International Emergency Nursing 23 (2015) 89–93

Contents lists available at ScienceDirect

International Emergency Nursing

journal homepage: www.elsevier.com/locate/aaen

The effect of the use of ultrasound in the success of peripheral venous catheterisation

Elif Günay İsmailoğlu MSc, RN (Research Assistant) [a,1,*], Ayten Zaybak PhD, RN (Associate Professor) [a,1], Funda Karbek Akarca PhD, MD (Emergency Medicine Specialist) [b,2], Selahattin Kıyan PhD, MD (Associate Professor) [b,2]

[a] Fundamentals of Nursing Department, Ege University, Faculty of Nursing, İzmir, Turkey
[b] Department of Emergency Medicine, Ege University, Medical Faculty, İzmir, Turkey

ARTICLE INFO

Article history:
Received 11 March 2014
Received in revised form 21 July 2014
Accepted 30 July 2014

Keywords:
Emergency department
Emergency nurse
Nursing practice
Pain
Peripheral intravenous catheterisation
Ultrasound

ABSTRACT

The aim of this study was to investigate the effect of ultrasound-guided peripheral venous catheterisation in patients where difficulty was experienced in peripheral venous catheterisation. The study was conducted in the emergency department at a university hospital in İzmir Turkey. After obtaining institutional review board approval and written informed consent, 60 patients with a history or suspicion of difficult cannulation were enrolled with 30 patients in traditional and 30 in ultrasound group. In the ultrasound group, peripheral intravenous catheterisation was performed using a portable ultrasound device with 13.5 MHz ultrasound probe and 20 gauge intravenous catheter. The success rate of peripheral venous catheterisation was 30% in the control group and 70% in the treatment group. The success rate was significantly higher among the treatment group. The mean intensity of felt pain was 6.00 ± 1.98 in the control group and 4.77 ± 1.74 in the treatment group. The mean intensity of felt pain was significantly lower in the treatment group. The state of chronic disease affected the success rate in patients in the treatment group.

1. Introduction

Peripheral intravenous (IV) catheterisation is a basic technique in modern medicine which is used for such purposes as maintaining liquid–electrolyte balance, giving blood and medication, supporting parenteral nutrition or haemodynamic monitoring (Potter and Perry, 1997). For this reason, IV techniques are one of the procedures most frequently encountered by nurses and other health personnel (Aponte and Acosta, 2007; Bukata, 2007).

For successful IV catheterisation, it is very important that the patient's veins should be visible or palpable (Aponte and Acosta, 2007). A number of conditions may cause serious difficulties in performing IV catheterisation. These include peripheral vascular collapse in cases of trauma, shock and burns, chronic medical conditions, obesity, vein problems associated with the repeated use of IV medication, peripheral oedema, hypothermia or dehydration (Crowley et al., 2012; Kuensting et al., 2009; Witting et al., 2010). Difficulties with IV use can delay a patient's diagnosis and treatment, and necessitate repeated invasive techniques, resulting in greater pain and discomfort (Bauman et al., 2009; Witting et al., 2010).

It is well known throughout the world that it is a major problem when IV intervention cannot be carried out or is delayed. But, a solution to this problem has not yet been found (Aygün et al., 2009). In such cases an external jugular vein, intraosseous lines, peripherally inserted central catheter lines, central venous catheters are generally used in place of an IV catheter (Acar et al., 2009; Chinnock et al., 2007). Although many of these options are available, they can carry the risk of significant complications (Tirado et al., 2013). Especially, the placement of a central venous catheter can cause serious problems such as infection, artery puncture, pneumothorax, haemothorax, venous thrombosis, and haemorrhage (Acar et al., 2009; Bukata, 2007). For these reasons, it has been reported that the use of new technology in selecting a vein for use in peripheral IV catheterisation would greatly increase the success of this technique and help to avoid the problems mentioned above (Costantino et al., 2005; Keyes et al., 1999; Witting et al., 2010). Recently, this has been one of the fields in which ultrasound has been used as an imaging technology. Ultrasound-guided peripheral IV catheterisation provides a new choice in emergency medical procedures as a method which makes a speedy and successful IV catheterisation easier, can

This article was presented at the 2nd Congress of Basic Nursing Care, İstanbul Turkey, September 27–29, 2012.

* Corresponding author. Tel.: +90232 311 5616; fax: +90232 388 6374.
E-mail address: gunayelif2011@hotmail.com (E.G. İsmailoğlu).
[1] Ege University, Faculty of Nursing, 35100, Bornova, İzmir, Turkey.
[2] Ege University Hospital, 35100, Bornova, İzmir, Turkey.

http://dx.doi.org/10.1016/j.ienj.2014.07.010
1755-599X/

provide real-time vascular imaging (Aponte and Acosta, 2007; Blaivas, 2005; White et al., 2010; Yavaşi and Akarca, 2010).

2. Methods

2.1. Aims

The purpose of this study was to investigate the effect of ultrasound-guided peripheral venous catheterisation in patients where difficulty was experienced in peripheral venous catheterisation on the success rate and the amount of pain felt by the patient.

2.2. Design

This descriptive, systematically allocated study compared ultrasonographically guided peripheral IV access with a traditional technique.

2.3. Study setting and sample

The study was conducted between January and June 2011 in the emergency department, serving around 350 patients a day, of a 2000-bed capacity university hospital located in the province of İzmir in Turkey. The study sample was made up of 60 patients who were over 18 years of age, were conscious, could speak Turkish, were not connected to a mechanical ventilator, did not need central venous catheterisation, were not in a critical condition or in need of resuscitation and with a history or suspicion of difficult cannulation (because of obesity, peripheral odema, dehydration and chronic diseases such as cancer, diabetes, chronic renal failure, etc). Before intravenous catheterisation, a tourniquet was applied by the practitioner. Then, upper extremity veins were evaluated by observing and palpating. The patients whose veins could not be located by sight or palpation were included in the study sample. Before the study was performed, information was given to the patients concerning the procedures, and informed consent was obtained.

In this study, a simple random sampling method was used. Patients were divided into groups until each group had 30 patients. The first patients who fitted the sampling criteria and who consented to take part in the study were included in the treatment group and the second patient was included in the control group. The sampling process was continued in this way until each group had 30 patients. Thus, the number of patients in each group was equal. Patient demographics and factors related to the success of vein access were similar for both groups (Table 1). The statistical testing power of the study was aimed to be at least 80% at the beginning of the study and a sample size of 60 patients has a power of greater than 0.90 at a significance level of 0.05.

Collection of research data was carried out by one researcher and four volunteer nurses who had been working for at least one year in the emergency care unit where the study was conducted. Before the study, an emergency medicine specialist gave theoretical and practical training on ultrasound-guided peripheral venous catheterisation to the researcher who collected the data and to the emergency service nurses. Following the training session, the researcher and the nurses carried out the study.

Table 1
The demographic characteristics of the treatment and control groups.

	Treatment group ($n = 30$)	Control group ($n = 30$)	Statistical analysis
Age group (%)			
18–44	10 (33.3)	7 (23.3)	$x^2 = 2.689$; $P = 0.442$
45–59	12 (40.0)	14 (46.7)	
60 and over	8 (26.7)	13 (43.3)	
Sex (%)			
Female	19 (63.3)	16 (53.3)	$x^2 = 0.601$; $P = 0.300$
Male	11 (36.7)	14 (46.7)	
Chronic medical condition (%)			
With	18 (60)	16 (46.7)	$x^2 = 6.15$; $P = 0.522$
Without	12 (40)	14 (53.3)	
Body mass index (mean ± SD)	26.81 ± 6.10	25.77 ± 5.41	$t = 0.70$; $P = 0.488$

2.4. Study protocol

Venous catheterisation was carried out on the patients in the treatment group using a portable ultrasound device (SonoSite Micromaxx Portable Ultrasound Device with a 13.5 MHz surface probe) and 20 gauge intravenous catheter. Data were collected using the dynamic approach technique. The dynamic approach technique is one of the ultrasound guided peripheral IV access techniques and can be applied by one or two operators (Crowley et al., 2012; Yavaşi and Akarca, 2010). In the two operator technique a person controls the probe and the other person performs the catheterisation on the vein. In the one operator technique that we used in our study, a person controls the probe and at the same time performs the catheterisation. The steps in peripheral IV catheterisation by the traditional method and using ultrasound are set out below (Potter and Perry, 1997; Yavaşi and Akarca, 2010). (Table 2).

2.5. Measurements

A case report form and a visual analogue scale (VAS) were used in collecting data. The case report form was developed in line with the relevant literature (Aponte and Acosta, 2007; Bauman et al., 2009; Costantino et al., 2005; Crowley et al., 2012) and contained questions to determine patients' age, sex, body mass index and chronic conditions. In addition, a record was made on the case report form of information relevant to the method of catheterisation used, state of complications during catheterisation, the success of catheterisation (success criteria: aspiration of at least 5 mL of blood after the catheterisation and 5 mL of saline solution being given without leakage) (Potter and Perry, 1997) and the level of pain felt by the patient during the operation. Previous to the peripheral venous catheterisation procedure, information was given to the patients in the control and treatment groups on the use of the VAS (0 cm: no pain to 10 cm: the worst imaginable pain) (Aslan, 2002; Collins et al., 1997). Pain evaluation was performed in the study immediately after the peripheral venous catheterisation, and the numerical value equivalent to the point indicated on the scale by the patient was recorded on the case report form.

2.6. Data analysis procedures

Statistical Package for Social Sciences (SPSS) version 16.0 for Windows (SPSS Inc., Chicago, IL, USA) was used in the evaluation of the data obtained. The analysis of patients' identifying characteristics was performed using numerical and percentage values and arithmetic means; numerical and percentage values were used in determining the success rate of the method used, and arithmetic mean was used to assess the severity of pain felt by patients. The chi-squared (χ^2) test was used to determine differences between groups by age, sex, body mass index and chronic medical condition variables. Also, the chi-squared (χ^2) test was used to determine differences between control and treatment groups in terms of success rate, first attempt success rate and state of complication. The Student t-test was used to determine differences between control and treatment group in terms of average number of attempts and pain

Forbidden

You don't have permission to access this resource.
