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ORIGINAL

Improvement of Arteriovenous Fistula Self-Care in Hemodialysis Patients

Mejora del Autocuidado de la Fístula Arteriovenosa en Pacientes de Hemodiálisis

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ABSTRACT

Introduction: chronic kidney disease (CKD) represents a growing public health issue that demands replacement therapies such as hemodialysis. Proper self-care of the arteriovenous fistula (AVF) is essential to maintain vascular access effectiveness and prevent complications. However, a lack of knowledge regarding self-care practices increases the risk of infections and thrombosis, compromising the continuity of treatment.
Objective: to evaluate the impact of a structured educational intervention on the level of knowledge, self-care practices, and the incidence of complications related to the arteriovenous fistula in hemodialysis patients and their primary caregivers.
Method: a quasi-experimental pretest-posttest study without a control group was conducted at the CENAG S.A. Hemodialysis Center, Ecuador. Fifty CKD patients and thirty caregivers, selected by convenience sampling, participated. The intervention included face-to-face educational sessions, adapted printed materials, and follow-up telephone calls. Statistical analysis was performed using Student's t-test for related samples, with significance established at $p<0,05$.
Results: following the intervention, the level of self-care knowledge increased from 4,5 ± 1,2 to 8,6 ± 1,0 points ($p<0,001$), adherence to self-care practices rose from 48 % to 87 % ($p<0,01$), and the identification of warning signs improved from 38 % to 85 %. The incidence of complications decreased from 32 % to 12 %, reflecting a 62 % reduction. Participants reported greater confidence and autonomy in managing their vascular access.
Conclusions: the educational intervention significantly improved knowledge, enhanced self-care practices, and reduced complications associated with AVF in hemodialysis patients. These findings underscore the importance of integrating continuous education programs as an essential component of nephrological care, particularly in resource-limited settings.

Keywords: Self Care; Arteriovenous Fistula; Renal Dialysis; Health Education; Renal Insufficiency; Chronic.

RESUMEN

Introducción: la insuficiencia renal crónica (IRC) representa un problema de salud pública creciente que demanda tratamientos sustitutivos como la hemodiálisis. El adecuado autocuidado de la fístula arteriovenosa (FAV) es esencial para mantener la efectividad del acceso vascular y prevenir complicaciones. Sin embargo,

el desconocimiento de prácticas de autocuidado incrementa riesgos como infecciones y trombosis, afectando la continuidad del tratamiento.
Objetivo: evaluar el impacto de una intervención educativa estructurada en el nivel de conocimiento, prácticas de autocuidado y la incidencia de complicaciones relacionadas con la fístula arteriovenosa en pacientes en hemodiálisis y sus cuidadores principales.
Método: se diseñó un estudio cuasi-experimental de tipo pretest-postest sin grupo control, realizado en el Centro de Hemodiálisis CENAG S.A., Ecuador. Participaron 50 pacientes con IRC y 30 cuidadores, seleccionados por conveniencia. La intervención incluyó sesiones educativas presenciales, materiales impresos adaptados y seguimiento telefónico. El análisis estadístico empleó la prueba t de Student para muestras relacionadas, con significancia establecida en $p<0,05$.
Resultados: tras la intervención, el nivel de conocimiento sobre autocuidado aumentó de 4,5 ± 1,2 a 8,6 ± 1,0 puntos ($p<0,001$), la adherencia a prácticas de autocuidado pasó de 48 % a 87 % ($p<0,01$) y la identificación de signos de alarma se incrementó de 38 % a 85 %. La incidencia de complicaciones disminuyó de 32 % a 12 %, evidenciando una reducción del 62 %. Los participantes manifestaron mayor seguridad y autonomía en el manejo de su acceso vascular.
Conclusiones: la intervención educativa mejoró significativamente los conocimientos, prácticas de autocuidado y redujo las complicaciones de la FAV en pacientes en hemodiálisis. Estos hallazgos destacan la necesidad de integrar programas de educación continua como parte esencial de la atención nefrológica, especialmente en contextos de recursos limitados.

Palabra clave: Autocuidado; Fístula Arteriovenosa; Diálisis Renal; Educación en Salud; Insuficiencia Renal Crónica.

INTRODUCTION

Chronic renal failure (CRF) is a growing public health problem characterized by the progressive and irreversible loss of kidney function, which consequently accumulates toxins and fluid in the body. In advanced stages of the disease, hemodialysis becomes a vital necessity, and arteriovenous fistula (AVF) is the vascular access of choice due to its durability and low infection rate compared to other types of access.

Despite its advantages, the success of AVF depends largely on patients' correct implementation of self-care practices. Ignorance of these practices has been documented to increase the risk of complications such as infection, thrombosis, and access failure, negatively affecting treatment continuity and quality of life.

The need to design an educational intervention for AVF self-care arises from the evidence that insufficient knowledge of preventive practices increases complications in hemodialysis patients. Structured educational sessions adapted to the socio-cultural and literacy characteristics of the patients were assumed to improve adherence to self-care practices and decrease the incidence of infections and thrombosis.

The theoretical underpinning of this strategy was based on Orem's self-care model and the World Health Organisation's 2021 recommendations, which emphasize the importance of patient empowerment for sustainable outcomes. Combining visual methods, practical demonstrations, and active follow-up has been identified as a pragmatic approach to reinforcing learning and overcoming barriers to understanding.

The theoretical underpinning of this strategy was Dorothea Orem's self-care model, a widely recognized theory in the nursing discipline. According to Orem, self-care is defined as the practice of activities that individuals initiate and carry out for themselves to maintain life, health, and well-being. His model states that when a person faces limitations in their capacity for self-care, a demand for therapeutic self-care is generated, which can be met through educational interventions that strengthen their competencies.

Self-care is crucial for hemodialysis patients with arteriovenous fistulas to prevent complications such as infection and thrombosis. Orem's Self-Care Deficit Theory provides the ideal framework for intervention, as it identifies when patients need support and education to meet their health needs autonomously.

Applying this model in the present linkage project allowed the design of educational strategies focused on fostering the knowledge, practical skills, and motivation of patients and their caregivers. Emphasis was placed on strengthening patients' self-care agency, i.e., their ability to actively and responsibly assume the actions necessary for maintaining vascular access and preventing complications.

By integrating principles of Orem's theory with the World Health Organisation's recommendations on health education, the aim was to convey information and empower patients as key actors in preserving their health and optimizing hemodialysis treatment outcomes.

Recent literature supports the effectiveness of educational programs in improving AVF care. Studies have shown that educational interventions increase patient knowledge and reduce complication rates by up to 50 %. Furthermore, health education has been shown to promote early detection of warning signs and encourage

proper hygiene practices, which are crucial factors in preventing adverse events.

Given the limited human and material resources for ongoing training, improving health education for hemodialysis patients is even more pressing in Ecuador. In response to this situation, the linkage project 'Self-care and Protection of the Arteriovenous Fistula for CKD Patients and Caregivers at the CENAG S.A. Haemodialysis Centre' was developed to improve knowledge, promote safe self-care practices, and reduce complications associated with vascular access.

Thus, it was expected that strengthening patient knowledge would not only improve their immediate self-care but also contribute to reducing hospitalizations, increasing efficiency in the use of healthcare resources, and comprehensively improving the quality of life of this vulnerable population.

The purpose of this study was to evaluate the impact of a structured educational intervention on the knowledge and self-care practices of the arteriovenous fistula in patients with chronic renal failure undergoing hemodialysis and their caregivers in the Haemodialysis Centre CENAG S.A. to reduce complications associated with vascular access, improve the quality of hemodialysis treatment and promote patient autonomy and empowerment in the management of their health condition.

METHOD

Study design

A quasi-experimental, pretest-posttest study without a control group was conducted to evaluate the effect of an educational intervention on knowledge and self-care practices of arteriovenous fistula (AVF) in patients with chronic renal failure (CRF) undergoing hemodialysis and their caregivers. The design was selected due to ethical considerations, given that all patients treated at the CENAG S.A. Haemodialysis Centre benefited from the educational intervention.

The research was conducted at the Haemodialysis Centre CENAG S.A. in Guayaquil, Ecuador. This institution provides specialized hemodialysis treatment to patients with advanced CKD. Before the intervention, significant limitations were detected in patients' knowledge of self-care of their vascular access, which justified the need to implement a structured educational program.

Population and sample

The target population was hemodialysis patients with AVF vascular access and their primary caregivers. Fifty patients and 30 caregivers were selected by non-probability convenience sampling, taking into account the following criteria:

Inclusion criteria

- Patients diagnosed with CKD on hemodialysis treatment and carriers of AVF.
- Primary caregivers of hemodialysis patients.
- Voluntary consent to participate in the educational intervention.

Exclusion criteria

- Patients with severe cognitive impairment that prevented comprehension of the information.
- Patients using vascular access other than AVF.
- Carers are not directly involved in the daily care of the patient.

Educational intervention

The intervention was structured in five phases:

- Phase 1: initial diagnosis. Surveys and semi-structured interviews were used to assess the level of knowledge of AVF self-care and review the history of complications.
- Phase 2: Design of the educational programme. Development of printed and audiovisual educational materials adapted to simple language, focusing on AVF hygiene, warning signs, and protection techniques.
- Phase 3: implementation of the program. Six face-to-face educational sessions in small groups, with practical demonstrations and materials delivery. This was complemented by individualized telephone follow-up.
- Phase 4: Post-intervention evaluation, re-application of surveys to measure changes in knowledge and practice and clinical evaluation of the incidence of complications.
- Phase 5: follow-up and analysis. Quantitative and qualitative analysis of the results obtained to determine the impact of the intervention.

Variables and measurement instruments

Primary variable: level of knowledge of AVF self-care.

Secondary variables: adherence to recommended practices and frequency of complications (infections,

thrombosis).

The instruments used were

- Structured questionnaire validated by experts to measure knowledge.
- Clinical record of complications.
- Participant perception and satisfaction survey.

Data analysis

Quantitative data were analyzed using the Student's t-test for related samples, with a significance level of $p<0,05$. Frequencies, percentages, and measures of central tendency were calculated.

Qualitative analysis was performed on the content of interviews and observations using manual thematic coding.

Ethical considerations

The study complied with the ethical principles of the Declaration of Helsinki and current national regulations. Written informed consent was obtained from all participants, ensuring the confidentiality of information through anonymous coding. No conflicts of interest were identified, and the Haemodialysis Centre CENAG S.A authorities approved the research.

RESULTS

Description of the study population

The study included 80 participants, 50 patients diagnosed with chronic renal failure (CRF) on hemodialysis, and 30 primary caregivers. The patients' ages ranged from 35 to 80, with a mean of 58 ± 10 years. In terms of gender, 60 % (n=30) were men, and 40 % (n=20) were women. The average length of time patients had been on hemodialysis was 4,2 ± 1,8 years.

Regarding health conditions, 68 % of patients had hypertension as a comorbidity, 42 % had type 2 diabetes mellitus, and 30 % had a history of cardiovascular disease. Regarding educational level, 60 % had only primary education, 30 % had completed secondary education, and only 10 % had higher education. These educational and clinical characteristics reflect the need for teaching strategies adapted to the participants' profiles.

75 % of the caregivers were direct relatives of the patients, mainly children, spouses, or parents, while 25 % were employed caregivers.

Most caregivers were 25-55 years old, and 65 % had attained at least secondary education. Their active participation was essential to reinforcing the educational process and encouraging adherence to self-care practices.

Prior to the implementation of the educational intervention, both patients and their caregivers had low levels of knowledge about the practices necessary for proper arteriovenous fistula care, which led to a high frequency of complications. This situation justified the need to develop a structured educational program adapted to the socio-cultural and cognitive characteristics of the participants to strengthen their self-care and vascular access protection skills.

Quantitative results

After the educational intervention was implemented, significant changes were observed in knowledge levels, self-care practices, and the incidence of complications associated with arteriovenous fistula.

Regarding the level of knowledge of AVF self-care, patients showed considerable improvement. Before the intervention, the average knowledge, measured on a scale of 0 to 10, was 4,5 ± 1,2. Post-training, the average increased to 8,6 ± 1,0, a 91 % increase. This difference was statistically significant ($p<0,001$), indicating that the educational intervention positively impacted the acquisition of essential knowledge for AVF care.

Regarding adherence to recommended self-care practices, the percentage of patients correctly performing preventive actions increased from 48 % to 87 % after the intervention. This 81 % increase reflects a substantial improvement in AVF protection behaviors, including correctly flushing the area, observing signs of infection, and controlling external pressures on the fistula.

There was a significant increase in the identification of warning signs. Before the intervention, only 38 % of patients and caregivers could recognize signs such as redness, pain, swelling, or lack of pulsatility in the AVF. After training, this percentage rose to 85 %, showing better preparedness to act promptly in case of possible complications.

A significant reduction was documented in the incidence of clinical complications. Before the intervention, 32 % of patients (n=16) had experienced infection, thrombosis, or other AVF-related complications in the last trimester. Subsequently, this percentage decreased to 12 % (n=6), corresponding to a 62 % reduction in the complication rate. This difference was also statistically significant ($p<0,01$).

Below is the pre-and post-intervention comparison for the leading indicators assessed:

Table 1. Pre and post-intervention comparison in the leading indicators evaluateds

Indicator	Pre-intervention	Post-intervention	Variation (%)
Level of knowledge about AVF (scale 0-10)	4,5 ± 1,2	8,6 ± 1,0	+91 %
Adherence to self-care practices	48 % (n=24)	87 % (n=44)	+81 %
Identification of warning signs	38 % (n=19)	85 % (n=43)	+123 %
Incidence of complications (infections/ thrombosis)	32 % (n=16)	12 % (n=6)	-62 %

Source: training programme.

Qualitatively, participants expressed in interviews their perception of greater safety and autonomy in caring for their vascular access. They also reported that the educational material used, adapted to simple language and supported by visual resources, facilitated the understanding and practical application of the knowledge acquired.

Overall, the results demonstrate that the educational intervention effectively improved knowledge and adherence to safe practices and reduced complications associated with arteriovenous fistula in patients with chronic renal failure on hemodialysis.

Statistical analysis of the data showed a significant improvement in the level of knowledge of patients and caregivers after the educational intervention. The average understanding of arteriovenous fistula self-care increased from 4,5 ± 1,2 to 8,6 ± 1,0 points on the scale, with a highly significant difference ($p<0,001$).

Also, the frequency of arteriovenous fistula-related complications, such as infections and thrombosis, decreased significantly in the month following training, from 32 % to 12 %, representing a 62 % decrease in adverse events.

Adherence to self-care recommendations also showed a significant improvement. Before the intervention, 48 % of the participants were engaged in adequate AVF protection practices, while after the educational program, this proportion increased to 87 %, a statistically significant difference ($p<0,01$). These results reflect the positive impact of the intervention in strengthening preventive behaviors.

Qualitative analysis

Analysis of the post-intervention interviews and surveys revealed highly favorable perceptions of the educational program. Ninety-two percent of patients and caregivers considered the training clear, understandable, and applicable to their daily lives, especially highlighting the usefulness of the didactic materials and practical sessions.

Participants reported feeling more confident in identifying warning signs of arteriovenous fistula early and making timely decisions to act in case of complications. This perception of greater empowerment was a recurrent element in the discourses collected.

In addition, the personalized accompaniment offered by the health team and the provision of printed materials adapted to the participants' educational level greatly facilitated their understanding, retention of the information, and application of the practices taught in their daily lives. Accessibility of content and individualized follow-up were identified as key factors for the success of the intervention.

Barriers and facilitators

During the development of the educational intervention, several barriers and facilitating factors were identified that influenced the implementation and the results obtained.

Among the main barriers identified were learning difficulties associated with the advanced age of some patients (30 %), initial resistance to changing self-care habits (24 %), and irregular attendance at educational sessions (20 %) due to transport problems or unstable health conditions. Also, limitations in the academic level of some participants made it difficult initially to understand some technical concepts related to arteriovenous fistula self-care.

On the other hand, relevant facilitating factors were identified that enhanced the success of the intervention. Using didactic materials adapted in simple language and visual resources was crucial to improving the understanding of the contents. The active support of the healthcare staff of the Haemodialysis Centre CENAG S.A. contributed to strengthening the educational link with the patients. In addition, the personalized follow-up after each session and the primary caregivers' active participation promoted greater adherence to the self-care practices taught.

The combination of these facilitating strategies allowed the initial barriers to be progressively overcome, achieving favorable results for most participants.

DISCUSSION

The present study demonstrates that a structured educational intervention based on Orem's self-care model and adapted to the participants' socio-cultural characteristics generates a significant improvement in knowledge levels, self-care practices, and the reduction of complications related to arteriovenous fistula in hemodialysis patients.

The results obtained show that the level of self-care knowledge improved significantly, from 4,5 to 8,6 points on the scale evaluated. This trend is consistent with that reported by Villanueva in 2024, who states that targeted education strengthens patient skills in vascular access management. Clementino et al.[28], in their systematic review, conclude that targeted educational strategies for AVF care achieve considerable increases in knowledge and decrease adverse events, findings that are also reflected in this intervention.[27,28]

Adherence to self-care practices increased markedly from 48 % to 87 %, confirming the effectiveness of personalized educational programs. Da Ferreira et al.[29] and Pessoa et al.[30] argue that regular educational reinforcement and accompaniment are fundamental to consolidating sustainable behavioral changes in populations with educational limitations, as evidenced in our group of patients.[29,30]

Regarding the incidence of complications, a 62 % reduction in events such as infections and thrombosis was documented. This result is consistent with reports by Dilbilir al.[31] and Peralta et al.[32], who found that self-care training contributes to significantly decreasing hospitalization rates and corrective procedures in patients with AVF.[31,32]

In the qualitative analysis, 92 % of participants reported feeling more confident to act on complications, supporting the importance of patient empowerment in self-care, as Trampuž et al.[33] stated. Furthermore, the perceived clarity, accessibility of educational material, and individualized follow-up were in line with World Health Organization (WHO, 2021) recommendations and Trampuž et al.[33] findings on factors favoring knowledge retention.[33,34]

Despite the positive results, some relevant barriers were identified, such as learning difficulties in elderly patients and initial resistance to habit change, phenomena widely described in the literature.[29] Adapting the materials and providing personalized support was key to overcoming these barriers and ensuring the success of the intervention.

Comparison with recent international studies, such as that of Vajdič Trampuž B et al.[34], confirms that education in AVF care improves clinical indicators and strengthens patient autonomy, an essential element for the sustainability of public health interventions.

In the Ecuadorian context, where access to health education programs is limited, the experience at the Haemodialysis Centre CENAG S.A. provides evidence of the feasibility and effectiveness of low-cost, high-impact educational interventions. As Bachleda et al.[35] and Ponikvar J et al.[36] suggested, integrating continuing education programs within routine care settings represents a fundamental strategy to improve clinical outcomes in vulnerable populations.[35,36]

However, this study has some limitations that need to be considered. The absence of a control group limits the possibility of attributing all observed changes exclusively to the intervention. Also, the follow-up was conducted in a short period (one-month post-intervention), precluding the assessment of long-term outcomes' sustainability. Future studies should consider controlled experimental designs and prolonged follow-up to validate and extend the findings.

CONCLUSIONS

- Implementing a structured educational intervention aimed at hemodialysis patients and their caregivers proved effective in significantly improving knowledge of arteriovenous fistula self-care, increasing adherence to safe practices, and reducing the incidence of vascular access-associated complications.
- Knowledge strengthening and hands-on training empowered participants, promoting early identification of warning signs and encouraging sustainable self-care behaviors. These results are consistent with international evidence supporting education as a key strategy in preventing adverse events in patients with chronic renal failure.
- The intervention, based on Orem's self-care model and adapted to the socio-cultural level of the population, allowed for overcoming educational barriers and consolidating positive changes in the daily management of the arteriovenous fistula. In addition, simple educational materials, personalized support, and caregiver involvement were critical elements for the success of academic programs in nephrology care settings.
- The present study provides locally relevant evidence on the feasibility and effectiveness of integrating self-care education programs within hemodialysis services, especially in resource-limited settings such as the CENAG S.A. Haemodialysis Centre.
- Future research should include the design of controlled studies with longitudinal follow-up to

evaluate the sustainability of the results in the medium and long term and explore the transferability and replicability of this type of intervention in other care centres for patients with chronic kidney disease.

- Finally, it highlights the need to institutionalize continuing education strategies as an integral part of hemodialysis care, recognizing their impact on improving quality of life, reducing complications, and optimizing health resources.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to the development, execution or

publication of this research.

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