

# Umbilical Vein Superficialization and Preservation in Neonates: A Valid Way for Central Line Insertion: First Experience

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## Abstract

**Objective:** We evaluated the feasibility and safety of a new technique of operative Superficialization and preservation of the umbilical vein during neonatal laparotomy with central venous catheter insertion.

**Methods:** 25 neonates were subjected to this new technique during laparotomy. The technique is performed as follows: after transverse or transumbilical laparotomy incisions, the umbilical vein is dissected 2-3 cm cephalad to the umbilicus. A proximal area of the vein almost of 2 cm is skeletonized and passed to be superficial to the rectus muscle. A very small stab equal to the catheter diameter is done 1- 1.5 cm proximal to the incision site, where the end of the vein is passed via the subcutaneous tissue and skin then fixed by sutures to skin after passage of the suitable size catheter.

**Results:** In 23 cases, no difficulty was encountered. Operative difficulty was reported in 2 cases where there is anomalous course of the vein in one case. Another case with already inserted catheter, need to be flushed with change of the catheter. Catheter slippage, infection and deep insertion reported each once.

**Conclusion:** This is the first report of operative Superficialization and preservation of the umbilical vein during neonatal laparotomy which is feasible and safe technique.

## Introduction

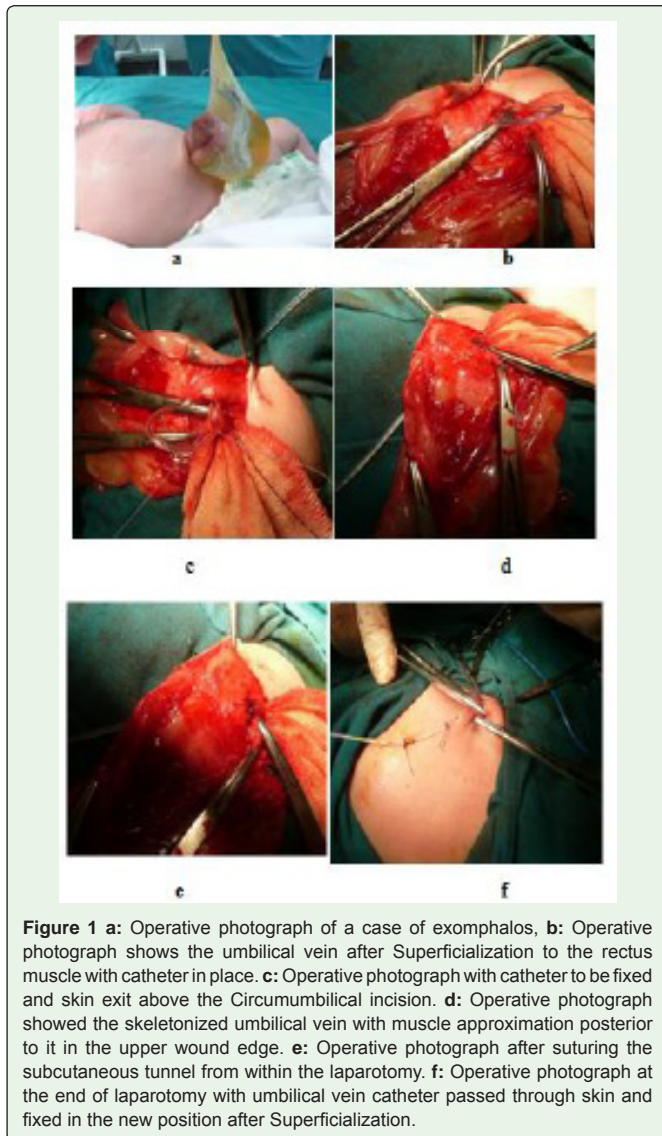
Vascular access is often needed for long term use in newborns and infants. There has been a steady increase in the use of Central Venous Catheter (CVC) in the neonatal practice over the past few years and has been accepted as routine even in premature infants [1-3]. Originally CVC was performed for four main reasons; total parental nutrition, administration of drugs, venous pressure measurements and exhaustion of peripheral veins. Different types of catheters were used including totally implantable and non totally implantable depending upon its use and indications [3,4]. This is indicated to facilitate save and comfortable delivery of medications or nutritional support in infants and neonates. Different routes for insertion are used. The umbilical vein route remains a valid one in neonates. In the classic laparotomy for neonates, usually the umbilical vein is ligated or transfixed as it crosses the incision line of classic transverse laparotomy. Umbilical vein catheterization that is a common bedside procedure in the neonatal intensive care units is not free of complication [4]. Modern emergency and intensive care pediatrics is impossible without adequate venous and arterial vascular access. However no other skill for neonatal intensive care causes more anxiety in primary care providers or is more difficult to teach [5]. The umbilical vein is commonly used and easily accessible central venous route despite the significant incidence of thrombosis [6,7]. The idea of Superficialization of a vein for a vascular access is used many times before for hemodialysis access in the arm [8], but there is no previous description of the Superficialization of umbilical vein in neonates during laparotomy in the English literature.

## Aim

The aim of this study was to present our experience of a new technique allowing operative Superficialization and preservation of the umbilical vein during neonatal laparotomy for subsequent post operative use in neonates along the period of 3 years.

## Patients and Methods

In the period between 1st October 2010 and 30<sup>th</sup> September 2014, 25 central umbilical venous catheters have been inserted during laparotomy in neonates with age ranged between 1 day and 14 days. These cases have been done in Tanta university hospitals and other affiliated hospitals. All cases of peritonitis, Necrotizing Enterocolitis (NEC) or former umbilical sepsis were excluded from our study. Neonates that will be subjected to laparotomy and a central venous line is needed were



included constituted the 25 neonates of the study. Ethical committee of the Tanta University approved the study design and an informed consent signed by each patient's father or guardian. The technique of Superficialization and sparing is operatively performed as described by Dr. Sherif Shehata, as follows: after transverse or trans umbilical incisions for laparotomy, the umbilical vein is identified and dissected 2-3 cm cephalad to the umbilicus. A proximal area of the vein length almost of 1-2 cm is skeletonized and passed to be superficial to the rectus muscle. A very small stab equal to the catheter diameter is done using the scalpel's tip 1- 1.5 cm proximal to the incision site, where the end of the vein is passed via the subcutaneous tissue and skin then fixed by sutures to skin after passage of the suitable size polyurethane catheter. Now the vein lies between the rectus muscle posteriorly and the skin anteriorly. Two viral sutures were taken within the muscle around the vein. [Figure 1- a,b,c,d,e,f].

The distal part of the vein is transfixated or ligated then the laparotomy is completed as indicated. During catheter removal- after withdrawal of the catheter- the area is compressed for 3 minutes. Cases

were evaluated for patency and any complications reported. The site of skin stab is closed spontaneously in the period of follow up. Cases were subjected to post operative US to rule out portal vein thrombosis at 3 months after catheter removal. The weight of neonates ranged between 1100 grams and 4280 grams. Details of each case is reviewed as indication, confirmation of proper placement, complications and difficulties in insertion were reported and analyzed.

## Results

There were 25 neonates included in this study. In 2 cases, there was former insertion before surgery and the catheters were repositioned during surgery. The main indications were the need for repeated venous access in cases of exomphalos (9), congenital diaphragmatic hernia (5), intestinal atresia (5), gastroschisis (4), and malrotation (2) in that order of frequency.

In most cases (23), no difficulty was encountered. Operative difficulty was reported in 2 cases where there is anomalous course of the vein in one case in the form of tortuosity to the left side but with careful dissection to relief the kink we succeeded to insert the line. Another case with already inserted catheter once before, need to be flushed with change of the catheter.

Catheters were remained in position for a period ranged from 5 to 17 days as needed except one that is slipped 2 days after insertion. There were no problems encountered during catheter removal as compression after removal of the catheter is enough. Infection at site of exit reported once in one of the cases of intestinal atresia that treated conservatively and the catheter removed at the 8<sup>th</sup> day of insertion without sequel. Deep insertion reported once in a case where tip of the catheter appeared in the SVC of exomphalos that necessitate pulling it back for 2 cm and fixation to skin.

## Discussion

There has been a steady increase in the use of Central Venous Catheter (CVC) in the neonatal practice. The umbilical vein is also a commonly used and an easily accessible central venous route. In many circumstances, CVC is used for the comfort of the patient to avoid repeated vein puncture or for convenience of nursing care [8,9]. Also central lines via peripheral veins have been successfully used by some [10], but it was found to be less reliable, often technically difficult and prone to blockage or accidental removal [11]. In the early neonatal period before umbilical vein obliteration, umbilical vein is a very convenient route for CVC. We did not encountered total obliteration of the umbilical vein in any of our cases as 24 out of the 25 cases operated in the first 4 days of life. In cases where laparotomy is needed, it may be sacrificed during the procedure whatever the laparotomy incision used; classic supra umbilical, circum-umbilical or trans-umbilical [12]. The idea of Superficialization of a vascular access is used formerly in hemodialysis access with brachiobasilic fistula creation [8,13]. Also, jugular vein CVC insertion through separate skin stab to make a subcutaneous tunnel closes spontaneously following removal after applying pressure which is the same principle used in our series. The idea of the current technique came that in clean neonatal laparotomy, the umbilical vein is accessible and can be used rather than sacrificed. The vein had enough length and can be superficialized anterior to the rectus muscle in order to help fixation and spontaneous closure later following withdrawal of catheter. This will make compression later effective as it is supported by a muscle

posteriorly and compression externally over the skin. Operative difficulty was encountered twice but managed successfully during catheter insertion. Anatomical abnormalities are not high as in other routes that need imaging in the form of venography, digital subtraction angiography and magnetic resonance angiography pre operatively [14]. Deep insertion of the catheter was reported in one patient in this series that necessitate manipulation to adjust it. Neither hematoma, hemorrhage or catheter dislodgment were reported in the current series. This can be explained by the fact that operative meticulous hemostasis is done and good fixation with sandwiching the catheter within the umbilical vein between the subcutaneous tissue and the rectus muscle. The rate of postoperative bleeding and hematoma is commoner in tunneled catheters than in non tunneled catheters [14,15].

Venous thrombosis occurred in one case but resolved with flushing and change of the catheter during operative insertion. Venous thrombosis reported to be of higher incidence with other CVC routes like jugular vein [10]. Central venous line presence is recognized in pediatric population as the most significant risk factor for development of venous thrombo-embolism. Factors involved in catheter-related venous thrombosis include prematurity, thrombogenicity of the implant and infusate and catheter sepsis [16,17]. Infection reported once in this series but did not necessitate catheter removal. This low incidence of infection as compared to other venous access [12,17] may be attributed to our selection criteria of only clean laparotomy in neonates without umbilical sepsis. Another limiting factor may be the small number of cases. Also, we did not encounter any case of portal vein thrombosis or infection during the period of follow up on US. Other studies demonstrated primary catheter sepsis rate ranging from 9% to 26% in neonates [1,2,9]. This variability depends on unit related parameters such as size and settings, patient related factors such as severity and type of illness, and catheter related parameters such as catheter type, site and condition under which the catheter was placed [18,19]. Our cases exclusively inserted during laparotomy in clean cases with surgical sterilization in operative theatre. The umbilical vein is wide, virgin and will obliterate spontaneously later, so it is an excellent chance to use in the early neonatal time after laparotomy as designed in the current study and supported by the results. One of the advantages of this new technical issue is the use of ordinary umbilical CVC with low cost not like other catheter types [12,19]. No accessories is needed and handling is easy. No case of portal vein thrombosis reported in our cases could be attributed to that the longest period CVC used was 17 days. Longer time use may have risk potential for portal vein thrombosis. The use of CVC in neonates is associated with a substantial complication rate [19], which is not the case in this study. Extending the indications of the current technique to include all types of neonatal pathologies may be needed for more detailed evaluation in different aspects.

Based on this study, operative central venous catheter insertion is a save procedure even in very small babies. . This is the first report of operative Superficialization and preservation of the umbilical vein during neonatal laparotomy which is feasible and safe technique. Silicone type catheter has more advantages than other types. The appropriate size for a definite indication is an important factor to minimize complications. In our local circumstances, many ordinary types can be used efficiently at lower cost. To minimize the infection rate, shortening of the extracutaneous part is advisable in small infants by making a subcutaneous tunnel. We could provide a simpler

alternative for CVC insertion in clean laparotomy cases among neonates with preservation of the jugular and subclavian routes for longer use or other indications. Careful observation and experience are of paramount importance to deal with anatomical venous abnormalities or complications especially in small size newborns.

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