A PLAN FOR THE PREVENTION OF PHLEBITIS IN PAEDIATRIC INPATIENTS

Title
A PROGRAM FOR THE PREVETION OF PHLEBITIS IN PAEDIATRIC HOSPITALS

Abstract words
160

Article words
3.807

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Abstract

Introduction

Phlebitis due to vein infusion is a significant issue in clinical practice. Recent studies have shown that 25-70% of patients receiving infusion therapy present phlebitis (i.e. inflammation of a vein).

Objective

The aim of our study was to firstly introduce and implement a plan for the management of the peripheral venous catheter, that would allow nurses to monitor and evaluate the evolution of the clinical conditions of the insertion site, and secondly see if this plan was effective in preventing phlebitis.

Methods

We used the following methods: a review of the literature, Andrew Jackson's "Visual Infusion Phlebitis Score" and the NHS (National Health Service) Peripheral Venous Cannulation Policy data-gathering grid.

Results and Conclusions

The data produced by our research showed that throughout the period the Visual Infusion Phlebitis (VIP) Score was used, infusion phlebitis did not manifest in any of the patients included in our study.

Article

The insertion of peripheral venous catheters is an invasive procedure commonly performed in hospitals.[1]

The main complications of vein infusion therapy are mainly linked to phlebitis. Phlebitis can be defined as *an acute inflammation of the internal lining of the vein.* [2]

The clinical signs of phlebitis are described by many authors and classified according to the severity of the clinical condition. [3] [4] [5]

Recent studies have also shown that phlebitis can occur in 25-70% of the patients undergoing vein infusion therapy. [6] [7] [8]

Pain or erythema could be the first signs, which if ignored or overlooked can rapidly evolve and deteriorate, leading to the hardening of the vein – a palpable venous cord – and ultimately to sepsis or thrombosis.

In order to prevent complications, it is important to know what are the predisposing factors to phlebitis and what is the correct approach to the

insertion procedure, maintenance and control of the catheter. [9] [10]

All health professionals should be aware of the importance of prevention, of timely observation of the insertion site of the venous catheter and of the need to report what actions were performed. [11]

Objective

The aim of our research was to set up a plan for the early assessment of any signs and symptoms of phlebitis (inflammation of the vein where the catheter is inserted) to intervene in a timely and appropriate manner and minimise complications linked to the insertion of the venous catheter.

The objectives of this plan were twofold: assessment and monitoring.

Materials

The project of our research consisted in the daily observation of the insertion site of the peripheral venous catheter in patients admitted to the Department of Anaesthesia and Resuscitation at the “Giannina Gaslini” Children’s Hospital using the Visual Infusion Phlebitis (VIP) Score [3], a specially designed chart reported in literature.

The reason for choosing the above-mentioned department was grounded in literature: firstly because intensive care units are reported to have some of the highest rates of phlebitis and complications associated with catheter insertion, mainly for the high level of healthcare complexity of patients admitted to Paediatric Intensive Care Units (PICUs). [12]

Secondly, because this type of medication is a requirement when using the VIP Score as an observational tool. [13]

To facilitate the observation of the peripheral venous catheter access, without causing traumas to the patient’s skin and running the risk of

displacing the catheter with potentially serious physical and psychological consequences both for patients and their families, it was preferable to have a transparent medication. In fact, the Intensive Care Unit at the “Giannina Gaslini” Children’s Hospital mainly employs this type of medication for its patients.

Statistics have shown that the incidence of phlebitis is higher in intensive care units. This was useful for our study because it was included as a selection criteria when choosing the right place where to conduct our research. [5]

The VIP Score was identified to achieve these objectives. [3] It is a numeric scale ranging between 1 and 6. Each score corresponds to specific clinical signs and the higher the score the higher the level of severity, and for each score there are a set of actions to undertake. It allows an accurate documentation of the clinical conditions of the insertion site of the peripheral venous catheter (PVC).

The VIP Score was introduced to raise the awareness of the healthcare staff on the issue of the onset of phlebitis and its use proved to have positive effects because it produced an accurate documentation concerning the clinical situation of the PVC insertion site. To gather our data, we used a grid validated by the “South Western Staffordshire NHS Primary Care Trust”, where we registered the patient’s name and surname, date and time of observation, the score assigned to the insertion site examined using the VIP Score, what actions were undertaken (if any), the intactness of the medication and if this had been substituted, and finally the signature of the person who collected the data. This allowed health professionals to obtain a clear and updated picture of the clinical situation of the PVC insertion site and thus also improve its management.

The sampling of our study was non-probabilistic.

The inclusion criteria of our study were identified on the basis of international scientific literature: newborn patients and post heart-surgery patients.

Programmed substitution of the PVC was suggested as a method to prevent phlebitis and correlated infections: the incidence of phlebitis increases when the catheter remains in place for >72 hours.

There does not seem to be much difference in the onset of phlebitis between 72 and 96 hours due to the permanence of the catheter.

In paediatric patients, you must not substitute the PVC e reposition it, unless clinical conditions absolutely require it. [12][14]

To conduct our research project we asked and obtained the authorization from the Healthcare Directorate and the Department of the Healthcare Services of the “Istituto Giannina Gaslini”. We also submitted our research project to the Ethical Committee of the “G. Gaslini” Institute, but they did not feel it was their duty to express an opinion on this research.

To ensure anonymity and respect the privacy of the subjects included in the sample, we did not report their names and surnames, and when collecting the data, the subjects were registered in a specially-designed form using only their initials.

The turnover rate of the neonatal patients in the Department of Anaesthesia and Resuscitation was not fixed and in any case it was not very high because of the various issues pre-term patients may present and therefore we could often observe PVC accesses for long periods of time.

The post cardiac-surgery patients all came to the ICU from the operating theatre for the delicate post-operative phase.

A similar study conducted by Paulette Gallant, Alyce A. Schutlz “Evaluation of Visual Infusion Phlebitis Scale for determining appropriate discontinuation of peripheral intravenous catheters” Journal of Infusion Nursing in 2006 focused on post cardiac-surgery adult patients, whereas cardiac-surgery paediatric patients never seem to have been studied from this point of view.

It was for this reason that we decided to include also this type of patient in order to widen the age bracket and come up with more heterogeneous results.

In our study, we included 46 PVCs inserted in 32 paediatric patients (28 newborns and 4 post heart-surgery patients) for a 6-week period of observation. Six patients were excluded from the study because they did not have transparent medications for their PVCs.

RESULTS

Newborns

The peripheral venous catheters (PVCs) used for the sample of newborns included in our study were in total 42. Due to the presence of non-sterile gauze medication, 3 peripheral venous catheters were excluded from our study.

For these 3 peripheral venous catheters, inserted in 3 different patients, our observation focused on the intactness of the medication and on the anatomical site where the device was inserted.

The PVCs were applied in 28 patients (15 males and 13 females), for a total of 98 observations and reports during the period of our study.

The observations of the PVCs, the VIP scores and their appropriate documentation were made almost exclusively during the morning hours

when the most of the healthcare activities are carried out on newborns.

In fact, when planning healthcare activities, it is very important to respect as much as possible the newborns' sleep/wake rhythm to fully satisfy their need to sleep and rest and reduce the chances of destabilizing them (some signs of destabilization in a newborn are: dystonic movements, yawning, alteration of the vital signs and desaturations).

Medications

The first element we took into consideration was the type of medication used to secure PVCs. Patients who had a medication made with non-sterile gauze were not included in our study.

The type of medication applied in the neonatal patients was in 96% of the cases a semi-permeable transparent medication in polyurethane, the same as the one reported in literature, and in the remaining 4% of the cases it was a non-transparent medication in non-sterile gauze.

Transparent medications make it easier to observe the insertion site. This allows health workers to detect any disorder linked to the PVC without causing any trauma to the patient. Medications with non-sterile gauze do not allow to perform a direct observation of the insertion site of the catheter, causing traumas and run the risk of dislocating the catheter. However, it was possible to observe if there were clinical signs such as reddening or hardening along the vein, even though these clinical signs indicate an average (VIP Score = 4) or advanced (VIP Score = 5) stage of thrombo-phlebitis, clinically and physiologically confirmed. But this type of observation cannot be considered scientifically valid because it does not exclude with certainty the presence of the first signs of phlebitis unless the

insertion site is observed with scientific rigor.

Always in relation to the aspect of the medication, the data-gathering grid included the possibility to report if the PVC medication was intact or not, and if not, if it was substituted or not.

Nurses paid maximum attention at changing the medication immediately when it was no longer intact. The intactness of the medication was observable even when there was a non-sterile gauze (when it was intact it was not changed) and therefore we included it in our study. When the medication is not intact pathogens may invade the PVC access, which is a breach of the skin and therefore a potentially privileged site for microorganisms. The first microorganisms that colonize the tip of the catheters are those that live on the skin (generally Gram positive bacteria). This can be the cause of infection of the PVC insertion site. In fact in literature it is reported that the onset of phlebitis may also occur when the medication is not changed according to the protocol.

Anatomic sites

We shall now examine the anatomic sites where the PVCs are inserted. Finding a venous access in newborns, especially in pre-term babies, is not always very easy. The gauge of the blood vessels in newborns is proportional to their gestational age (i.e. in pre-term babies it is smaller than in full-term babies), it is smaller than in adults and the vessels are harder to palpate because their muscular tunic is less developed.

The following Graph, summarises the data we gathered during our study.

TABLE 1. Anatomic sites in newborns where the PVCs were inserted.

Anatomic sites	N° PVC

Palmar digital branches	16
Dorsal Venous Network	9
Arm	15
Epicranic	1
Leg	4

Table 1 shows that 36% of the PVCs were inserted in the veins of the palmar venous arch, 33% in the veins of the upper limbs, 20% in the veins of the plantar venous arch, and 2% in the epicranial site. The venous catheters used were Venflon 24-Gauge, that is the needle with the smallest possible diameter for the diagnostic and therapeutic needs of the patients, in compliance with international guidelines.

This choice was made on the basis of common protocols to uniform practice and minimize the risk of complications in patients.

Patients admitted to the Department of Anaesthesia and Resuscitation can have more than one vascular access inserted contemporaneously and with different purposes, on the basis of the complexity of their clinical conditions. In some patients, an arterial catheter was inserted in the radial artery, generally used for blood gas analysis, a test that requires the collection of a blood sample, which in a short lapse of time provides accurate information on the patient's respiratory status and acid-base balance.

Patients could also have venous catheters inserted peripherally, but much longer than a normal PVC, or a Central Vein Catheter for the infusion of particular therapies or parenteral nutrition.

Therefore, according to their clinical course and length of stay in the Department, newborns can have more than one PVC inserted either contemporaneously or subsequently, after removing the venous access previously inserted.

PVCs were not substituted at regular intervals of time, but only when they were no longer strictly necessary for diagnostic and therapeutic purposes or when there were inflammatory clinical signs that motivated an immediate and timely removal. These actions comply with the Centre for Disease Control and Prevention (CDC) Atlanta Guidelines

The authors of the CDC Atlanta Guidelines declare that on the contrary of adult patients where the removal and repositioning of the catheter ought to take place within 72 hours from its insertion, in paediatric patients the PVC must not be substituted and reinserted unless there are clinical and/or symptomatological conditions that require it. Catheters remained on site between a minimum of one day to a maximum of six days.

The arithmetic mean of the days of permanence was $\overline{x}$ = 2.4 days, equal to 57.6 hours.

Standard deviation was $\sigma = 1.58$ calculated with the following formula:

The interval $x = 2.40 \pm 1.58$ included 76% of the measurements and the result obtained correctly described our sample.

The patients included in our sample could be transferred to other wards inside the Institute when their clinical conditions became stable and continue their treatment in a specific ward. This did not allow us to collect further data and continue to observe the insertion site of the catheter from the beginning to the end.

Relationship between PVCs included in our study and the VIP Score obtained.

The catheters inserted in newborn patients were 42. Of these catheters, 93% had a VIP Score equal to 1, whereas in the remaining 7% the VIP Score was 2. No PVC obtained a VIP Score >2. The total number of

observations made during our study was 99. Our findings were recorded in a specific file and are shown in Table 1.

Of the total number of scientific observations, 97% obtained a VIP Score = 1, this means that the insertion site was ‘healthy and presented no sign of phlebitis’ and that the action suggested was only the observation of the cannula.

In 3% of the cases, a VIP Score = 2 was obtained, this means that the insertion site presented one of the following two signs: a) ‘slight pain; b) ‘reddening’, ‘probable first signs of phlebitis’ and the action suggested was the observation of the cannula.

The relevance of this finding for clinical practice is that it allows health workers to pay particular attention to the status of the insertion site and prevent the onset of further complications, which could lead to phlebitis. In fact, an early detection of the first signs of phlebitis improves both patient outcomes and nursing-sensitive outcomes.

From the viewpoint of a comprehensive and attentive management of the PVC, identifying and recording a VIP Score = 2 helps nurses gain full control over a clinical situation and monitor the respective symptoms, and should it be necessary to remove the venous catheter nurses would be in the position to motivate this decision on the basis of sound scientific evidence.

In a patient who had a VIP Score = 2, the PVC was removed and subsequently reinserted in a different anatomical site.

The day before, the area around the insertion site became red, the medication applied on the PVC was not intact, in other words it was not perfectly attached to surrounding skin.

Instead, in the other two cases with the same score the medication was

intact, so it was not substituted.

The day after obtaining Score = 2, the VIP Score returned to 1, therefore no action was taken apart from a constant observation of the PVC insertion site.

The Standard Deviation of the VIP Scores = 2 was calculated to check if the trend of this figure was on the whole similar to the one found in literature. We found that in 33.3% of the cases the first potential signs appeared after 24 hours and in 66.6% of the cases after 72 hours from the insertion of the PVC.

In literature, it is reported that the onset of the first signs of phlebitis (a little pain and slight reddening on the insertion site) increase from 12% to 34% after the first 24 hrs. and by 65% after 48 hrs.

None of the clinical signs regarding other scores of the Andrew Jackson VIP Score (Scores 3, 4, 5, 6) were observed during the period of the study, therefore none of the patients included in our sample of newborns presented signs of phlebitis.

As mentioned above, the period of observation of the PVC insertion site varied a great deal in relation to external factors, such as the transfer of the patient to another Unit, non-infusion of the therapy through the catheter itself and the removal of the catheter because treatment was no longer necessary.

The period of observation ranged between a minimum of one day to a maximum of 13 days per patient and it was also correlated to any previous periods of PVC insertion.

Post cardiac-surgery patients

The total number of PVCs included in this study were 4, all applied on 4

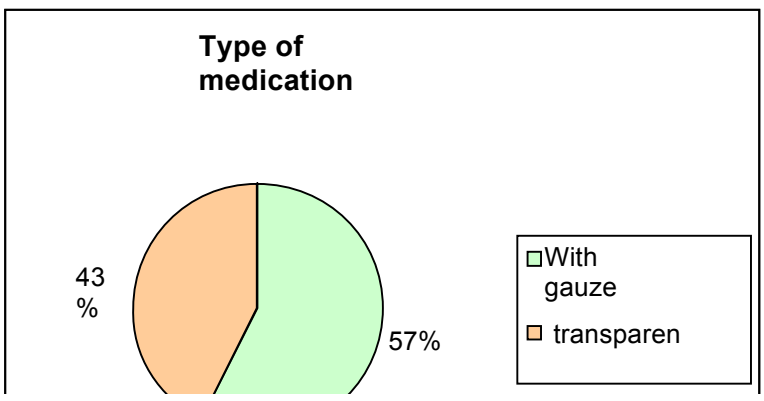
male patients. Three patients with a non-sterile gauze medication and those without a PVC infusion were excluded from our study.

The paediatric patients who underwent cardiac surgery with extra-corporeal circulation (ECC) were admitted to the Anaesthesia and Resuscitation Unit. The type of cardiac surgery can change according to the children's age that could vary significantly. In fact, there are some heart malformations that are incompatible with life and need to be operated immediately and other types of malformations that are not urgent and therefore some paediatric patients are operated in their pre-school or school years.

Medication

With regard to the type of medication it is important to state that PVCs were inserted in the Cardiac Surgery Operating Theatre, while the patient was prepared for the surgery. Usually, several PVCs are inserted, as well as the arterial catheter and the central venous catheter, because of the complexity of cardiac surgery. These PVCs were all applied with a non-sterile gauze medication, so none of them had a transparent medication. Usually, during the operation PVCs are used for the infusion of different substances, according to the physician's orders.

At the end of the surgery not all the inserted PVCs continued to be used for infusion, so some of them remained inserted, but could not be included in the study. Forty-three percent of the patients had a transparent PVC medication (Graph 1).



Graph 1. Type of PVC medication used for post cardiac surgery patients.

This happened because in the Intensive Care Unit Department, the post-operative phase was managed by intensive care nursing and medical staff.

In the event a gauze medication was not intact or nurses decided to change it, it was preferable to substitute it with a transparent one for the reasons mentioned above.

Non-sterile gauze medications presented the same difficulties described above during the observation of the insertion site. Nevertheless, we also observed the vessel where the PVC was inserted to check if the vessel became hard, stiff and saw if the diameter of the vein was palpable. These observations could be physiologically confirmed.

During the short period of observation, 100% of the medications were intact, both those with the gauze and the transparent ones.

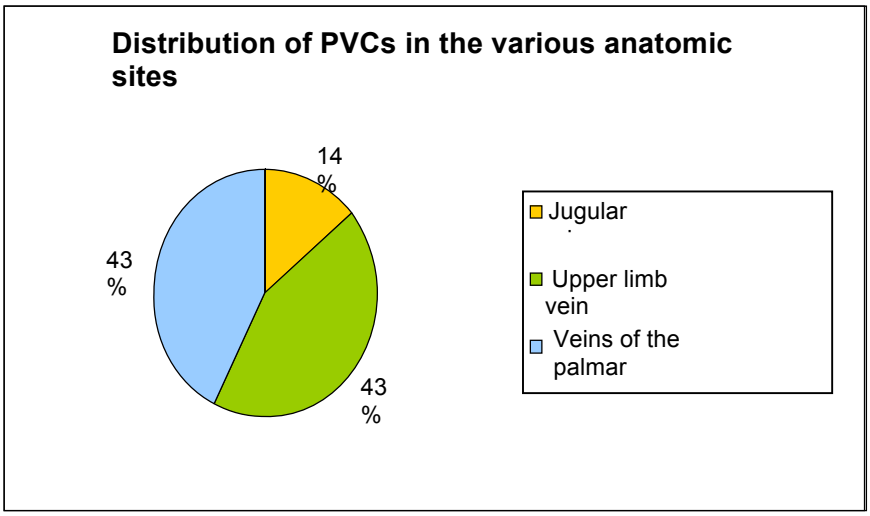
The post-operative care of cardiac surgery patients is very complex and their stay in the intensive care unit can vary significantly, according to their health conditions. For this reason, in relation to the patients' length of stay, the number of observations can vary from a minimum of one day to a maximum of five days, with a statistic mean of three days.

In addition, considered the presence of various vascular accesses –

central, peripheral, which are arterial and much longer than the standard ones – in some PVCs infusion was stopped (following physician's orders) and were left inserted until they were no longer deemed necessary.

The anatomic sites

Most of the PVCs were inserted on the veins of the upper limb, in particular the median antecubital vein or on the veins of the palmar venous arch (Graph 2).



Graph 2. Distribution of PVC anatomic accesses following cardiac surgery.

The PVCs had a different gauge, according to the patient's age and needs.

Relationship between the PVCs included in our study and the VIP Scores obtained

The total number of PVCs included in our study were 4. All PVCs with a transparent medication obtained a VIP Score = 1

The average observation time for the PVCs included in our study was one day.

In 3 post-cardiac surgery patients it was not possible to observe the PVC

insertion site because the medication was made with non-sterile gauze, in addition many patients did not receive any infusions through their PVCs.

The total number of PVCs included in our study was 46. The total number of observations and reports made, using the VIP Score, was 103.

The graph shows that in 97% of the total sample the VIP score was 1 (no sign of phlebitis) and in 3% the VIP Score was 2 (probable first signs of phlebitis).

Conclusions

The data we collected in our study showed that during the period the Visual Infusion Phlebitis Score was used, no onset of infusion phlebitis was observed.

In addition, of the 3% with a VIP Score = 2, the catheter was removed only in one case, before the clinical signs worsened, and in the other two cases careful observation of the access site, the substitution of the medication and the type of infusion allowed the VIP Score to return to normal, thus avoiding potential harm for the patient.

Our study fully confirmed the research hypotheses made at the beginning of the study.

In conclusion, we can state that the aim of our research was achieved, because an accurate PVC management plan allowed to prevent the onset of infusion phlebitis. Since the insertion of a peripheral catheter into a venous blood vessel is one of the most common procedures carried out in hospitals all over the world, our study can improve the outcomes of nursing practice, which has been proven to be relevant also from a legal point of view. In fact, evidence based nursing is safer both for patients and nurses themselves.

Strengths

The strengths of our study include: ensuring systematic observations thanks to the use of a validated tool like Andrew Jackson's VIP Score. With this tool observations are objective, independently from the number of people who perform them.

Observations are scientifically sound, because they are objective, reliable, can be checked and reproduced.

Our study focused on paediatric patients, who are not investigated very often.

The mean time of observation in relation to the average time of PVC insertion and the turnover rates of intensive care patients proved that the design of our study was appropriate.

One last strength was the high level of interest and collaboration the nursing team showed in our research project.

Limits

A limit of our study, mainly conditioned by the widespread use of non-sterile gauze medications, was the small size of our sample.

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