

Original Article

Prevention and Treatment of Vascular Access Complications Through A Multidisciplinary Team

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Abstract - Introduction: Vascular accesses, such as fistulas, catheters, and AV grafts, play a crucial role in successful treatment but can also lead to numerous complications, such as Infections, Thrombosis, and Stenosis. This paper explores how effective nursing leadership, in collaboration with a multidisciplinary team, can reduce the frequency and severity of these complications. Nursing plays a key role in the prevention and treatment of Vascular Access Complications in Hemodialysis Patients. Nurses are the first and most frequent contact with patients, which allows them to play a key role in the early recognition of complications and the provision of appropriate intervention. The role of the nursing team in vascular access management is multifaceted and includes patient education, monitoring of access status, identification of risk factors, and implementation of preventive measures. Objective of the Paper: The analysis of the significance of nursing leadership, the role of nurses in preventing and treating vascular access complications, and the effects of teamwork in a multidisciplinary context. It will address patient education, preventive measures, and interventions nurses undertake according to professional guidelines. Additionally, the research results, obtained through surveys and analysis of medical data, will be presented. Methods: This is a non-experimental correlational research study of the survey type, along with a literature review. Conclusion: Effective nursing leadership and collaboration within a multidisciplinary team significantly contribute to reducing vascular access complications and improving the quality of care for Hemodialysis Patients.

Keywords - Nursing, Leadership, Vascular Access, Multidisciplinary Team, Health Education, Prevention.

1. Introduction

Kidney failure is a serious medical condition that occurs when the kidneys are unable to perform their basic functions of Filtering Blood, Regulating Fluids and Electrolytes, and Controlling Blood Pressure. When the kidneys lose their functionality, patients require Hemodialysis Therapy, which filters blood through a dialysis machine, removing harmful substances and excess fluid from the body. For dialysis to be effective, the patient must have adequate vascular access, a method that allows direct contact between the Patient's Blood and the Dialysis Machine. (1-3)

There are several types of vascular access used in the treatment of patients with Chronic Renal Failure, the most commonly used of which are Arteriovenous Fistulas, Arteriovenous Grafts, and Dialysis Catheters. (1)

Nursing plays a key role in the prevention and management of vascular access complications in Hemodialysis Patients. Nurse technicians are the first and most frequent contact with patients, which allows them to play a key role in the early recognition of complications and the

provision of appropriate intervention. The role of the healthcare team in the management of Vascular Access is multifaceted and includes patient education, monitoring of access status, identification of risk factors, and implementation of preventive measures.

Patient education about the importance of vascular access maintenance is a fundamental element in the prevention of complications. Healthcare professionals play a key role in educating patients on how to properly care for their access, including hygiene, recognizing early signs of Infection and thrombosis, and the importance of regular check-ups and access maintenance. Patient education can significantly reduce the risk of developing serious complications, such as Infection or thrombosis, thereby contributing to greater hemodialysis efficiency and reducing the need for additional surgical interventions. (2-18).

Nursing interventions in the prevention of vascular access complications encompass a wide range of activities, including the proper use of antiseptic techniques when manipulating the access, as well as performing regular examinations and tests to monitor the functionality of the access.



Within a multidisciplinary team, a nurse or technician coordinates and facilitates the efficient work of all team members – from Physicians Nephrologists and Surgeons, to Anesthesiologists and other healthcare professionals.

Vascular access complications significantly affect the quality of life of patients on Hemodialysis. According to various studies, Infection is the most common complication associated with Dialysis Catheters, and estimates show that Infection occurs in about 10%-15% of patients using catheters. Thrombosis is also common, with an incidence rate of about 25%-30% in patients with AV grafts. In AV Fistulas, Thrombosis occurs in about 10%-15% of cases, while Stenosis and Aneurysms account for about 20% of all complications (19).

Some studies show that catheter-related infections are responsible for about 30% of hospitalizations in Hemodialysis Patients, and the possible outcome of such infections, such as Sepsis, can increase patient mortality.

According to the World Health Organization (WHO), catheter-related infections are the leading cause of death among Dialysis Patients, with mortality rates ranging from 10%-20% in those who experience a serious infection.

According to Research, Nursing Leadership in this area involves the following key aspects:

- Educating patients about vascular access maintenance, recognizing early symptoms of complications, and basic hygiene measures that can prevent infections.
- Coordination and collaboration with a multidisciplinary team (Nephrologists, Surgeons, Medical Technicians) to ensure timely and effective intervention in the event of complications.
- Continuous monitoring of access status, including regular monitoring of fistula or graft functionality, identification of potential risks such as Stenosis or Thrombosis, and Implementation of Preventive Measures.
- Providing emotional and psychological support to patients experiencing stress, anxiety, and depression due to long-term treatment and complications of vascular access.

A multidisciplinary approach to the treatment of patients with vascular access is essential to ensure comprehensive care and minimize the risk of complications. In this team, nurses or technicians often take on a key role as leaders, coordinators, and mediators between the different team members, thus enabling better organization and efficiency of the entire treatment process.

Nursing leadership in a multidisciplinary team represents one of the most important functions in modern healthcare practice, especially when it comes to complex cases such as vascular access in patients with Chronic Renal Failure.

Nursing leadership involves not only managing the patient's treatment, but also coordinating the work of different healthcare professionals and engaging patients in self-management of their health.

Patient education on vascular access maintenance and recognition of complications plays a key role in preventing and reducing complications. Nurses are often on the front lines of educating patients on how to properly care for their Vascular Access (AV Fistula, Catheter, or AV Graft). Proper education can significantly reduce the risk of complications such as Infection, Thrombosis, STENOSIS, or Aneurysm (20-23).

In many healthcare settings, there are structured educational programs based on nursing leadership, which include nursing interventions and patient and family education. The programs are based on documented research that shows that patient education can reduce complication rates, improve quality of life, and reduce the number of hospitalizations due to infections or other problems with vascular access. Statistics show that education can reduce the incidence of complications by as much as 30%-40%, making it a key element of preventive measures.

2. Research Methodology

The research was conducted as a study using a quantitative method of data collection via a questionnaire. The aim of the research was to examine the attitudes, knowledge, and experiences of nurses employed in Hemodialysis Centers regarding nursing leadership and prevention of vascular access complications.

The target population was nurses/technicians employed in Hemodialysis Units in the Territory of the Republic of Serbia. The research was conducted in the period from January to April 2025. The sample included 97 respondents, with all participants voluntarily agreeing to participate and meeting the criterion of being directly involved in the Process of Preparation, Implementation, and Monitoring of Hemodialysis.

For the purposes of this research, a structured questionnaire was used, compiled based on the literature and consisting of three parts:

1. Sociodemographic data: Work Experience, Education, and Specific Training.
2. Knowledge and practice related to vascular access: Questions on the management of AV Fistulas, Grafts and Central Catheters, Recognition and Prevention of Complications.
3. Attitudes about nursing leadership: Assessment of the role of the nurse in the Multidisciplinary Team, Assessment of Independence in Decision-Making, and Initiative for Patient Education.

The questionnaire was anonymous, and completion took an average of 10–15 minutes. It had a total of 30 questions.

The collected data were analyzed using Microsoft Excel. Descriptive statistical parameters were used: Percentage Representation, Cross-Tabulation. The data were presented in the form of tables and graphs for easier interpretation.

2.1. Ethical Aspects

The research was conducted in accordance with the ethical principles of scientific research. Participants were informed about the purpose of the research, and participation was voluntary and anonymous.

3. Research Results

The results of this study indicate a strong association between the level of professional education of nurses and their ability to recognize and implement adequate measures to prevent vascular access complications. Nurses who have completed specialized education in the field of Hemodialysis are significantly more likely to apply standardized procedures for early detection of thrombosis, which indicates the importance of continuous professional development.

Table 1. Distribution of respondents' answers in relation to work experience

| Work experience | Number | % |
|-----------------------------|--------|--------|
| Up to 10 years 32 33% | 32 | 33% |
| 11-20 years 33 34% | 33 | 34% |
| 21-30 years 22 22.68% | 22 | 22,68% |
| From 31 and above 10 10.32% | 10 | 10,32% |
| Total | 97 | 100% |

According to the distribution of answers to the first question, the most respondents have up to 20 years of work experience, which is 22.68%.

Patient D.B. from Ivanjica, 52 years old, due to Terminal Renal Failure with Anemia syndrome, is on a chronic program of repeated Hemodialysis three times a week at the Hemodialysis Center in Ivanjica. She is dialyzed through a left cubital AV fistula that was created in 2015 at the Clinical Center “Zemun”.

Local nursing report from 08.01.2025. year: Palpation over the AV fistula feels a good trill. Auscultation: I hear a murmur 5/5. Skin of proper integrity, with two Aneurysms with an external diameter of 8x8 cm of a harder consistency. It is not painful. The patient does not report problems related to the vascular access, denies itching, fever, and bleeding between two Hemodialysis Sessions. I puncture the access without problems.

According to the respondents' answers, we conclude that the largest number of respondents, 64.95%, did not complete

“dialysis school”, and 35.05% completed the aforementioned school.

Table 2. Distribution of respondents' answers according to education “Dialysis School”

| Dialysis School | Number | % |
|-----------------|--------|--------|
| Yes | 34 | 35,05% |
| No | 63 | 64,95% |
| Total | 97 | 100% |

Table 3. How many patients with vascular access do you have in your department

| Number of patients | Number | % |
|--------------------|--------|--------|
| Less than 10 | 2 | 2,06% |
| From 11 to 30 | 23 | 23,71% |
| From 31 to 50 | 10 | 10,31% |
| From 51 to 70 | 11 | 11,34% |
| From 71 to 100 | 40 | 41,24% |
| Over 101 | 11 | 11,34% |
| Total | 97 | 100% |

Based on the respondents' responses, we concluded that the majority of respondents work in centers that dialyze from 71 to 100 patients, which is 41.24%. Two respondents work in small centers that have up to 10 patients, 2.06%. We concluded that the majority of respondents have sufficient experience in working with this population.

Table 4. Have you received additional training related to vascular access

| Training | Number | % |
|----------|--------|--------|
| Yes | 37 | 38,14% |
| No | 60 | 61,86% |
| Total | 97 | 100% |

Most dialysis center employees have not received specific training related to vascular access procedures, while 38.10% have attended some training.

Table 5. How often do you perform vascular access procedures

| Procedures | Number | % |
|--------------|--------|--------|
| Never | 3 | 3,10% |
| Occasionally | 14 | 14,43% |
| Very often | 10 | 10,31% |
| Daily | 70 | 72,16% |
| Total | 97 | 100% |

The largest number of respondents 72.16% work with vascular access every day, while 10.31% do it very often. 14.43% do it occasionally, and 3.10% never perform vascular access procedures.

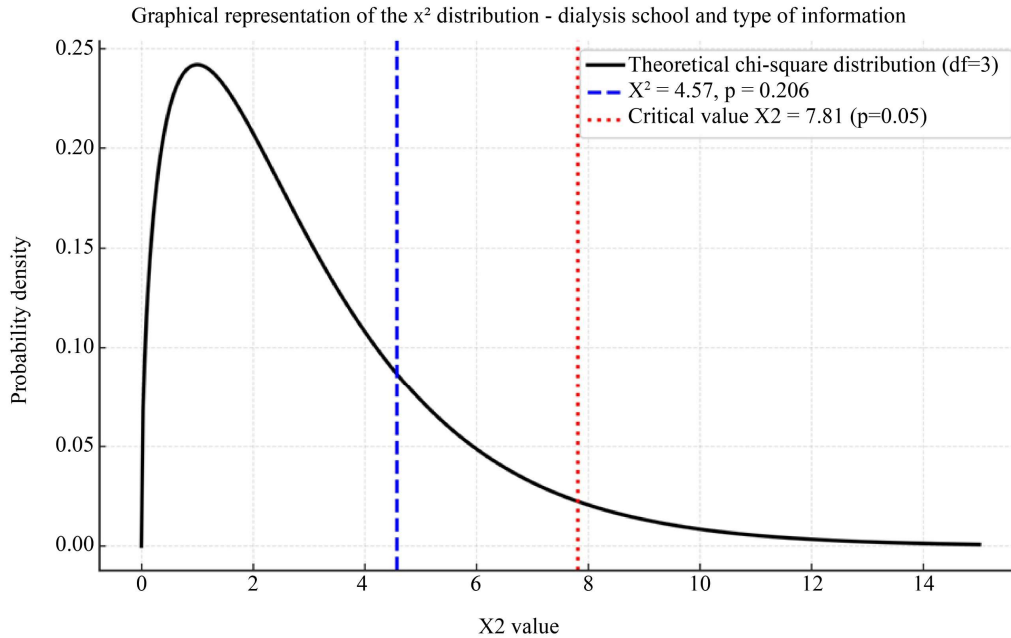


Fig. 6 Graphical representation of the χ^2 distribution – dialysis school and type of information

4. Discussion

The black line shows the theoretical χ^2 distribution (df = 3), while the blue dashed line represents the obtained result from the analysis ($X^2 = 4.57$, $p = 0.2059$). The red dotted line indicates the critical value $X^2 = 7.81$ ($p = 0.05$), which represents the limit of statistical significance. As the obtained X^2 value does not reach the critical value, the results confirm that there is no statistically significant association between completed dialysis school and the type of information provided to patients.

These findings are in line with the theoretical expectations that formal education is not the only factor influencing the effectiveness of communication and patient education. Instead, practical experience, continuing education, team support, and work organization may have a key influence. This indicates the need for a multidisciplinary approach in planning and implementing educational activities in dialysis centers.

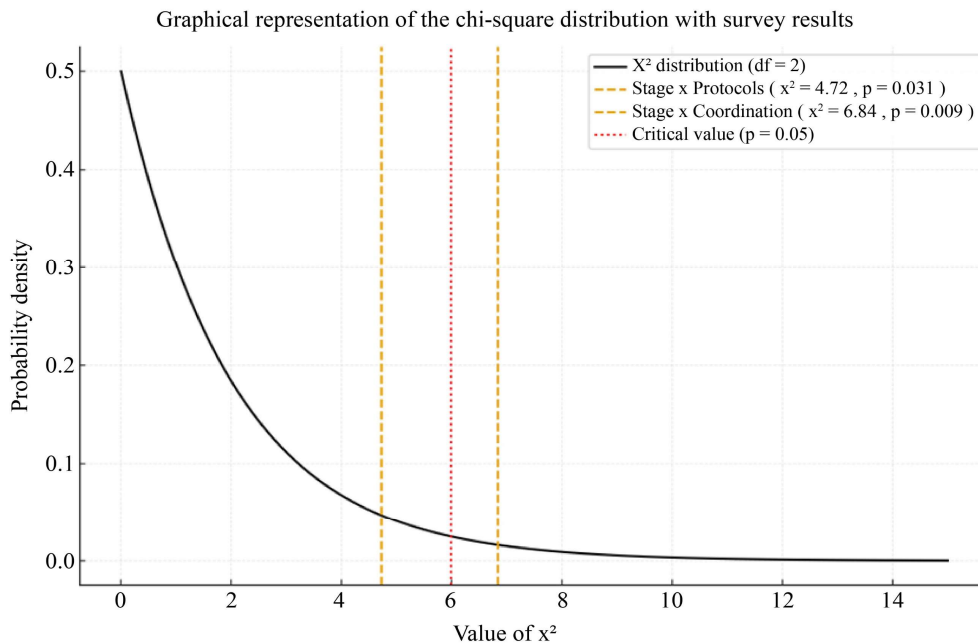


Fig. 7 Graphical representation of the χ^2 distribution of the research results

The figure shows the theoretical χ^2 probability distribution (df = 2) with the values obtained in the research. The black curve represents the theoretical distribution, while the dashed lines indicate the obtained χ^2 values for the analyses: “Working experience × Protocol adherence” ($\chi^2=4.72$, $p=0.031$) and “Working experience × Coordination

in a multidisciplinary team” ($\chi^2=6.84$, $p=0.009$). The red dotted line indicates the critical value ($\chi^2=5.99$, $p=0.05$). It is visible that both values exceed or approach the critical limit, which confirms the statistically significant association between working experience and aspects of professionalism.

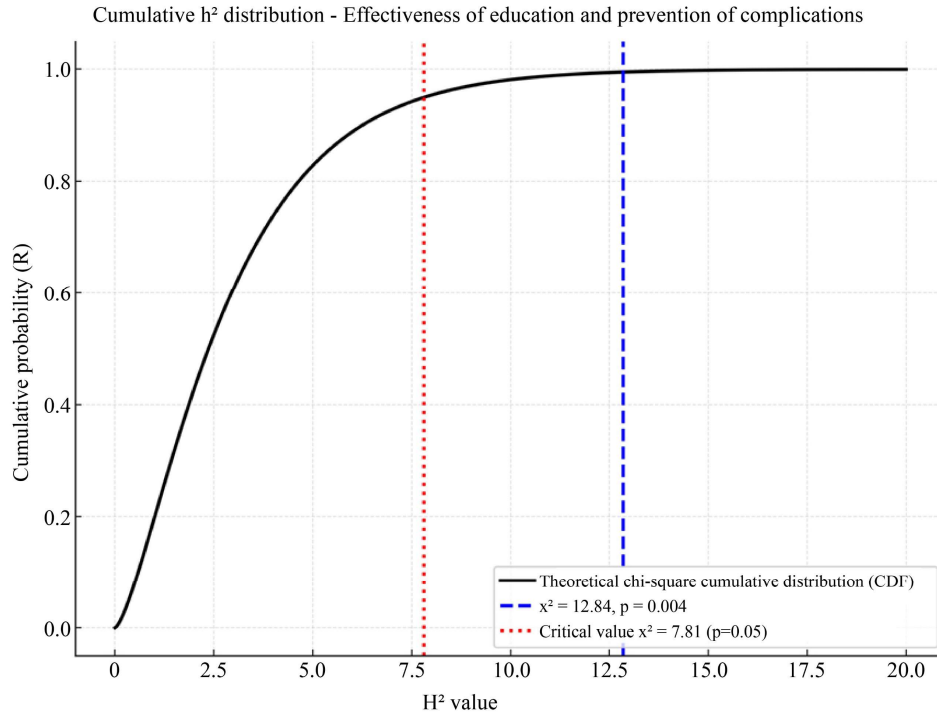


Fig. 8 Cumulative χ^2 distribution – Effectiveness of Education and Prevention of Complications

These findings are consistent with the theoretical assumptions of modern nursing practice, where continuing education and professional development directly affect the quality of care and the prevention of complications. In this case, higher scores on the effectiveness of education are associated with better results in the implementation of the protocol, reduced incidence of infections and thrombosis, as well as greater consistency in cooperation within the team. This confirms the importance of the educational component within the multidisciplinary approach to the treatment of patients on Hemodialysis and the prevention of complications.

5. Conclusion

Despite recommendations from relevant professional associations and professional literature, the analysis showed that a significant number of nurses are not sufficiently familiar with procedures for monitoring and protecting vascular access. This may be due to insufficient availability of education, workload, or insufficient support within institutions.

These findings are consistent with previous studies that highlight the importance of a multidisciplinary approach in the

management of patients with Chronic Renal Failure, predominantly in the Spanish narrative literature. When there is active and clear communication between team members, including Nephrologists, Surgeons, Nurses, and other staff, the likelihood of timely detection and resolution of complications increases.

However, it should be noted that this research has its limitations. It relied mainly on self-assessment through a questionnaire, which carries the risk of subjectivity and bias. Future research should include analysis of clinical documentation, as well as direct observation of procedures.

The role of the nurse in the healthcare system today goes far beyond the traditional framework of primary care. Especially in the context of caring for patients with Chronic Renal Failure, Nurses have a key responsibility in preserving and improving the quality of life of patients, which is especially visible in the domain of vascular access for Hemodialysis.

The research conducted in this paper confirmed the positive impact of good teamwork and clearly defined nursing

interventions on reducing the incidence of complications. Patients who have the support of an organized and well-communicated team have fewer interruptions in treatment, fewer emergency interventions, and better psychosocial functioning. In addition, nurses showed a high awareness of their role in health promotion, symptom control, and monitoring of vascular access status, which further emphasizes the importance of their position in a multidisciplinary context.

5.1. Timely Intervention is Crucial

This work has shown that nursing leadership is a fundamental component in the organization of care for patients undergoing Hemodialysis. Nurses not only participate in direct clinical practice, but also take the initiative in preventive activities, health education of patients, and coordination of all members of the multidisciplinary team. The conclusion of this paper is that nursing leadership and collaboration within a multidisciplinary team are key to reducing vascular access complications and improving the quality of healthcare.

By investing in the continuing education of nurses, strengthening team culture and developing leadership competencies, it is possible to achieve significant progress in the care of patients on Hemodialysis. This not only contributes to better health outcomes but also to building trust between patients and the healthcare system, which is the foundation of any modern and humane medicine.

Proposed Measures

1. Continuing education of nurses
 - Organizing regular training, workshops, and expert meetings on vascular access, prevention of complications, and modern treatment protocols.
 - Introducing certification for nurses working with hemodialysis patients.
2. Development and implementation of Standard Operating Procedures (SOPs)
 - Development of clear, written procedures for vascular access care.

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- Implementation of SOPs in daily clinical practice, with periodic revision and adaptation to new professional guidelines.
3. Formation and strengthening of multidisciplinary teams
 - Establishment of teams that include a nurse, physician, nephrologist, surgeon, dietitian, and psychologist.
 - Regular team meetings to exchange information, monitor patient status, and make joint decisions.
 4. Introduction of a health education program for patients
 - Holding educational sessions for patients on the importance of proper maintenance of vascular access, recognition of early symptoms of complications, and the importance of regular check-ups.
 - Preparation of information brochures, videos, and visual posters.
 5. Improving communication and information exchange
 - Implementation of electronic systems for maintaining medical records and monitoring the status of vascular access.
 - Ensuring the availability of information to the entire team in real time.
 6. Monitoring and analysis of quality of care indicators
 - Introduction of a system for recording and analyzing incidents of complications (infections, thrombosis, etc.).
 - Regular analysis of data in order to improve practice and identify trends.
 7. Strengthening the role of nursing leadership

Appointment of nursing care coordinators within hemodialysis centers.

 - Encouraging nurses to participate in protocol development, education, and scientific projects.
 8. Introduction of a system of supervision and support for junior nurses
 - Mentoring by more experienced nurses.
 - Providing psychological support to staff working with chronic patients.

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