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Patient experiences with peripherally inserted venous catheters— A cross-sectional, multicentre study in Norway

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Abstract

Aim: To investigate patient experiences with peripherally inserted venous catheters, namely PICC lines and Midlines, as well as the influence of socio-demographic variables, length of stay, comorbidity and complications on these experiences.

Design: The study had a descriptive, multicentre, cross-sectional design.

Methods: We used a questionnaire to investigate patient experiences ($N = 359$).

Results: Patients experiences were not optimal on each of the items in the questionnaire. Nevertheless, few respondents would have preferred a traditional peripheral venous catheter instead. Moreover, free-text answers indicated that patients were very satisfied with their catheter. Results also indicate that the hospitals have different approach when selecting a PICC line or a Midline as route of choice. The only factor associated with patient experiences was “complications.”

Conclusion: Even though patients reported of several disadvantages with the PICC line/Midline, findings indicate that they would have chosen this again. PICC lines and Midlines are beneficial from the patients' perspective, even though they have disadvantages.

KEYWORDS

Midline, nurses, nursing, patient experiences, PICC line, venous catheter

1 | INTRODUCTION

Due to demographic changes, the demand for healthcare services is increasing. Nevertheless, the hospital length of stay is decreasing. As a consequence, both hospitalized and discharged patients have more comorbidities and are sicker, and patients also receive medical treatment outside hospitals (Alper, O'Malley, & Greenwald, 2017; St Sauver et al., 2015).

Most often, intravenous (IV) access is obtained to provide therapies that cannot be administered or are less effective if

given by alternative routes. Peripheral IV catheters has been the traditional choice, allowing for the safe infusion of medications, fluids, blood products and nutritional supplements (Frank, 2018). The duration of catheterization has been considered an important risk factor for infection with venous catheters. In general, replacement of catheters is favoured when clinically indicated rather than routine catheter replacement. Nevertheless, peripheral catheters are recommended for an interval of no more than 3–4 days (Jacob & Gaynes, 2019). Such short interval limits the patients' opportunity to receive intravenous treatment outside hospitals.

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Discomfort due to repeated insertion and increased costs complicates out-of-hospital intravenous treatment (Cheung, Baerlocher, Asch, & Myers, 2009). Hence, patients often need central venous access for long-term intravenous therapy.

1.1 | Background

Central venous access devices are generally classified based on duration of catheter use (short-term, mid-term, long-term), type of insertion (central, peripheral), location of insertion (jugular, brachial), number of lumens (single, double, triple), and whether the catheter is implanted or not (Chopra, 2019). Peripherally inserted central catheters (PICCs) are gaining in popularity due to the relative ease of insertion into the peripheral veins of the upper extremity (brachial, cephalic, basilic) and may be left in place for 1 year or more (Biffi, 2014; Chopra, 2019; Hughes, Cantwell, & Waybill, 2014). Midline catheters are peripherally inserted and terminate three to eight inches from the insertion site. Such catheters have been adopted alongside PICCs. They may be left in place from weeks to months, even though they may need to be replaced every 28–30 days or earlier if any complication (Jacob & Gaynes, 2019). In Norway, PICCs and Midlines are inserted ultrasound-guided, and their placement is verified with either ECG or X-ray (Greca, 2014). Complications related to PICCs and Midlines are, for example, deep venous thrombosis and infections (Chopra et al., 2013; Clemence & Maneval, 2014; Maki, Kluger, & Crnich, 2006; Nolan, Yadav, Cawcutt, & Cartin-Ceba, 2016).

Several studies and reports have emphasized the importance of obtaining patient experiences for evaluating the quality of health services (Garratt, Sullivan, & Danielsen, 2008; Murray & Frenk, 2000; OECD, 2013; Skudal et al., 2012). Patient experiences add a different aspect to quality indicators and clinical outcomes in health care (such as infection rates) (Frank, 2018; Miles & Asbridge, 2016). Several studies exploring oncological patients' experiences with PICCs have indicated high satisfaction (Molloy, Smith, & Aitchison, 2008; Oakley, Wright, & Ream, 2000; Park, Jun, & Oh, 2015). Moreover, studies emphasize the importance of information and education to both patients and health-care personnel about the catheter prior to discharge (Edström, Lindqvist, & Rosengren, 2015; Oakley et al., 2000; Sharp et al., 2014). A systematic review from 2017 describes high patient satisfaction due to an experienced freedom related to daily activities and an increased sense of self-control (Mitchell et al., 2017). Recent research mainly focuses on specific patient categories. Consequently, further studies on patient experiences in a wider patient population have been recommended (Mitchell et al., 2017; Nicholson & Davies, 2013).

IV antibiotics are one of the most common treatment strategies worldwide (Barr, Semple, & Seaton, 2012; Ho, Archuleta, Sulaiman, & Fisher, 2010). We have not been able to identify studies on patient experiences with venous catheters, as well as factors associated with these experiences, in a wider population.

2 | AIM

The aim of this study was to investigate patient experiences with PICCs and Midlines, as well as to investigate the influence of socio-demographic variables, variables retrieved from the patients' medical journal (height, weight, catheter arm and eventual complications), length of stay and comorbidity on these experiences.

3 | METHODS

3.1 | Design

The study had a descriptive, quantitative, multicentre design, using a questionnaire to investigate patient experiences (Polit & Beck, 2014).

3.2 | Setting and participants

The study was conducted in three hospitals in south-eastern Norway. In the current hospitals, PICCs and Midlines are inserted by nurse anaesthetists and anaesthesiologists in dedicated rooms nearby the surgical ward or in the postanaesthesia care unit. Catheters may also be inserted bedside when needed. Hospital 1 has a catchment area of 455,000 inhabitants, and in 2016, 377 catheters were inserted. Hospital 2 covers an area of 188,000 inhabitants, and in 2016, 96 catheters were inserted. Hospital 3 covers an area of 290,000 inhabitants, and 350 catheters were inserted in 2016.

A statistician was contacted to conduct sample size calculations to be able to detect significant associations between patient experiences and gender, age, height, weight, comorbidity, length of stay, primary diagnosis and primary treatment strategy and to be able to detect significant differences between hospitals. No total score for the questionnaire exists; hence, we could not calculate sample size. Earlier studies focusing on PICC-related complications have included 60–438 participants (Krein et al., 2018; Periard et al., 2008). In agreement with the statistician, we aimed at including approximately 300 patients in our study.

A non-random, consecutive selection strategy was used. In the period June 2017–December 2018, all patients who received either a PICC or a Midline in each of the three hospitals, who fulfilled the inclusion criteria, were invited to participate. Inclusion criteria were patients 18 years or above, who were able to provide oral and written consent to participate and with sufficient Norwegian skills to understand and respond to the questionnaire.

3.3 | The questionnaire

A questionnaire translated to Swedish by Edström et al. (2015), based on a questionnaire developed by Johansson, Engervall,

Bjorvell, Hast, and Bjorkholm (2009), was used. After obtaining permission to use and modify this, the questionnaire was translated from Swedish to Norwegian using forward-and-back translation according to Brislin (1970). Two professional bilingual translators with Norwegian as their mother tongue performed two independent translations into Norwegian. After comparing the translations and synthesizing these into one, the questionnaire underwent a backward translation to Swedish by a translator with Swedish as her mother tongue. Finally, four nurse anaesthetists evaluated the questionnaire by comparing both the Swedish, English and Norwegian versions with regard to semantic, idiomatic, experiential and conceptual equivalence.

Following this procedure, the questionnaire underwent testing of face validity. This was done by distributing the questionnaire to 10 nurse anaesthetists prior to the study period to assess the adequacy, appropriateness and understandability of the questionnaire, including language and scoring instructions. Feedback did not reveal any problematic issues in any of these aspects.

The questionnaire consists of a total of 20 questions including four dimensions: information, discomfort, anxiety and restrictions in daily life. Each question had four response alternatives (totally disagree-disagree-agree-totally agree or reversed; totally agree-agree-disagree-totally disagree). Moreover, all questions had the opportunity to add comments. In addition, the questionnaire included the socio-demographics gender, age, primary diagnosis and primary treatment strategy.

3.4 | Additional variables

Comorbidity was calculated using the "Charlson comorbidity score" (Charlson, Pompei, Ales, & MacKenzie, 1987), obtained from the Norwegian Patient Register (NPR). Moreover, data were retrieved from the participants' medical journal (height, weight, length of stay, catheter arm, PICC or Midline, registered complications).

3.5 | Procedure

All catheters were inserted by a nurse anaesthetists specifically trained in PICC and Midline insertion. The catheters were inserted with maximal barrier precautions and skin antiseptics with 0.5% chlorhexidine, using ultrasound-guided venipuncture of the upper midarm and sutureless devices for securing the catheter. The appropriate central position of the catheter tip was verified either by the intracavitary electrocardiography (EKG) method during the procedure or by chest X-ray after the procedure.

The nurse anaesthetist who inserted the catheter provided information and inclusion of patients in relation to the procedure. Patients who consented to participate received a questionnaire and a pre-stamped envelope at discharge. The patients were instructed to fill out the questionnaire 2 weeks after the PICC

line was inserted, in-line with recommendations in the literature (Bjertnaes, 2012) and return this to the first authors' office address.

3.6 | Analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS) (IBM Corporation, 2017). Descriptive statistics and frequencies were used to describe the respondents' socio-demographics. One-way analysis of variance (ANOVA) was used to assess differences between hospitals. *T* test was used to compare non-responders and responders regarding gender and age. The mean scoring at each questionnaire item was estimated by a logistic regression model that used socio-demographic variables (gender, age, height, weight), length of stay, CCIS, primary diagnosis, primary treatment strategy, type of catheter (PICC/Midline) and length of stay as independent variables and patient experiences as dependent variables. Insignificant variables were removed from the model one at a time until only significant effects remained. Missing items were not included in the analysis. All tests were two-sided and used a significance level of 0.05.

The free-text comments were analysed through a simple thematic analysis inspired by Braun and Clarke (2006), in four steps: (1) familiarization with data; (2) initial coding; (3) identifying themes; and (4) naming overarching themes.

3.7 | Ethics

Approval was collected from Regional committees for health care and medical research ethics in Norway, as well as the Norwegian Centre for Research Data. The study was conducted in line with research ethical guidelines in the Declaration of Helsinki (WMA, 2015). Written informed consent was obtained from all of the study participants. The study conforms to the ICMJE requirements and coheres to the Revised Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0) (Appendix S1). The researchers are all nurse anaesthetists, three of them trained in catheter insertion.

4 | RESULTS

In the current study, Cronbachs' alpha was 0.7, which is acceptable. A total of 1,049 patients were invited to participate in the study, whereof 359 (34%) patients responded to the questionnaire 2 weeks after insertion of the catheter. Of these, 52.2% were male, mean age was 62.4 years and mean length of stay was 14 days. PICCs represented 67.5% of the catheters. Non-responders were 50% male, and mean age was 68.3 ($SD = 31.2$). There were significant differences between responders and non-responders age ($p < .01$). Table 1 gives an overview of responders' socio-demographics.

TABLE 1 Descriptives of respondents 2 weeks after insertion of catheter

	Hospital 1 (N = 54)	Hospital 2 (N = 88)	Hospital 3 (N = 216)	p-value
Male (%)	53	50.6	52.8	.85
Still hospitalized	75.5	28.9	23.7	<.01*
Still have the catheter	79.6	45.2	72.9	<.01*
Age, mean (SD)	62.3 (13.9)	59.6 (16.9)	63.5 (14.2)	.12
Age, range	26–83	21–91	19–91	
CCI	3.4 (2.0)	1.9 (1.1)	2.9 (1.7)	<.01*
Height, cm	173.3 (9.7)	173.4 (9.0)	172.5 (8.4)	.72
Weight, kg	77.9 (25.9)	76.3 (18.7)	78.6 (25.4)	.81
Length of stay, days	20.3 (14.7)	12.7 (12.2)	13.2 (12.3)	<.01*
Primary diagnosis				.86
Infection	32.7	72.2	36.2	
Cancer	30.6	2.5	38.7	
Pneumonia	2		0.5	
Gastrointestinal disease	16.3	3.8	3.0	
Cardiac disease	4.1	2.5	2.5	
Malnutrition	4.1	-	0.5	
Hyperemesis		5.1		
Primary treatment				.85
Antibiotics	44	81	49.8	
Analgesics	2	1.2	3.4	
Nutrition	16	4.8	9.3	
Fluids	2	6.0	9.8	
Medication	18	7.1	7.8	
Cytostatics	14	-	13.2	
Blood sampling	-	-	3.9	
Right arm	92.6	89.3	30	.68
Complications				.86
Leakage	3.7		6.6	
Occlusion	16.7		1.1	
Infection	1.9		1.1	
Read/tender	1.9		0.5	
Thrombosis		1.4	2.2	

Note: Numbers in per cent. SD = standard deviation. Age = in years. CCI = Charlson comorbidity score. One-way analysis of variance.

*p-value < .05 = significant.

Table 1 shows that significantly more patients were still hospitalized after 2 weeks in hospital 1. Patients in this hospital also had significantly higher comorbidity. There were no significant differences between hospitals regarding gender, age, primary diagnosis or treatment.

4.1 | Patient experiences with PICCs and Midlines

There were significant differences between hospitals on several of the items in the questionnaire. Table 2 gives an overview of responders' mean scoring, where 5 is the most positive response. In item

1–3 + 7, 5 equals to “totally agree,” while in item 4–20, 5 equals to “totally disagree,” since these items are negatively loaded. All items indicate quality improvement potentials.

4.2 | Factors influencing the experiences

Only one of the independent variables made a unique statistically significant contribution to the model, namely “complications” (Table 3). Gender, age, height, weight, length of stay, CCIS, primary diagnosis, primary treatment strategy, type of catheter (PICC/

Item	Hospital 1 (N = 54)	Hospital 2 (N = 88)	Hospital 3 (N = 216)	p-value
1. Satisfied with information in front	3.26 (1.1)	3.6 (0.9)	3.7 (0.8)	.01
2. I know why I got the catheter	3.6 (0.9)	3.9 (0.6)	3.8 (0.6)	.03
3. I forget that I have the catheter	3.2 (0.9)	2.8 (1.1)	3.1 (0.9)	.12
7. I would have preferred a PVC	1.8 (1.3)	1.1 (0.5)	1.4 (0.9)	<.001*

Responses to the items in the questionnaire, mean values. 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

	Hospital 1 (N = 54)	Hospital 2 (N = 88)	Hospital 3 (N = 216)	p-value
4. Discomfort during insertion	3.3 (0.8)	3.6 (0.6)	3.5 (0.7)	.12
5. Discomfort when coverings are changed	3.7 (0.6)	3.9 (0.6)	3.7 (0.6)	.02*
6. Discomfort under administration	3.8 (0.5)	3.9 (0.2)	3.9 (0.4)	.20
8. The catheter is uncomfortable	3.1 (1.3)	3.6 (0.6)	3.5 (0.8)	<.001*
9. It is tender	3.7 (0.5)	3.7 (0.6)	3.7 (0.5)	.77
10. It itches	3.7 (0.5)	3.5 (0.7)	3.6 (0.6)	.08
11. Worried that it might dislocate	3.4 (0.6)	3.7 (0.5)	3.6 (0.7)	.01*
12. Worried when I sleep	3.7 (0.5)	3.8 (0.4)	3.7 (0.5)	.30
13. Worried when someone hugs me	3.8 (0.4)	3.9 (0.3)	3.8 (0.4)	.01*
14. Worried that it might get infected	3.6 (0.7)	3.6 (0.6)	3.4 (0.7)	.05
15. My family worries	3.8 (0.5)	3.8 (0.5)	3.8 (0.4)	.72
16. Trouble when showering	3.5 (0.5)	2.9 (0.8)	3.2 (0.7)	<.001*
17. Trouble when training	4.2 (0.9)	4.3 (1.0)	4.5 (0.9)	.02*
18. Trouble when moving my arms	3.9 (0.7)	3.7 (0.6)	3.7 (0.6)	.22
19. Trouble getting dressed	3.5 (0.5)	3.3 (0.7)	3.5 (0.6)	.01*
20. Having a catheter limits my daily life	3.0 (1.5)	4.2 (1.5)	3.6 (1.7)	<.01*

Note: Responses to the items in the questionnaire, mean values. 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree.

One-way analysis of variance.

*p-values < .05 = significant.

TABLE 3 Significant result from the linear regression model

	Wilks' lambda	p-value	F
Complications	0.71	<.01	2.58

Midline), catheter arm and length of stay did not have any impact on patients' experiences with their catheter.

4.3 | Comments

Through thematic analysis of the free-text comments, we identified five themes: (1) the best that has happened to me; (2) total disaster; (3) challenging areas; (4) information; and (5) healthcare personnel competence. Since comments were short and only written text, it did not allow for a thorough analysis of the contents. Nevertheless, comments complemented the structured answers to the questionnaire items. Table 4 gives some examples of comments collated under the five themes.

TABLE 2 Overview of responses to the questionnaire items

5 | DISCUSSION

This study is the first to investigate patient experiences with PICCs and Midlines, as well as predictors to such experiences, in a wider population. Results give insight into areas that need emphasis to ensure that patients have positive experiences and feel safe and to prevent complications.

Our findings indicate that hospitals have different approach when selecting a PICC or a Midline as route of choice. For example in hospital 1, most patients were still hospitalized and with higher comorbidities than in the two other hospitals. Moreover, both primary diagnosis and primary treatment strategy leading to catheter insertion varied between hospitals. A working group comprising members from professional organizations representing the disciplines of critical care medicine, infectious diseases, healthcare infection control, surgery, anaesthesiology, interventional radiology, pulmonary medicine, paediatric medicine and nursing has developed guidelines for preventing catheter-related infection, which include selection of catheter types and cites (O'Grady et al., 2011). Following an evidence-based guideline

TABLE 4 Examples of free-text comments, collated under the five themes identified

The best that has happened to me	Total disaster	Challenging areas	Information	Healthcare personnel competence
Absolutely fantastic experience	The shit never worked	They were not able to withdraw blood samples	I did not get any information in front of the insertion (in the ward)	The catheter got occluded due to lack of flushing
My PICC has saved me from a lot of discomfort	The PICC got infected	The area was red and tender a few days after insertion	They told me what it was and how to use it before the insertion (in the ward)	Nurses have different approach to an aseptic procedure and that worried me
I am relieved from the many pin-pricks several times a day	It got stuck to everything	The skin around it itches	It was the home nurses who told me about the advantages of having a PICC	At the ward, they lack training in this
I am going to ask for a Midline the next time!	A thrombosis around the catheter was detected—I could have been without that	I find it challenging to shower	I got good information before the procedure (at insertion)	Not everyone followed the procedure (in the ward)
Less unpleasant insertion process than regular cannulas	I am afraid that it may be occluded or dislocate	I really missed not being able to take a swim in the ocean	They comforted me during the procedure and gave the information I needed (at insertion)	The nurses at the ward seemed unsecure when handling my catheter
My daily life has gotten easier	I was not prepared that it forces me to stay at home due to the changing process		They had to try several times before they succeeded, they could have prepared me for that	I had to remind them to flush myself
Because of the PICC, I am allowed to stay at home			I felt taken cared of and safe	
A great relief!				
Earlier, I needed 8–10 venous cannulas each treatment—now, I have my Midline				

when approaching patients that need venous access for longer intervals could lead to a more sufficient approach to access route for different patients, conditions and treatment strategies.

Results give insight into areas that need emphasis to improve quality through increasing patient experience. All items were rated far below the “top score.” Nevertheless, few respondents would have preferred an ordinary peripheral venous catheter instead. The disadvantages with having a PICC from the patients perspective are supported by several other studies (Edström et al., 2015; Harrold, Martin, & Scarlett, 2016; Oakley et al., 2000; Paras-Bravo, Paz-Zulueta, & Santibanez, 2018; Park et al., 2015). Nevertheless, these studies focus on cancer patients. The comments added some further information that support earlier research indicating patient satisfaction with their PICC (Edström et al., 2015; Nicholson & Davies, 2013; Paras-Bravo et al., 2018); patients appreciated not having to insert new catheters every 2–3 days and that the PICC/Midline allowed them to stay at home rather than in hospital. Our findings also support that both patients and healthcare personnel need good information about the catheter (Harrold et al., 2016; Krein et al., 2018). Despite growing use, little is known about how such catheters influence quality of life and activities of daily living (Mayer, 2017; Paras-Bravo et al., 2018; Sharp et al., 2014).

On the other hand, the experience is substantially less positive for those who experience a PICC-related complication (Krein et al., 2018), which also appears in the comments in our study. Even though we did not aim at exploring the incidence of complications and hence did not have objective measures for example infection or thrombosis, we could identify registrations in the patients' medical journal. Complications associated with PICCs include local bleeding, improper placement, pneumothorax and skin damage (Edström et al., 2015; Johansson, Hammarskjöld, Lundberg, & Arnlind, 2013).

Christensen et al. (2016) concluded that PICCs lead to a decreased risk for infections compared with a Hickman catheter. Chopra et al. (2013) conclude in their review that even though PICCs are associated with increased risk of infections compared with other central venous catheters, this should be evaluated in-line with the many advantages. Moreover, there is no consensus on whether PICCs/Midlines lead to more infections or not (Periard et al., 2008; Turcotte, Dube, & Beauchamp, 2006). In addition, bothersome complications from the patient perspective are more common than those that typically rise to the level of healthcare provider attention or concern. Hence, understanding the patient experience is critical for providing safe and effective care (Krein et al., 2018).

Irrespective of how uncomfortable the patient found the procedure or the catheter, most patients would have chosen this again. This is supported by a study, showing that patients recommend proactive PICC insertion to other patients (Harrold et al., 2016). Hence, nurses should involve patients in clinical decision-making and provide individualized information and support that facilitates adaptation for patients living with a PICC (or a Midline) (Sharp et al., 2014).

5.1 | Limitations

Our study has several limitations. First, our assessment of patient experiences primarily relied on patients answering a structured set of questions. Another approach, such as qualitative interviews, may have provided more in-depth insight into patients' experiences. Nevertheless, we included patients from three different hospitals, within a range in gender, age, comorbid conditions and primary diagnosis that make our findings valid in a wider population.

Second, the selection of patients invited may have been skewed, since not all patients that fulfilled the inclusion criteria were invited to participate. The nurse anaesthetists reported that many patients were somnolent, terminally ill or in a very vulnerable situation; hence, they did not invite them at all. In retrospect, invitation to participate may have been provided after patients had returned to their home. Moreover, we could have used another sampling method, for example purposive or strategic. Comparison of responders to non-responders showed that non-responders were significantly older than responders, which may also have affected to results. Third, we did not have objective parameters to measure complications; hence, we could not add insight into incidence of catheter-related complications in our sample.

Moreover, we could have performed separate analysis of PICCs and Midlines. Nevertheless, the regression analysis found no significant associations between type of catheter and patient experiences. In addition, patients are not familiar with the differences, since PICCs and Midlines are inserted, fixated and used similarly.

To our knowledge, this is the first large-scale study focusing on patient experiences with PICCs and Midlines from a diverse sample of patients who received their catheter at different hospitals. The questionnaire had high face validity and acceptable reliability, which support the validity and reliability of our findings.

6 | CONCLUSION AND IMPLICATIONS FOR CLINICAL PRACTICE

This is the first study to investigate patient experiences and predictors with PICCs and Midlines in a wide population. Findings are sustainable and with potential to spread to other locations and geographic areas. Even though patients reported of several disadvantages with the catheter, findings indicate that they would have chosen this again. Findings provide essential information that should be included in quality improvement initiatives.

Nurses should involve patients in clinical decision-making and provide individualized information and support that facilitates adaptation for patients living with a PICC or a Midline. Further studies should focus on the interface between complications and/or disadvantages and patient satisfaction, as well as on shared decision-making when selecting access route.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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