserted over the guide wire. This technique has its own complications because it is a blind technique hence there is a chance of accidentally puncturing artery instead of vein, through and through puncture of the vein and laceration of vessel wall, chance of pleural puncture with resultant hemothorax and pneumothorax, and also need for repeated blind attempts. Capaccioli L et al reported failed first access in 6 cases (6.8%). A pneumothorax occurred in 4 patients (4.7%) and late complications were seen in 15 patients (17.8%) and recommended fluoroscopy guided visualization of the catheter position while insertion and positioning.<sup>1</sup> To find a simpler alternative we started following the venous cut down technique for chemotherapy port insertion, which is done under direct observation.

## **METHODS**

This was a prospective cohort study carried out in Surgical Oncology department at our tertiary health care hospital over a period of one year.

### ***Inclusion Criteria***

All patients who were diagnosed to have malignancy and required chemotherapy as primary treatment modality in case of hematologic malignancies or as adjuvant treatment in solid organ malignancies and were willing for the placement of chemotherapy port or catheter were included. Some of the patients planned for palliative chemotherapy were also included in the study.

### ***Exclusion Criteria***

All those patients who were not willing for the procedure as well as those who had local contraindications like skin infection were not considered for the procedure. All those who had thrombocytopenia or neutropenia which could not be corrected were not considered for this intervention till the recovery of the cell counts.

### ***Procedure***

For the purpose of this study, a proforma was prepared which included the details of all the patients, procedure details and post-operative follow up till the delivery of first cycle of chemotherapy. Site for skin incision over lower neck was determined by following the prominence of external jugular vein in neck by suitable tilt or valsalva manoeuvre. The required catheter length was estimated by measuring it from the point of exit of catheter out of skin or the site for placement of port on chest wall to cut down site in neck and from there till sternal angle. All patients were subjected to standard chest radiograph 6 hours post procedure routinely to assess the catheter

placement as well as to monitor complications like pneumothorax or haemothorax which were to be noted for the purpose of this study if there were any. Catheter tip placement in the superior vena cava or its junction with right atrium was considered as normal while any misplacement was noted. All patients underwent electrocardiographic monitoring to recognize any arrhythmia that occurred while placing the catheter due to atrial irritation. Acute kink at the site of entry into vein was avoided by carefully planning the tunnel which should provide for gradual change in course of catheter and a suture for keeping the catheter in place using absorbable material was used if needed.

### ***Outcome factors***

- Total operative time.
- Type of anesthesia required.
- Vein used for cannulation.
- Blood loss estimated by gauze soakage.
- Catheter tip misplacement.
- Complications like hematoma, pneumothorax or hemothorax.
- Revision required if any.
- Time to start first dose of chemotherapy and infection at the site.

## **RESULTS**

In all, 23 patients were evaluated over a period of one year. Out of these, 8 (34.7%) were males and 15 (65.21%) were females. Age distribution was from 10 to 65 years. In all these patients the average operating time was 30 minutes which was calculated from the incision to completion of the procedure. Local anesthesia was used for all cases (100%) and there was no conversion to general anesthesia and it was without any inconvenience to the patient. In all the cases external jugular vein was used for cut down and cannulation (100%). There was less than a gauze soakage in 10 patients (43.47%) and the remaining had about 2 gauze pieces soaked (56.52%), all of these were females. Slightly higher bleeding in female patients in our opinion was due to more tissue encountered during dissection as a result of body habitus difference between males and females. All the patients except one had properly placed tip (95.65%), which was defined as placement in superior vena cava near its junction with right atrium. One patient had the tip migrated into left brachiocephalic vein which did not require repositioning as the location was not considered adverse for chemotherapy delivery. There were no complications related to collection at puncture site or in the thoracic cavity, we ascribe it to total avoidance of blind puncture and the insertion site being away from the thoracic cavity. Revision was not required in any of these patients and all the patients started on chemotherapy the very next day and there was no documented infection clinically or otherwise during the course of first chemotherapy.

**Table 1: Results of the external jugular venous cut down insertion approach.**

Observed parameter	Number of patients	
Sex Distribution	Males	08/23 (34.7%)
	Females	15/23 (65.21%)
Anaesthesia	Local	23/23 (100%)
	General	None
Vein Used	External	23/23 (100%)
	Others	None
Soakage	<1 Gauze	10/23 (43.47%)
	1-2 Gauze	13/23 (56.52%)
Placement of Tip	Optimum	22/23 (95.65%)
	Misplacement	01/23 (4.34%)
Revision Required	None	
Day of Starting Chemotherapy	1 <sup>st</sup> Post Op	23/23 (100%)
Complications	None	

**Figure 1: Post-operative x-ray showing proper port tip placement.**

## DISCUSSION

Chemotherapy is an integral part of cancer treatment today. Almost all the patients require chemotherapy in one form or the other during the course of their treatment. Whenever chemotherapy is to be given over a long period of time, access to the central veins is required because these veins have higher patency rate and are less affected by the irritant properties of the drugs due to larger dilution volume and higher flow rate than peripheral circulation. The length of time required for the delivery of chemotherapy course which constitutes an indication for such a device placement is defined by various authors differently and there is difference of opinion in the literature. Capaccioli suggests that any time period less than 3 months is short term and possibly does not require such a device, others would suggest that long-term is anything over 6 weeks.<sup>1,2</sup> Most authors agree with this latter definition and suggest that an arbitrary time for any central venous catheter with a planned duration of use greater than 6 weeks is probably a reasonable definition. In our institutional practice we prefer venous access device for any chemotherapy which takes more than 4 weeks of treatment.

Venous access devices are classified as tunneled, non-tunneled, completely implantable and peripherally inserted central lines. A few commonly used such devices are Hickman, Broviac and Groshong catheter. Originally described by Hickman and colleagues and widely used Hickman catheter has one or two cuffs, the cuffs may act as antimicrobial barrier and help to fix the catheter, although controlled trials have failed to show a difference in colonization rates between cuffed and non-cuffed catheters.<sup>3-5</sup> Broviac catheter was the original design from which the Hickman catheter was a modification. The major difference between the two is the internal (lumen) diameter. This was 1.6 mm for the original Hickman catheter (as opposed to 1.0 mm for a Broviac catheter) in order to facilitate repeated blood sampling. The tips of Hickman and Broviac catheters are open ended.<sup>6,7</sup> In contrast, Groshong catheters have a formed blunt end with a slit-like orifice just proximal to the distal end which acts as one way valve so that blood cannot enter the catheter lumen and there is a significantly reduced chance of catheter thrombosis.

The ideal catheter material should be chemically inert, non-thrombogenic, flexible, radio-opaque and transparent. Chemical composition affects the thrombogenic potential and catheter related sepsis rates. Stiff catheters have the potential to damage vessel walls and accelerate thrombosis. The material of choice for long-term venous access is silicone elastomer. Silicone has been shown to have the lowest rate of infection when inserted peripherally. We used silicone elastomer catheters and ports in all our patients.<sup>8-10</sup>

There have been attempts to reduce chances of catheter related sepsis by chemical coated catheters but the results are debatable and also not so convincing in long term.

Majority of indwelling central venous access devices are placed in cancer patients by the Subclavian vein percutaneous approach. Venous cut down approaches are useful simpler alternatives; however, they are infrequently utilized. The cephalic vein and external jugular vein cut down approach has been previously shown to be technically feasible in 82% and 88% of the cancer patients respectively. Although the EJV cut down approach for central venous access is well described in the literature, the initial reports described its use in patients in whom either percutaneous approach or cephalic vein cut down was not technically feasible.<sup>11-18</sup> We have used this approach as the mainstay of central venous access for placing chemotherapy ports and catheters for long term use. We have found this technique as very simple, safe, effective and easy to learn by surgeons with previous exposure to saphenous vein cut down. Studies by a number of authors have shown that the Subclavian vein percutaneous approach for central venous access device placement has a documented risk of pneumothorax in approximately 1% to 4% of cases, in contrast to an absence of immediate perioperative complications, including pneumothorax, for both the cephalic vein cut down approach and the external jugular vein cut down approach which is also reflected in our

study as the absence of these complications in the entire cohort and we consider it as the main advantage of venous cut down technique.<sup>3,12,16,19-27</sup>

The optimum position for catheter tips is an area of debate, but most centers would leave the tip either in the lower superior vena cava or upper right atrium.<sup>28</sup> Peripherally inserted central catheters, through cephalic or basilica vein cut down, are another variation of the venous cut down approach with advantage in terms of lack of above mentioned complications however, failure to achieve a central tip position has been shown to occur in between 25% and 40% of attempts.<sup>29-31</sup> In contrast to this, our study showed almost 96% correct placement with external jugular vein cut down and remaining 4% also had a central placement albeit not in the superior vena cava or right atrium.

Incorrect placement of the catheter can have adverse effects as shown in a number of studies. For example, the rate of thrombosis related to the catheter rises from 21% if the catheter tip is in the superior vena cava to 60% if placed in the axillary, subclavian or innominate vessels. Also, studies using ultrasound and fluoroscopy have shown an average displacement of  $2\pm 3$  cm (and in some cases up to 9 cm) of the tip of the catheter by arm movement in peripherally inserted central catheters; this may trigger arrhythmias or increase the risk of thrombus formation due to endoluminal damage or cardiac perforation according to some reports. Moreover, the narrow gauge of the catheter limits infusion flow rates and makes aspiration difficult and a high percentage of catheters are removed because of premature failure (21%), often as a result of phlebitis (8.2%) or occlusion (8.2%). This failure rate is higher than that for tunneled catheters. These facts further emphasize the importance of external jugular vein cut down procedure which uses tunneled catheter with larger lumen diameter and has negligible rate of misplacement if correctly measured and cut to size.<sup>32-37</sup>

Catheter tips can change position on moving from lying to standing. Most insertions are done in a supine or head down position. Subsequent X-rays show descent of the abdominal contents and diaphragm and a change in the catheter position relative to the mediastinal contents.<sup>38</sup> This may lead to catheter malposition. Similarly, there is evidence that pendulous breast tissue may exert traction on the extra-thoracic portion of a tunneled catheter, which will cause outward movement with the potential for extravasation.<sup>39</sup> However our studied group of patients there was no difference between estimated and actual position of the catheter tip possibly due to a short intravascular length of catheter available for mobility and relatively less change in position of the head as compared to arm as in case of peripherally inserted central catheter. We propose this as another profound advantage of external jugular vein cut down method.

## CONCLUSION

From this study, we would like to conclude that this technique of chemotherapy port and catheter insertion is a safe, reliable and easily reproducible method. The procedure is very well done under local anesthesia and has no major complications as the entire procedure is done under vision and this method should be used as an effective alternative to the blind insertion technique traditionally followed. We propose that external jugular venous cut down approach may be considered as a potentially useful primary route for successful venous access device placement in cancer patients.

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