



Cross-sectional Study

Evaluation of the pain scale during arteriovenous fistula puncture with and without lidocaine gel 2% in patients undergoing haemodialysis in Kosovo

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ABSTRACT

Aim: this study aims to evaluate the pain scale during Arteriovenous fistula (AVF) puncture in patients undergoing regular haemodialysis sessions with and without Lidocaine gel 2%.

Methods: The study is Cross-Sectional, conducted at the University Clinical Centre of Kosovo - Clinic of Nephrology and Haemodialysis in Prishtina, Regional Haemodialysis Centre in Prizren, Regional Haemodialysis Centre in Gjilan and Regional Haemodialysis Centre in Mitrovica, all in Kosovo. In this research, 616 patients were surveyed during AVF puncture and the other group of 232 patients in whom 2% Lidocaine gel was applied before puncture at the fistula puncture site.

Results: In the above mentioned centres, the total number of patients who are on dialysis through AVF is 632, of which 324 men and 308 women. 560 patients had created AVF on the left arm and 72 patients on the right arm. In our research, 616 patients were surveyed, of which 312 men and 304 women. The most affected age group was between 60 and 69. The pain scale reported during AVF puncture was moderate in 304 (49%) patients, severe in 176 patients (29%) and mild in 136 (22%) patients. After the applying of Lidocaine gel 2%, the puncture of AVF was performed, so from the total number of 232 participants, 64 (28%) of them reported moderate pain and 168 (72%) of research participants reported mild pain during puncture of AVF. In order to compare results from both groups, we have chosen a random sample from the first group during AVF puncture without Lidocaine gel 2% (234 in total from 616 patients) and compared the result with the second group during AVF puncture with Lidocaine gel 2% (232 in total).

Conclusions: The average pain scale during AVF puncture without Lidocaine gel 2% was 5.04 while the average pain scale after applied Lidocaine gel 2% was 2.61.

1. Introduction

Haemodialysis (HD) is the most common procedure used among other extra renal purification techniques [1]. The first vascular access exploited is arteriovenous fistula (AVF) [2]. Chronic renal failure is a devastating medical, social, and economic problem for both patients and their families. Haemodialysis is the most frequently used renal replacement therapy with the AVF being the gold standard for vascular access in haemodialysis patients [3]. The extracorporeal blood flow rate is achieved through venous puncture, most often via two needles, one for blood aspiration called the arterial needle, one for venous reinjection called the venous needle [4,5].

The AVF puncture in HD is a repetitive care (generally 3 times a

week, approximately 300 punctures per year), requiring a needle of large caliber to guarantee the flow of the AVF required for the efficiency during HD. The AVF puncture can be a painful experience and a source of anxiety for some patients. Pain at AVF puncture has been poorly studied, and its prevalence is variable (40%–60%) [6–8]. Many factors are associated with its intensity: mainly diameter and length of the needle [9]. The problem arises as to the management of this pain within HD patients.

Many therapies were assessed in order to lower this pain: the "Buttonhole" technique [10] and such as Lidocaine with its different presentations (gel/spray/dermic patch) [11,12] and also hypnosis [13]. However, each therapy proposed has its disadvantages: contraindications, side effects, accessibility, high financial cost, and time constraint.

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Chronic Kidney Disease (CKD) is a progressive loss of kidney function that can take months or years to develop. Each kidney consists about 1 million filtering units called nephrons. If the nephrons are damaged, they stop working. Healthy nephrons withstand an additional workload for a certain time, but if the damage continues, nephrons lose their function and at some point they can no longer filter enough blood to keep us healthy.

Arteriovenous fistula (AVF) is the best and most qualitative way of vascular access for haemodialysis. First AVF was created in 1965 Brescia, Cimino and co-workers at New York.¹ AVF is an anastomosis between an artery and a vein. The most suitable veins for anastomosis are those of the forearm and arm. It is recommended to wait 3–4 weeks before initial cannulation after AVF creation.

In this study of patients with haemodialysis who had AVF, males were the first in frequency.

Diseases such as Hypertension, Atherosclerosis and Type 2 Diabetes are the most common causes of chronic kidney disease (CKD). The epidemiological spread of these diseases increases the prevalence for CKD. Currently, the average prevalence of CKD in highly developed countries is 10–15%. The overall prevalence of CKD increases with age, the older we are, the more pronounced are the CKD. The prevalence of CKD in the Polish population over the age of 65 is 29.4% [14,15].

The number of dialysis patients continues to increase every year. Also, more patients require long-term renal replacement therapy [16]. Most patients undergo dialysis when they are diagnosed with an estimated glomerular filtration rate (eGFR) below 15 ml/min/1.73 m² and uremic symptoms, or eGFR levels of 8–10 ml/min/1.73 m² without uremic symptoms [17].

Diabetic patients begin dialysis therapy when estimated glomerular filtration rate (eGFR) drops less than 20 ml/min/1.73 m² followed by uremic symptoms or eGFR levels of 8–10 ml/min/1.73 m² without uremic symptoms [18,19]. Blood flow in AVF is on average 300–800 ml/min.

2. Aim of study

The aim of this study was to evaluate the pain scale during Arteriovenous fistula puncture in patients undergoing regular haemodialysis sessions.

This study was conducted at the University Clinical Centre of Kosovo (UCCK) - Clinic of Nephrology and Haemodialysis, Regional Haemodialysis Centre in Prizren, Regional Haemodialysis Centre in Gjilan and Regional Haemodialysis Centre in Mitrovica. In this research, 616 patients were surveyed during AVF puncture and the other group of 232 patients in whom Lidocaine gel 2% was applied before puncture in the AVF puncture site.

3. Methods

The study is Cross-Sectional study performed in line with STROCSS criteria [29]. It included all 632 patients who were on regular haemodialysis 3 times per week for 4 h, and who performed the haemodialysis session through AVF on the forearm or arm. Since the study included human participants, we have registered it in a publicly accessible database ResearchRegistry.² Sixteen (16) patients left the study and continued their haemodialysis sessions at other haemodialysis centres. Six hundred and sixteen (616) patients were surveyed for the scale pain during AVF puncture without the application of Lidocaine gel 2%, while 232 patients were surveyed after the Lidocaine gel 2% was applied. The numerical scaling of pain from 0 to 10 indicates the level of pain. Zero indicates the absence of pain, while 10 represents the worst pain

possible. Thus, scaling is: 0-zero: painless, 1–3: mild pain, 4–6: moderate pain, 7–10: severe pain. Puncture was performed with 16 GA-R25 needles - Fresenius medical care. The data were grouped by age at certain intervals, by gender and localization of AVF in the left or right arm. The operator does not need additional training to perform the procedure.

4. Results

During this research, were obtain statistical data collected at the University Clinical Centre of Kosovo - Clinic of Nephrology and Haemodialysis in Pristina, Regional Haemodialysis Centre in Prizren, Regional Haemodialysis Centre in Gjilan and Regional Haemodialysis Centre in Mitrovica. In these centres, the total number of patients who are on dialysis through AVF is 616, of which 324 men and 308 women, as presented in Table 1. From them, 560 patients had created AVF on the left arm and 72 patients on the right arm. In our research, 616 patients were surveyed, of which 312 men and 304 women. Sixteen of the other patients were from outside of Kosovo who were unable to complete the survey.

All patients who are on haemodialysis through AVF, were divided into age groups in the interval of 10, and from this classification we see that the age group with the highest frequency who receive haemodialysis through AVF was age group 60–69, represented by 212 (34%) patients, age group 50–59 with 140 (22%) patients, age group 70–79 with 116 (18%) patients, age group 40–49 with 100 (16%) patients and others as presented in Table 2.

In all patients who underwent haemodialysis, without the application of Lidocaine gel 2%, a survey was conducted to determine the scale of pain during AVF puncture. The scale of pain is divided into three categories: severe, moderate and mild. Even though, 616 patients were surveyed, we have randomly selected a representative sample, with 95% confidence level and a margin of error of 5%, resulting in total of 234 patients. This was done in order to have same number of patients in both surveyed cases, without application of Lidocaine and with application of Lidocaine. Table 3 presents the results, where most common scale of pain was moderate with 64%, followed by severe scale with 24% and then mild scale with 12%. The average pain scale calculated was 5.04.

During our research, the AVF puncture was performed after application of Lidocaine gel 2% at the AVF puncture site. The results are found as in the table below, so after application of Lidocaine gel 2%, from the total number of 232 participants, 64 (28%) of them resulted with moderate pain and with mild pain during AVF puncture resulted 168 (72%) of participants in the research. So the average pain scale after using Lidocaine gel 2% was 2.61, as presented in Table 4.

5. Discussion

Pain is one of the most frequent symptoms among HD patients: more than 60% of patients have chronic pain, with several etiologies [20]. Venepuncture is one of the most frequently performed medical procedures. Many patients on haemodialysis repetitively experience pain and anxiety related to fistula punctures [21,22]. Repeated AVF punctures lead to a considerable degree of pain, due to the caliber and length of the bevel of fistula needles [23,24]. This is probably due to the differences in pain perception by individuals. Despite the fact that some patients do not experience any pain, the significant differences between the treatment and non-treatment scores in terms of severe and moderate

Table 1

Patients who are on dialysis by gender as well as the number of patients who participated in the research.

	Patients with AVF	Patients included on research
Female	308	304
Male	324	312
Total	632	616

¹ <https://www.calvaryhospital.org/about/meet-our-team/michael-j-brescia-md/>.

² www.researchregistry.com.

Table 2

Patients who are on haemodialysis according to age groups.

Age	Number of patients	%
20–29	24	4%
30–39	32	5%
40–49	100	16%
50–59	140	22%
60–69	212	34%
70–79	116	18%
over 80	8	1%
Total	632	100

Table 3

Pain scale, (mild, moderate, severe pain) in percentage as well as the average pain in the surveyed patients without the application of Lidocaine gel 2%.

Pain during punctuation	Pain scale	Number of patients according to scale of pain	Number of patients	%	Average scale of pain
Severe	10	0	56	24%	5.03846
	9	0			
	8	12			
Moderate	7	44	150	64%	5.03846
	6	24			
	5	24			
	4	82			
Mild	3	20	28	12%	5.03846
	2	28			
	1	0			
Total	0	0	234	234	100%

Table 4

Pain scale (mild, moderate, severe pain) in percentage as well as average pain in patients surveyed after the lidocaine gel 2% was applied.

Pain during punctuation	Pain scale	Number of patients according to scale of pain	Number of patients	%	Average scale of pain
Moderate	6	0	64	28%	2.661
	5	24			
	4	40			
	3	56			
Mild	2	68	168	72%	2.661
	1	44			
	0	0			
Total		232	232	100%	

pain displays the need for analgesia in patients undergoing venipuncture for AVF cannulation.

The AVF puncture is a repetitive technical care, perceived as aggressive (two separate puncture areas needed per session, three times a week as a rule) for patients whose HD management can last for several years, or even for life. The pain induced by AVF puncture has been poorly studied, and would be mainly related to the diameter and length of needles used. Thus, the management of pain is now a recurrent and challenging problem in HD to the extent that chronic pain impairs patients' quality of life.

In this research it is seen that the most affected gender by Haemodialysis and the creation of AVF were males in 324 cases, while females in 308 cases. The most affected age group was that of 60–69 years old. The most common scale of pain during AVF punctuation without application of Lidocaine gel 2% was moderate pain in 64% patients, followed by a severe pain in 24% of patients and finally a mild pain in 12% of patients. From these data obtained, the average pain was calculated, which turned out to be 5.04. In previously conducted research, the following results were obtained for pain: moderate in

58.5% of patients, severe in 30% and mild in 11.5% [25].

In one study conducted, the result for pain intensity during puncture of AVF in no intervention state was 4.59 [26].

After the application of Lidocaine gel 2%, the puncture of AVF was done and from the number of 232 participants, 64 of them resulted with moderate pain (28%) and with mild pain during AVF puncture resulted part the largest 168 (72%) of participants in the research. So the average pain rate after using Lidocaine gel 2% was 2.61.

In one study performed with 40 patients in haemodialysis in order to evaluate pain intensity measured from puncture in AVF, 15–20 min after applied Lidocaine gel 2%, results showed that the mean pain score was 5.54 without Lidocaine gel 2% and 3.81 after applied Lidocaine gel 2% [27].

In another study the results showed that the mean pain intensity was 2.30 after applied Lidocaine gel and 3.96 using Lidocaine gel placebo. Results showed that Lidocaine gel is effective in reducing pain when the needles are inserted into vascular access [28].

One of the challenges of conducting this research was to inform patients about the use of this drug in the prevention of pain during puncture of the AV Fistula, the presence of the research team for a period of at least 10 min at the beginning of the haemodialysis session. The use of 2% lidocaine gel will be an important factor in relieving fear and pain during AV-fistula puncture. In the future we will consider investigating the correlation of the effect of AV fistula age on puncture (e.g. new AV fistula just matured compared to AV fistula which is several months or years old).

In terms of limitations or withdrawal from the study were: AV-Fistula thrombosis in some patients, thrombophlebitis although rare, AV fistula failures not well matured.

As a conclusion, venipuncture for AVF cannulation causes mild to moderate pain in a group of haemodialysis patients. Topical application of lidocaine gel before AVF puncture significantly decreased pain and anxiety among haemodialysis patients.

Please state any conflicts of interest

No conflict of interest.

Please state any sources of funding for your research

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Ethical approval

Ethical approvals obtained.

Consent

Prior to participating in the study, participants provide written approval in the form of a consent form.

Author contribution

Ibrahim Rrudhani: Conceptualization, Data curation, Formal analysis, Writing – original draft. Naim Morina: Conceptualization, Writing – original draft. Premtim Rashiti: Conceptualization, Formal analysis, Writing – original draft, Correspondence.

Registration of research studies

Name of the registry: Research Registry.

Unique Identifying number or registration ID: researchregistry7610.

Hyperlink to your specific registration (must be publicly accessible and will be checked): <https://www.researchregistry.com/browse-the-registry/#home/registrationdetails/61f900d531d22610f43ac08f/>

Guarantor

The Guarantor is the one or more people who accept full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

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