Volume 5, No. 1, January 2015

ISSN No. 2231-5454

INTERNATIONAL JOURNAL OF NURSING DIDACTICS

RESEARCH PAPER

# Protocol on hemodialysis. Connecting and disconnecting the Central venous catheter: results of 21 years of experience

Gabriel Eduardo Rajoy Fernández, María del Mar Rionda Álvarez, Carmen Fátima Pérez Rodríguez
Nurses to hemodialysis service in Meixoeiro Hospital, Vigo, Spain.
E-Mail: gabriel6785@hotmail.com

**DOI: http://dx.doi.org/10.15520/ijnd.2015.vol5.iss01.36.49-52**

***Abstract: Introduction:*** One of the main nephrology nursing activities in haemodialysis units is the care of central venous catheters by complying with a protocol that places particular emphasis on universal aseptic measures during handling. There are also other variables that can affect the appearance of complications in the catheter, limiting its survival. ***Objective:*** The objectives of this study were to analyse the factors that can influence the appearance of complications of the central venous catheter for haemodialysis, and evaluate the infection rates in our centre. ***Material and method:*** A descriptive study was carried out of a cohort in the Dialysis Unit of Hospital Meixoeiro, between January 1991 and October 2012, with a sample made up of 1231 catheters. ***Results:*** 1231 catheters were implanted (1187 temporary catheters and 44 Hickman-type tunnelled catheters). Tempo rary: 78% in femoral, 18% in jugular, and 4 % in subclavian vein. Hickmam: 40 on the right side, and 4 on the left side. The average duration of the implanted catheters was 17.7 ± 30.8 days (median 8 days). 88% did not present incidents during placement. The main causes for placing catheters were IRA (56%) and failure of previous vascular access (30%). The main complication in the causes for removal was obstruction of the catheter (15%), while the most serious complication was infection (6%). Of the 1231 catheters, 70 presented an episode of infection after 19.1±33.0 days on average, (median of 12 days). Infection rate (2010-2012) of 0.75/1000 catheter days. ***Conclusion:*** We conclude that the application of continuous standardized care according to a protocol that places special emphasis on asepsis during connection and disconnection of the CVC results in a low infection rate in this unit.

***Key words:*** protocol; central venous catheter; haemodialysis; infection.

## INTRODUCTION:

Proper management of central venous catheters (CVC) has become a real challenge and a necessity for nephrology nursing team. Proper care of CVC, prevents the occurrence of complications and prolongs survival of the same [1].

The CVC is an effective vascular access (VA) for hemodialysis (HD), being used on frecuencia 2,3 despite KDOQUI recommendations and guidelines of the Spanish Society of Nephrology (SEN) which limit their use to clinical situations very specific that preclude the use of other AV [1,4].

The use of CVC has increased significantly in the last decade due to the change of the profile of HD patients (increased age and comorbidity) and inclusion on HD increasingly patients without vascular access [1, 5-8].

The main complications associated with CVC are dysfunction and infection being the most serious infection. Having highlighted the role that nursing plays in reducing these complications and duration of catheters [1-3,5-9].

Prophylaxis is essential to reduce the risk of infection CVC, although it may be overestimating the effect of pharmacological measures [1.9], forgetting a fundamental aspect is the aseptic handling of CVC in all manipulations by the staff nursing. Having published rates 1/1000 catheter days alone with aseptic measures [9].

SEN10 guides and protocols of the Spanish Society of Nephrology Nursing (SEDEN) stress the importance of making proper management of CVC for HD in order to prevent infection and those establishing acceptable rates until 1episodio / 1000 days -catéter [1,3,4].

## OBJECTIVES:

General: Analyze the factors that influence the occurrence of complications in central venous catheters for hemodialysis.
Specific: Show the lowest incidence of infections obtained with strict adherence to aseptic protocol in handling the CVC.

## MATERIAL AND METHODS:

***Study Design:***

A descriptive cohort study was designed, which aims to analyze the state of the CVC in HD on Dialysis Unit Meixoeiro Hospital between January 1991 and October 2012.

- ***a. Type of study:*** descriptive study of a cohort
- ***b. Scope:*** Dialysis Unit Meixoeiro Hospital.
- ***c. Inclusion criteria:*** Patients with CVC to follow this unit from implantation until withdrawal.
- ***d. Exclusion criteria:*** Patients with CVC placed in another dialysis unit, or not complete follow this unit.
- ***e. Inclusion period:*** January 1991 to October 2012.
- ***f. Follow-up period:*** Since the introduction until removal of CVC.
- ***g. Sample size:*** Formed by 1231 CVC implanted.

***h. CVC type:*** implanted catheters most were temporary (96%; 1187 CVC), and Hickman catheters were tunneled (4%; 44 CVC) type.

***Protocol:***

The objective of our protocol is to connect and disconnect the patient from the hemodialysis session through the catheter with maximum aseptic measures, leaving the catheter permeable and anticoagulated for the next session.

Management protocol is the use of a sterile field, based on universal standards aseptic use of sterile gloves whenever the catheter, use of masks both by the nursing staff as patient is handled. 0.05% chlorhexidine use in cleaning the connections, and for disinfection of the outlet orifice which then cover with a sterile dressing. We place special emphasis on handwashing before and change gloves between professionals patient preparation for the session and catheter manipulation. The catheter lock is made with 1% heparin

It is a protocol with 21 years of existence, which is reviewed periodically to include new scientific evidence available, but has not practically unchanged.

***Ethical and legal aspects***

In this study have been respected and universal ethical principles (respect for personal autonomy, beneficence, non-maleficence and justice) applied in research on humans involved.

For this study has been made data processing as set out in Law 15/1999, "Law on Protection of Personal Data".

***Statistical Analysis:***

For descriptive statistical analysis was performed frequency distribution for different qualitative variables and mean ± standard deviation from the mean for quantitative variables. As the duration of the catheters did not follow a normal distribution, the median was also calculated.

For analytical statistical analysis, SPSS 20.0.0 was used, the way ANOVA were used to compare the relationship between quantitative and qualitative variables and chi-square statistic when both variables were qualitative. P values <0.05 were considered.

***Working variables:***

Nominal variable with six categories: anatomical location right femoral CVC, left femur, right subclavian artery, left subclavian, jugular right, left jugular.

Type implantation technique: nominal dichotomous variable with categories: clean, industrious. We consider clean technique when not submit incidents during placement and during implantation laborious if any associated complications occurred.

Duration: quantitative discrete variable that contain the number of days spent since the introduction of CVC until his retirement. Reason for placement: nominal variable with five categories: catheter dysfunction, IRA, infection, AVF failure, other.

Reason for placement: nominal variable with five categories: catheter dysfunction, IRA, infection, AVF failure, other.

Patient Hometown: Variable nominal six categories: hospitalization, emergency, critical care unit, address, private center, others.
Infection rate: no infections x 1000 / day follow-up.

**RESULTS:**

In the period between January 1991 and October 2012 have implemented a total of 1231 catheters. Were implanted temporary catheters 1187, 912 (77%) on the right side and 275 (23%) left. The racial veins used was: 929 (78%) femoral vein (59% on the right side and 19% on the left), 209 (18%) jugular (15% and 3% right left), 49 (4 %) subclavian. 44 were tunneled catheters Hickman (40 right and 4 left).

The average duration of the CVC in HD was 17.7 ± 30.8 days (median 8 days).

By relating the duration depending on the anatomical location we got there statistically significant relationship ($p < 0.01$) between these two variables. The average length according venous localization was 11.4 ± 18.0 days in right femoral, 11.2 ± 15.1 days left femoral, 28.7 ± 40.5 days in right subclavian 14.3 ± 21, 2 days left subclavian, 30.9 ± 32.0 days in right jugular, 28.0 ± 33.8 days in left jugular, 80.78 ± 81.96 days Hickman catheters in the right side, 150.2 ± 143 9 days left Hickman catheters.

By doing a bivariate analysis we obtained statistically significant relationship exists between the duration and reason for placement of CVC ($p < 0.01$), and the duration and reason for removing the CVC ($p < 0.01$).
In 88% of cases there were no incidents during placement.

When analyzing the duration depending on the presence of incidents during placement do not get a statistically significant relationship ($p = 0.31$). Still, we note that the catheters were implanted without presenting incidents during placement maintain a longer half-life 18.9 ± 33.3 days than if presented 12.6 ± 16.3 days.

We observed that the presence of incidents based on the location saved a statistically significant relationship ($p < 0.01$).

The causes that led to the placement of central venous catheter were diverse: IRA (56%), failure of AVF (19%), catheter dysfunction (11%), infection (2%), other reasons unspecified (12%). Statistically significant relationship exists between the subject placement and location ($p < 0.01$).

21% of the patients died with functioning catheters. Other causes of catheter removal were: catheter obstruction (15%), renal recovery (15%), step AVF (14%), catheter infection (6%), fever (2%), and 27% for other unspecified reasons.

The time between the introduction of the obstruction and CVC, varies with the anatomic location in which is placed: 13.1 ± 14.1 days right femoral, 13.7 ± 15.1 in left femoral,

28.7 ± 54.6 in right subclavian, 10.50 ± 9.62 in left subclavian, 29.36 ± 36.95 in right jugular, 5.7 ± 6.1 in the left jugular, 66.2 ± 77, 0 right Hickman, 363 (1case) in Hickman left.

The subsidiary HD patients with CVC included in this study were mainly from the ICU (39%), a ward (29%), home (25%) and the rest of a private center (4%) or emergency (3%).

Having related the origin of the patient variables and anatomic location of the CVC, we note that there is a statistically significant relationship ($p < 0.01$) between the two. Being the main femoral locating in all sources, although its prevalence differs, being 50% in from home, 70% of those attending an inpatient unit, 80% if they entered through emergency and 95% of patients who came from a critical care unit.

After analyzed the general characteristics of all catheters, we analyzed who presented an episode of infection:
Of the sample of 1231 CVC, 70 presented an episode of infection.
Infection rates (2010-2012): 0.75 / 1000 catheter-days.

The occurrence of said infection episode with an average of 19.1 ± 33.0 days after implantation CVC (median 12 days).
We observed in our study that the duration of CVC from placement until the onset of infection episode bears no statistically significant relationship with the anatomical location variables ($p = 0.87$), implantation technique ($p = 0.27$), reason for placement ($p = 0.65$) nor patient origin ($p = 0.99$).

When comparing the duration with venous location we got the time between the introduction of the CVC and the onset of infection varies venous location: Appears to 21.5 ± 49.7 days in the CVC inserted in the right femoral, 11.1 ± 8.2 days left femoral, 22.2 ± 8.0 days right subclavian, 12.00 ± 8.18 days left subclavian, 28.00 ± 20.01 days in right jugular, 17, 0 ± 11.3 days left jugular.

The anatomical territories had higher frequency of infection coincided with the locations that were more frequent in the implementation. Infected locations: 68% femoral (right 40% 28% left), jugular 21% (18% right, 3% left), 11% in subclavian (right 6%, 5% left). 2 infected Hickman catheters right side and none on the left side.

79% of the CVC that presented infection during use showed no incidents during implantation. As noted in our study the implantation technique bears no statistically significant relationship with the origin ($p = 0.75$), or the location ($p = 0.17$), if there statistically significant evidence to the reason for placement ($p = 0.02$).

The reason for placing catheters were infected was 43% by failure of a previous AV (28% catheter dysfunction, 15% failure AVF), 39% by IRA, 10% unspecified causes and 8% by infection.

According to the source patient infected with CVC: 51% hospitalization, 30% home, 16% UCI, 3% ED.

**DISCUSSION:**

The catheters are often alternative after failure of AVF, for elderly patients with an impaired vascular bundle, comorbidities, dialysis unscheduled, etc ...

The average duration of CVC in our study is similar to the data provided by other units studied temporary catheters [2, 5, 10].
In our results we obtained that the duration depending on the location is higher in jugular and subclavian catheters and placed on the right side, in line with other authors[5].

We found that the duration depending on the presence of incidents during placement bears no statistically significant relationship. Although our study whether higher figure as the average life of the catheters showed no incidents during placement. And like other publications one bring a rate of implants without high incidences.

Consistent with other studies publicados[1,9], our main reasons for placement of CVC were the IRA and the exhaustion of a previous VA.

The main problems associated with the catheters are obstruction and infection being the most severe.

The scientific literature warns of the relative frequency of the obstruction to allow appropriate hemodialysis, the most frequent in our study consistent with published by other authors [2,5,10] complication. And still later this dysfunction jugular blood flow and the CVC on right side.

Infection is a major concern of health personnel and is one of its greatest challenges. The clinical practice guidelines warn about the importance of the existence of a protocol for the connection and disconnection of the CVC in HD, with the aim of achieving a lower rate of infections to 1 episode / 1000 catheter-days according to collect Guides SEN [4] and protocols SEDEN.

In our results, we note that currently this dialysis unit has achieved rates of 0.75 / 1000 catheter days would be considered excellent according to criteria that set the standards of scientific literature. Other authors have also reported rates below 1 episodes / 1000 catheter-days [1,3,6,9] and less than 2 episodes / 1000 catheter-days infection [7,8].

All this shows that compliance with a strict protocol that is based on the application of the universal aseptic measures can prevent infection without exposing patients to possible side effects of any drug treatment.

The period of time between the placement of the catheter and the onset of infection in our study is similar (19.1 ± 33.0 days) that provide consulted other studies [2,5,10] (11-29 days).

In our study, we observed that the presence of incidents during placement has been greater in the CVC which subsequently filed episode of infection (21% incidence in placement), against which later were not infected (12%), coinciding with other studies [1] encrypt this situation by 7%.

**CONCLUSIONS:**

The application of a protocol that places special emphasis on the universal aseptic measures during handling of CVC results in a low rate of infection in our study.

By demonstrating the results of our study we found that work using a standardized methodology and continuous (notarized) has shown a low occurrence of infectious complications, decreasing the variability of care and increasing clinical patient safety.
Nursing records on AV are indispensable for the management and monitoring of clinical practice tool.

**REFERENCES:**


[1]. Cárcamo Baena J, Salgueiro Lazo M, Gómez Castilla C, Rodríguez Pérez MdlA, Tienda Moreno M, Rico Castillo C, et al. Modelo de manejo multidisciplinar de catéteres permanentes tunelizados: resultados a 5 años. Rev Soc Esp Enferm Nefrol (serial online) 2012 (citado 27 Oct 2012); 15 (2). p.138-144. Disponible en: URL:http://www.revistaseden.org/files/3108_modelo de manejo.pdf.

[2]. Contreras Abad MD, Moreno Delgado MC, Muñoz Benítez I, Herencia Castillejo P, Suanes Cabello L, Crespo Montero R. Estudio de los catéteres temporales para hemodiálisis y su relación con las complicaciones. Rev Soc Esp Enferm Nefrol (serial online) 2009 Oct (citado 27 Oct 2012). p. 111-113. Disponible en: URL:http://www.revistaseden.org/files/2150_P%C3%A1ginas%20de%202009-37.pdf.

[3]. Mirabet Sáez B, Ferrándiz Martínez MA, García Fornieles T, Sainz Montes MdM, Martí i Monros A, Navarro Daudén L, et al. Protocolo enfermero de cuidados de los catéteres venosos tunelizados como acceso vascular para hemodiálisis. Resultados a los 450 días. Rev Soc Esp Enf Nefrol (serial online) 2012 (citado 23 Ene 2013); 15 Suppl (1). p. 73. Disponible en: URL: http://www.revistaseden.org/files/3197_73.pdf.

[4]. Rodríguez Hernández JA, Gutiérrez Julián JM. Sociedad Española de Nefrología. Acceso vascular en hemodiálisis. (serial online) 2004 Nov (citado 23 Ene 2013); p.116-141. Disponible en URL:http://www.senefro.org/modules/webstructure/files/guia_acceso_vascular.pdf?check_idfile=984.

[5]. Crespo Montero R, Contreras Abad MD, Casas Cuesta R., Muñoz Benítez I, Moreno Delgado MC, Suanes Cabello L. Estudio retrospectivo de las complicaciones de los catéteres temporales para hemodiálisis. Rev Soc Esp Enferm Nefrol (serial online) 2011(citado 27 Oct 2012); 14 (1). p. 43-49. Disponible en: URL:http://www.revistaseden.org/imprimir.asp?idArticulo=2592.

[6]. Tulleuda Lari ML, Galceran Gui JM, Casals Suau G, Gassó Bonvehí D, Mas Rubio D, Obradors Soriano F, et al. Catéteres centrales para hemodiálisis. Resultados de una colaboración multidisciplinar. Rev Soc Esp Enferm Nefrol Comunicaciones Presentadas al XXXII Congreso Nacional SEDEN (serial online) 2008 Ago (citado 27 Oct 2012). Disponible en: URL: http://www.revistaseden.org/files/2048_67[2].pdf.

[7]. Velayos González MP, Martínez Gómez S, Portalés Pérez J, Gago Gómez MdC, Andrés Vázquez MdM, Gruss Vergara E. Análisis de las complicaciones de los catéteres permanentes para hemodiálisis en un área de salud: repercusión económica. Comunicaciones presentadas al XXXI Congreso Nacional de la Sociedad Española de Enfermería Nefrológica. Rev Soc Esp Enferm Nefrol (serial online) 2007 Abr (citado 27 Oct 2012); p. 25-30. Disponible en: URL: http://www.revistaseden.org/files/145.pdf.

[8]. Martín Chacón E, Martín Álvarez MC, Sánchez Calzado M, Banegas Sultán V, Gil del Reino O, Menayo Gómez J, et al. Incidencia de bacteriemia en pacientes portadores de catéter permanete tunelizados para hemodiálisis. Rev Soc Esp Enferm Nefrol (serial online) 2008 Dic (citado 27 Oct 2012); 11 (4): 277/281. Disponible en: URL:http://www.revistaseden.org/files/2069_Incidencia de bacteriemia.pdf.

[9]. Arribas Cobo P., Rodríguez Estaire J, Martínez Aranda MA, Quesada Armenteros MT, Sáenz Santolaya AJ, Guimerá Ferrer-Sama MA. Prevención de las bacteriemias en pacientes portadores de catéteres para hemodiálisis. Rev Soc Esp Enferm Nefrol (serial online) 2010 Sep (citado 27 Oct 2012). Disponible en: URL:http://www.revistaseden.org/files/2749_36 1706.pdf.

[10]. Resille Gil I, Mariscal Ordoñez MC, Navarro Bermúdez M. Estudio Descriptivo del tiempo de duración de los catéteres temporales y del análisis de las causas de retirada de los mismos. Rev Soc Esp Enfer Nefrol Comunicaciones Presentadas al XXXV Congreso Nacional SEDEN (serial online) 2010 Sep (citado 23 Ene 2013). Disponible en URL: http://www.revistaseden.org/files/2728_16%20%201553.pdf.