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ORIGINALES

The use of venous catheters of average line in hospitalized patient

Uso de catéteres venosos de línea media en pacientes hospitalizados

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ABSTRACT:

In the current context in which numerous alternatives have emerged in intravenous therapy, studies are needed on the different devices available to determine which is the most suitable system in each case. The midlines arise as an alternative to the use of peripheral venous catheters and central peripheral insertion catheters. The main objective of this study is to evaluate the use of midline catheters in hospitalized patients.

Method; Retrospective study of 1016 patients. We analyzed variables related to the mean time of catheter use, the incidence rate for each of the complications, the number of catheters removed and their causes.

Results: 46.5% of the catheters were inserted in men (472). The average age was 65 years (SD 16.8), being the youngest of 14 and the oldest of 101 years. 40% of the catheters were channeled due to poor venous access of the patient (406), 42% for long intravenous treatment (427) and 18% for irritant treatment (183). Regarding the effectiveness of the catheters, the average time of use was 12.1 days (SD 9.4). The treatment was terminated by 854 patients, 704 (69.3%) by the end of treatment and 150 (14.8%) by death. 7.4% of patients presented complications (75). 4.4% (45) were removed due to malfunction of the catheter, 1% due to patient complications (10). 2% of the catheters were removed due to fever (20).

Conclusions: The middle line catheter is a venous access device with a low complication rate, it has a average residence time of around 12 days. It is an alternative to short peripheral catheters in patients with poor vein access and offers an alternative to frequent rotations in patients with antibiotic treatments longer than 7 days.

Key words: venous access devices; midline catheter; midline.

RESUMEN:

En el contexto actual en el que han surgido numerosas alternativas en terapia intravenosa, se hacen necesarios estudios sobre los diferentes dispositivos disponibles para determinar cuál es el sistema más idóneo en cada caso. Las líneas medias surgen como alternativa a la utilización de catéteres venosos periféricos y catéteres centrales de inserción periférica. El objetivo de este estudio es evaluar el uso de los catéteres de línea media en pacientes hospitalizados.

Método: Estudio retrospectivo de 1016 pacientes. Se analizaron variables relacionadas con el tiempo medio de utilización del catéter, la tasa de incidencias para cada una de las complicaciones, el número de catéteres retirados y sus causas.
Resultados: El 40 % de los catéteres se canalizó por mal acceso venoso del paciente (406), el 42% por tratamiento intravenoso largo (427) y el 18% por tratamiento irritante (183). Respecto a la efectividad de los catéteres, el tiempo medio de utilización fue de 12.1 días (DE 9.4). Finalizaron el tratamiento 854 pacientes, 704 (69.3%) por fin de tratamiento y 150 (14.8%) por fallecimiento. Presentaron complicaciones el 7.4 % de los pacientes (75). Se retiraron por mal funcionamiento del catéter el 4.4% (45), el 1% por complicaciones del paciente (10). El 2% de los catéteres se retiró por fiebre (20).
Conclusiones: El catéter de línea media es un dispositivo de acceso venoso con una baja tasa de complicaciones, presenta un tiempo medio de permanencia en torno a los 12 días. Supone una alternativa a los catéteres periféricos cortos en pacientes con mal acceso venoso y ofrece una alternativa a las rotaciones frecuentes en pacientes con tratamientos antibióticos superiores a 7 días.

Palabras clave: dispositivos de acceso venoso; catéter de línea media; midline.
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INTRODUCTION

Endovenous therapy is a usual treatment in hospitalized patients. Drug perfusions can produce phlebitis and extravasations, so patients are often carriers during the entry of several peripheral venous routes [(1)].

Inserting a venous catheter is an invasive process that in addition to pain and discomfort, it generates complications such as phlebitis [(2,3)]. The characteristics of the perfusions constitute the main factor of the failure of the peripheral routes; the nursing personnel must adapt the type of venous catheter to the particularities of the prescribed treatment. Depending on the aggressiveness and duration of treatment, peripheral venous catheters or central venous catheters will be used. The general recommendation is that central venous catheters are used for infusions with a pH lower than 5 or higher than 9. Although there are not available studies providing results that suggest that the pH itself causes phlebitis [(4)], there are numerous studies that show that many factors contribute to thrombophlebitis related to the perfusion (anatomical location, sex, experience of the inserter, etc.) [(5)].

In recent years, the use of the so-called midline catheters (CM) has come back. The midline catheters are venous catheters between 8-25 cm in length. These catheters offer patients and professionals the possibility of extending the duration of intravenous therapy, since they are composed of safer and biocompatible materials, such as polyurethane. These catheters are inserted through peripheral access through the brachial or basilica vein, until the catheter tip is located in the deep venous system (axillary or subclavian vein). They also allow the perfusion of intravenous treatments with an indication of administration through short peripheral venous routes, with the added advantage that they can last up to six weeks. According to the CDC o Centros para el Control y la Prevención de Enfermedades (Centres for Disease Control and Prevention), "midline catheters are associated with lower rates of phlebitis than short peripheral catheters and with lower infection rates than central ones" [(6-10)].

The technique of insertion by means of ultrasound-guided micro puncture has also meant an important advance to solve the problems related to venous accesses in hospitals [(11)]. This technique increases the percentage of success and therefore decreases the required number of venipunctures.

Unlike central insertion catheters, in which placement and removal requires the intervention of doctors, midline catheters can be inserted and removed by nurses.

Therefore, in recent years the use of CM catheters has intensified, both for intravenous therapy in continuous or intermittent perfusion.

The main objective of this study was to evaluate the use of CM in hospitalized patients.

METHOD

A retrospective study was performed for all the patients to whom a CM had been made in the UTIV (Unidad de Terapia Intravenosa o Intravenous Therapy Unit). Between July 16, 2015 and April 18, 2017, 1140 catheters were considered. We did not take into account those that did not included any data regarding the withdrawal. So, the final sample is based in the data of 1016 patients.

The data required for this study were obtained from the database prepared by the nursing staff of the UTIV (Unidad de Terapia Intravenosa). It recorded the socio-demographic profile of the patients (sex, date of birth, age and specialty), the type of intravenous perfusion treatment, the data related to the insertion (date of insertion, place of puncture), complications or incidents that arose, as well as the reason and date of withdrawal. This investigation is classified in the risk-free group, according to the executive order 008430/1993, of the Ministerio del Sanidad (Ministry of Health).

In compliance with the Ley de Protección de Datos y Documentación Clínica (Law on Data Protection and Clinical Documentation), the registry did not collect personal data that would allow the identification of the participants.

To evaluate the use of CM, we analyzed the indications for inserting these catheters in hospitalized patients, the average time of use, the complications inherent to their use and the causes of withdrawal in relation to the reason for insertion.

Complications related to the catheter, total or partial obstruction and rupture were considered. Referred to the patient, infection at the point of puncture, fever, bacteraemia, phlebitis and thrombosis. Finally, the accidental withdrawal by the patient or the health personnel was considered as another cause of withdrawal.

The patients were divided into three groups based on the indication of channelling of a CM:

• Poor venous access, including those patients with absence of visible or palpable superficial veins and/or failure of two or more attempts.
• Patients subject to an antibiotic treatment for more than a week.
• Patients with an indication of intravenous treatment considered irritant, due to their osmolarity and/or pH.

Statistical analysis

A descriptive analysis was made of both the basic socio-demographic variables of the patients and the characteristics of the inserted catheters. Likewise, a first

approximation of a descriptive nature of the time of use of the implanted catheters and the reason for withdrawal was carried out. Depending on the nature of the variables, chi-square test, Student t-test or ANOVA test were used.

RESULTS

The results of the descriptive analysis are shown in Table 1. 1016 catheters were analyzed, 46.5% were inserted in men (472). The mean age was 65 years (SD 16.8), being the youngest 14 years old and the oldest 101 years old. 40% of the catheters were channelled through poor venous access (406), 42% by long intravenous treatment (427) and 18% by irritant treatment (183). The arm of choice of the participants was the right one in an 80.6% of the patients (819) and in 94.8% of the cases the basilic vein was canalized (963).

By specialty, the units that request a CM in a greater percentage are: Medicina Interna (Internal Medicine) 23.7%; Cirugía (Surgery), 18.3%); Digestivo (Digestive Unit), 12.6%; Enfermedades Infecciosas (Infectious Diseases), 8.7%); Cirugía Traumatológica (Trauma Surgery), 8.3%; Neurología (Neurology), 6.8%; Neumología (Pneumology), (5.2%).

The irritant treatments given to patients in greater percentage were: Isoplasmal, 30.6% (56); Potassium chloride, 19.1% (35); Vancomycin, 12% (22); Cloxacillin, 9.3% (17).

The average time of use of the CMs was 12.1 days (SD 9.4). In patients with poor access, the average was 12.3 days (95% CI 11.2-13.3), in the long treatment group of 11.5 days (95% CI 10.7-12.3) and in those of irritant treatment of 13 days (95%). IC 13-11.5). The differences between groups were not significant (p = 0.15).

The treatment was finished up by a total of 854 patients, of which 704 (69.3%) was by the end of the treatment, and 150 (14.8%) because they died. By groups, a total of 68.5% of patients with poor venous access (278), 71% of those with long treatment (303) and 65.6% with irritant treatment (120) finished the treatment.

Table 1: Characteristics of the patients in the sample

N=1016		
Sex (man)	472	46.5%
Age	65 años	16.8
Arm (right)	819	80.6%
Veins (Basilic)	963	94.8%
Implementation time	12.1	9.4
Indication of the catheter		
Poor venous access	406	40%
Long-term treatment (> 7 days)	427	42%
Irritant treatment	183	18%
CGU*		
Internal Medicine	241	23.7%
Colon & Rectal Surgery	186	18.3%
Gastroenterology	128	12.6%
Infectious Disease	88	8.7%
Orthopaedic Trauma	84	8.3%
Neurology	69	6.8%
Pulmonology	52	5.1%
Oncology	45	4.4%
Vascular Surgery	44	4.3%

Others	79	7.8%
Causes of withdrawal		
End of treatment	704	69.3%
Death	150	14.8%
Malfunction of the catheter	45	4.4%
Change by central catheter	42	4.1%
Fever	20	2.0%
Complications of the patient	10	1%
Renovation	3	0.3 %
Others	42	4.1%
Irritans traitments		
Isoplasmal	56	30.6%
Cloruro Potásico	35	19.1%
Vancomicina	22	12 %
Cloxacilina	17	9.3%
Gentamicina	8	4.4%
Alprostadil	7	3.8%
Clindamicina	5	2.7%
Daptomicina	5	2.7%
Bicarbonato	3	1.6%
Others	25	13.8%

*Clinical Mangement Unit

Within the group of long-term patients, a group of 143 patients with scheduled colon surgery was identified.

To those who were channelled a CM on the first day of hospitalization prior to surgery, a 90.2% (129) completed the treatment without complications, and only 3.5% (6) needed to channel a central venous catheter.

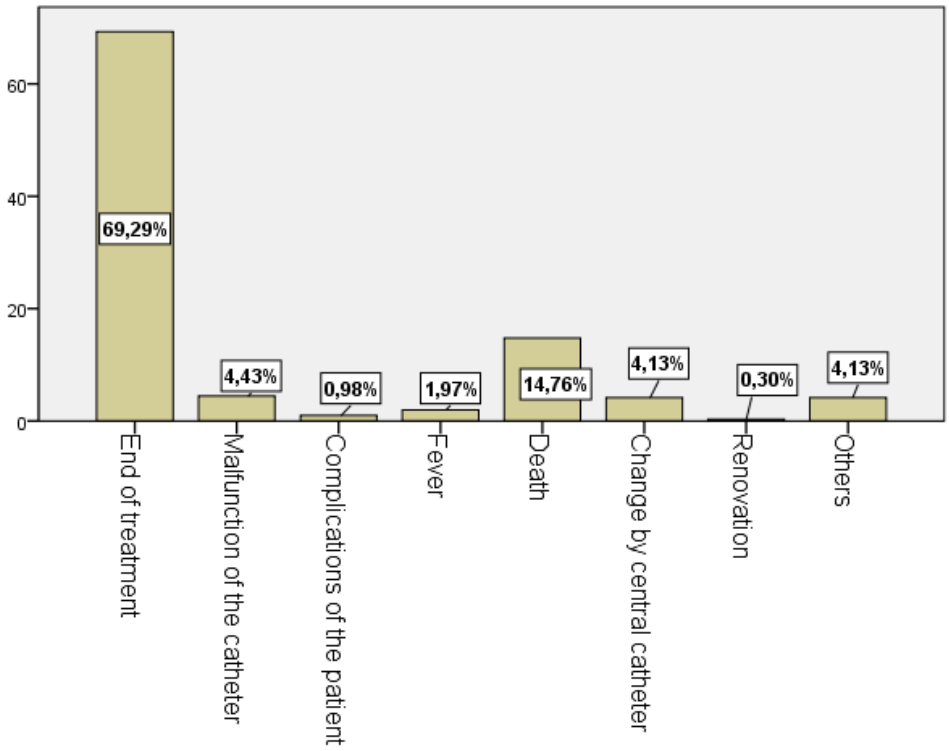
A total of 7.4% of the patients presented complications (75): 4.4% (45) due to a catheter malfunction, 2% (20) related to fever and 1% (10) due to the own patient complications.

When we analyzed the relationship between the indication of the catheter and complications, we found that patients who were channelled for poor venous access had a 4.7% of complications (19), while those in whom the indication was for long treatment had a 9.1 % of complications (39) and those of irritant treatment a 9.3% (17). The difference being statistically significant p = 0.027.

The patients who needed to change the CM for a central venous catheter represented a 2.2% in the group with poor venous access (9), 4.2% in the long treatment group (18) and 7.1% in the irritant treatment group (13). The difference was statistically significant, p = 0.017.

Figure 1 shows the causes of withdrawal. A 4.4% (45), due to the malfunctioning of the catheter; a 1%, due to complications in the patient (10); and a 4.1% (42), due to the need for a central venous access. 2% of the catheters were removed due to fever (20). In all cases a tip culture of the catheter was performed, but only 7 were positive. A new CM was channelled to three patients to complete the treatment.

Figure 1: Causes of withdrawal



DISCUSSION

CMs are currently used in the health system, although in different ways and variability, depending on the hospitals and the indications. In our hospital, its use as a venous access device has increased greatly since the UTIV was founded. Both healthcare personnel as well as patients have shown a high degree of satisfaction with them, since they preserve the venous capital and decrease the suffering of the patient avoiding multiple venipunctures.

In case of immediate urgency, the short peripheral catheter is the one preferred, but it is not recommended for the perfusion of products with high osmolarity or high irritative capacity. In these cases, midline catheters are considered an efficient alternative for patients with intravenous antibiotic treatments longer than a week [(7)-(10)]. In our research, the mean time of use of the CMs was 12.1 days and only a 7.4% of the patients developed complications. This percentage can be reduced with training programs since 4.4% of them are related to the management of the catheter.

The data related to colon surgery patients confirm that channelling a CM early in patients requiring prolonged hospitalization is a cost-effective option [(11)].

Recently published articles indicate that the scope of CMs may be expanding. A recent study by Caparas et al. showed the safety of the administration of vancomycin through a CM versus a PICC [(12)]. In our study, we found no difference in the complications between patients who were given antibiotic treatment, with low risk of phlebitis, and

those in whom the treatment was irritating. In all cases, the recommendations of the pharmacy services of the hospital regarding drug dilution and perfusion rate were followed. We consider that they should be taken into account as factors associated with the emergence of complications, in addition to the intrinsic characteristics of the medicines (osmolarity), the speed of ingestion and the duration of the treatment. Another important factor is the perfusion time of the administered solution since in high osmolarity solutions the risk of phlebitis for prolonged perfusions is greater than for solutions given in bolus [13].

Only 7% of patients with irritant treatment needed to channel a central line. They were mainly patients under treatment with isoplasmal, who required parenteral nutrition, due to their clinical evolution. Therefore CMs are shown as an alternative in patients that require irritant treatments and in which the channelling of a central venous line is not justified as the first option. The overall rate of complications during the channelling of a central venous catheter is estimated at around 15%, so its channelling should be considered only in absolutely necessary cases [14-16].

The cost of CMs, around 30 Euros each, makes these devices cost-effective with respect to central venous catheters of peripheral insertion [17]. The so-called PICC have a high price, so their use in therapies just a few days long must be considered.

Limitations

This study is a retrospective research carried out in an individual hospital centre, not a randomized clinical trial. We analyzed the complications that took place during the hospital stay of the patients, so there could be a lack of data on complications that occurred after hospital discharge.

Finally, we believed that research is needed on the potential impact of the different types of catheter and the manufacturers of them.

Conflict of interests

The authors declare that they have no conflicts of interest.

What is known?

MCs date back to the 1950s, and the hypersensitivity reactions to the catheter material in certain designs led to a decrease in its manufacture and use. After a redesign of insertion methods and materials, they have once again gained popularity as an alternative device for peripheral venous access.

The use of MC is compatible with patients who require intravenous therapy in the medium and long term. It allows a greater hemodilution of the drugs given to the patients, reducing the incidence of chemical phlebitis, infiltration and discomfort of the patient during the administration of the particular drug. The potential time of stay of up to 28 days suggests early placement during the course of hospitalization in patients expected to require prolonged intravenous perfusions or difficult venous access. While some studies suggest that irritant medication solutions cannot be administered through CM, recent studies indicate the opposite.

Which is the contribution?

The CM is a venous access device with a low complication rate; it has an average time of stay of around 12 days. They are a valid option for patients who require intravenous treatment during hospitalization. It is an alternative to short peripheral catheters in patients with poor venous access and reduces the risk, besides protecting the venous capital of patients with antibiotic treatments longer than 7 days, especially when used in a properly selected patient population.

Finally, CMs also represent a safe alternative for patients with an indication for irritant treatment in which the channelling of a central venous catheter is not justified.

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