

RESEARCH INTO PAIN PERCEPTION WITH ARTERIOVENOUS FISTULA (AVF) CANNULATION

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SUMMARY

Patients with end-stage renal failure (ESRF) undergoing haemodialysis (HD) are repeatedly exposed to stress and pain from approximately 300 punctures per year to their arteriovenous fistula (AVF). Repeated AVF punctures lead to a considerable degree of pain, due to the calibre and length of the bevel of fistula needles. Pain is a sensitive, emotional and subjective experience. The objective of this study was to measure pain associated with AVF needling. The analogue visual scale (AVS) divided into 10 equal parts (0 indicating lack of pain, and 10 unbearable pain) was used. Patients' perceptions were measured in three different HD sessions. Pain was considered mild during AVF needling. The buttonhole technique caused a mean degree of pain of 2.4 (± 1.7), compared to 3.1 (± 2.3) using the conventional rope-ladder technique. Although without reaching a statistically significant difference, diminished pain was associated with the buttonhole technique.

KEY WORDS Cannulation technique • Haemodialysis • Pain assessment • Vascular access

INTRODUCTION

Patients with end-stage renal failure (ESRF) undergoing chronic haemodialysis (HD) are more frequently now starting treatment as older people, maintenance of an adequate vascular access is a major challenge for dialysis nurses. Haemodialysis treatment performed three times a week repeatedly exposes patients to stress and pain from approximately 320 punctures to their arteriovenous fistula (AVF) each year. Sometimes more than one attempt is needed to keep a blood flow of at least

300 ml/min. Repeated puncturing of the AVF leads to fear, anxiety and a considerable degree of pain. Pain can be defined as a sensitive, emotional and subjective experience, and is usually related to past experience with a given situation (Innis *et al.* 2004; Vascular Access 2006 Work Group 2006). The degree of pain can be assessed in different ways, and one of the best ways to measure it is through an analogue visual scale (AVS), which is divided into 10 equal parts (0 indicating lack of pain, and 10 unbearable pain). The most frequent cause of pain for haemodialysis patients is needling, due to the calibre and length of the bevel of fistula needles. The pain perceived during cannulation has an impact on the quality of life of these patients.

BIODATA

Ana Figueiredo is a Professor at the Nursing School of PUCRS, and has been working as a Nephrology Nurse since 1985 in all aspects of this specialist area. She is Chair of the Nursing Liaison Committee of the International Society of Peritoneal Dialysis and Past-President of the Brazilian Nephrology Nursing Society.



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LITERATURE REVIEW

Patients rank pain during needle insertion as the most common problem regarding dialysis vascular access (Bay *et al.* 1998), and few studies have examined this issue. The buttonhole technique is an alternative that may reduce pain and facilitate fistula cannulation. No published study has refuted the superiority of the buttonhole technique over the rope-ladder technique, but despite that, the buttonhole method has not gained widespread acceptance (Twardowski 2007). Verhallen *et al.* (2007) described decreased pain at six weeks and three months, with the buttonhole technique in comparison with the rope-ladder technique. The paper by Verhallen *et al.* (2007) was discussed in an EDTA-ERCA Journal Club by 23 expert

contributors from 13 different countries, and all contributors who had introduced the buttonhole technique for patients with native AVF had found benefits for patients in terms of reduced pain (Murcutt 2008). In a recent commentary on the same paper, Twardowski (2007) recalls aspects of the technique he originally introduced as a ‘constant site needle insertion method’ in his 1977 report. As mentioned, the term buttonhole (and rope–ladder) techniques were only introduced by Georg Krönung in 1984 and both techniques were initially compared in 1979, with the results favouring the buttonhole method. Ball (2006) in a patient survey showed that 70% of patients experience less pain with the buttonhole technique (Ball 2006). Toma *et al.* (2003) developed a method to create a fixed puncture route for the buttonhole technique. In their evaluation 40.5% of patients replied that there was significant pain at the time of puncture by the conventional method they had used before the study, but none with the buttonhole technique. The same percentage of these patients replied that the pain with the buttonhole technique was less than with the conventional method. The remaining patients experienced the same mild pain with either approach. No patient found the pain with the buttonhole technique to be greater than they had experienced with the conventional technique before the study (Toma *et al.* 2003). Marticorena *et al.* (2006) evaluated a modified buttonhole (BH) cannulation technique in 14 chronic haemodialysis (HD) patients with problematic fistulae showing reduced cannulation pain scores.

The objective of this study was to measure pain associated with AVF needling.

METHODS

A descriptive and prospective study, was performed during the first semester of 2007 at the Haemodialysis Unit at *Hospital São Lucas from Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS)*, a University Hospital in Porto Alegre, Brazil. Haemodialysis patients who had been on treatment for more than three months, older than 18 years and with a native AVF in use for at least one month were invited to participate. Patients’ perceptions were measured with an AVS divided into 10 equal parts (0 indicating lack of pain, and 10 unbearable pain) using the mean degree of three different HD sessions. Questions about pain were asked by a nurse directly after cannulation which had been performed by another staff nurse. Descriptive analysis and Student’s t-test were used for statistical

analysis. All patients gave informed consent and the study was approved by the University Scientific and Ethics Committee.

RESULTS

During the period of the study, 70 patients were on haemodialysis treatment, and 50 had a native AVF. Forty-seven (94%) patients accepted to take part in the study. Overall clinical characteristics are shown in Table 1. Mean age was 57.3 (±14) years, and 29 (62%) were female. AVF had been in use for a median time of 14 months (range 10–36 months). The preferred site for AVF was the left arm in 33 (70%) patients and the right arm in 14 (30%). Twenty-one (45%) patients had a previous failed AVF. Hypertensive nephropathy and diabetes were the most frequent causes of end-stage renal disease in 43% and 37% of the patients, respectively.

| Variable | | Summary |
|-----------------------|----------------|------------|
| Age (years) | Mean + SD | 57.3 + 14 |
| Female gender | N (%) | 29 (62%) |
| Time of AVF (months) | Median (range) | 14 (10–36) |
| Left AVF | N (%) | 33(70) |
| Previous AVF | N (%) | 21 (45) |
| Cannulation technique | N (%) | |
| Buttonhole | | 19 (40) |
| Rope-ladder | | 28 (60) |
| Pain degree | Mean + SD | |
| Overall | | 2.7 ± 1.9 |
| Buttonhole | | 2.4 ± 1.7 |
| Rope-ladder | | 3.1 ± 2.3 |
| Male | | 2.4 ± 1.6 |
| Female | | 2.8 ± 2.1 |
| Arterial needle | | 2.6 ± 2.0 |
| Venous needle | | 2.8 ± 2.0 |

Table 1: Clinical characteristics (n: 47).

The buttonhole technique for cannulation was used in 19 (40%) patients, and 28 (60%) used the conventional rope–ladder technique.

When the arterial and venous needle was rated for each patient independently of the cannulation technique, the mean degree of pain was 2.7 (±1.9). The mean degree of pain was 2.8 (±2.1) in women, slightly higher than in men with mean

scores of 2.4 (± 1.6), although no significant statistical difference was detected ($p = 0.324$). When pain from arterial and venous needling was analysed, mean scores of 2.8 (± 2.0) and 2.6 (± 2.0) at the venous and arterial sites, respectively, were disclosed ($p = 0.589$).

The buttonhole technique caused a mean degree of pain of 2.4 (± 1.7), compared to 3.08 (± 2.28) using the conventional rope-ladder technique ($p = 0.128$).

DISCUSSION

Pain perceived during cannulation remains an unsolved issue for the dialysis team. Nurses need to try different strategies to minimize patients' pain during cannulation. The pain inflicted by needling is intermittent (usually three times/week), so it is not considered to be chronic (Brattberg *et al.* 1989; Kreling *et al.* 2006).

Birse and Lander (1998) reported the prevalence of chronic pain in a general population as 11–17%, considering the presence of pain or discomfort in the last weeks. Brattberg *et al.* (1989) considered chronic pain when it occurred for as long as six months, and reported a prevalence of 40%. There is great discrepancy between studies assessing pain, due to the different instruments used to measure it, and to the fact that it is a subjective feeling that can only be judged by the patient him/herself (Birse & Lander 1998). In a study evaluating patient satisfaction with pain management in an Internal Medicine Unit, mean pain scores have oscillated between 3.36, at the moment of assessment, to 5.82, as the worst pain in the last 24 hours (Innis *et al.* 2004).

In the present study, despite no statistical significance, women presented higher degree of pain in comparison to men. This is in accordance with other studies in which men and woman had similar degrees of chronic pain, although women felt more pain more often. The meaning of pain for men and women can be influenced by social and cultural aspects, and it is usual for women to express their feelings with more ease, while men are discouraged to express such feelings that could be interpreted as weakness or lack of virility (Verhaak *et al.* 1998; Innis *et al.* 2004). Biological factors can influence the intensity of pain, such as the increased sensitivity in women during the menstrual period. Another study from Sweden did not report difference in pain between males and females (Brattberg *et al.* 1989).

Previous studies in literature that specifically evaluate pain during AVF needling are rare (Crespo *et al.* 1994; Ball 2006; Verhallen *et al.* 2007). A study by Crespo *et al.* (2004) compared pain during cannulation when the bevel was inserted downwards or upwards, and less pain was reported with the bevel directed downwards, as it causes less tissue damage. A recent study from the Netherlands compared aspects of self-cannulation between the buttonhole and rope-ladder techniques (Verhallen *et al.* 2007). Decreased pain was experienced at six weeks and three months, but this effect was not consistent in the months thereafter. The average pain score using the buttonhole method was somewhat, but not significantly, less, compared with the rope-ladder method. A patient survey assessing patient satisfaction with the buttonhole technique showed that 70% of patients experience less pain (Ball 2006).

In this study, no significant difference between pain during arterial or venous needling was detected. It is still not clear if there is a difference between pain from the first needle inserted in comparison to the second one. It can be speculated that the second cannulation may cause further apprehension and fear, increasing the perception of pain, rather than the pain itself.

The buttonhole technique started to be used in the seventies, and it was suggested to be more comfortable and less painful for patients. Despite not showing statistical difference this data suggested a reduction in pain with the buttonhole technique, which seems to be clinically relevant. The creation of a subcutaneous tunnel leaves needling easier, with less chance of mistakes (Ball 2006; Ball *et al.* 2007; Verhallen *et al.* 2007).

One strategy that can be used by nurses is by the nurses being more positive when they approach the patients before needling. Using more positive language might help; for example saying to patients: 'I am going to start your dialysis' instead 'I will be sticking your needles'. Nurses have to bear in mind that pain can be influenced by different factors and talking to patients, trying to identify the source of the pain can be the first step to decreasing the perceived pain.

CONCLUSION

The degree of pain reported by patients during haemodialysis AVF needling can be considered mild. The buttonhole

technique seems to be less painful in comparison to the conventional rope-ladder technique, an apparently clinically relevant difference, despite not reaching statistically significant difference. Identifying the factors that influence the perceived pain is essential in order to be able to improve the quality of care of haemodialysis patients. Further studies are

needed to define the best needling technique for pain reduction.

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