

## An Evaluation of the Quality of Nursing Care Provided for Vascular Access in Hemodialysis Patients

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### ABSTRACT

**Introduction:** Care for vascular access of patients undergoing hemodialysis is a critical issue. Inflammation and subsequent infection are the major factors which threaten patients' health and diminish effectiveness of hemodialysis. Therefore, this study aimed to evaluate the severity and incidence of inflammation of vascular access in hemodialysis patients.

**Materials and Methods:** This cross-sectional study was conducted on 90 patients undergoing hemodialysis in Emam Reza and Montazerie Hospitals in Mashhad, June, 2014. Evaluation of inflammation severity over the course of one month (12 hemodialysis sessions) was performed by means of an inflammation tool designed by the Board of Nursing. Data were analyzed using SPSS version 16, and performing descriptive and Chi-square tests.

**Results:** The mean and standard deviation of incidence of inflammation in the first session of hemodialysis was  $3.2 \pm 1.3$  cases. The mean and standard deviation of the intensity of inflammation was  $12.5 \pm 4.7$ .

**Conclusion:** Since inflammation of vascular access in hemodialysis patients impairs their safety and health improvement, necessary measures to reduce this complication must be taken.

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### Introduction

Intensification of inflammation in vascular access may cause infection, leaving it prone to scar tissue formation (1, 2). In 2001, Sarani et al. conducted a multi-city study on hemodialysis patients, and reported the rate of hemodialysis is vascular access inflammation to be 85% in hospitals of Tehran, 36% in Shahre Kord, and 31% in Arak, Iran (3). Subsequent infection was one of the serious complications, and as Netina et al. suggested, in the presence of inflammation, the threat of septicemia increases by 18 times.

The second leading cause of mortality in hemodialysis patients is infection. The number of patients with hemodialysis vascular access infection increased by 34% during 1993-2006. Of 1000 patients who died from hemodialysis in 2006, 202 (20.2%) cases were diagnosed with infections due to venous catheter insertion (4-6). Moreover, 80000 cases of infections occurred in the vascular access, and mortality rate was 0-35%, depending on its severity (7).

One of the most common sites of inflammation is the vascular access. Hemodialysis patients are prone to infection and inflammation due to various reasons

including: weakened immune system, high prevalence of diabetes and vascular interventions, which cause cellulite at the vascular access (1).

The best way to prevent inflammation and reduce costs of hospitalization in hemodialysis patients is to prevent complications from venous catheter insertion creating inflammation, wounds and infections. Strategies for reducing infection include: using antibiotic prophylaxis for patients, washing hands and using masks by patients and nurses, using an appropriate antiseptic solution before vascular access, proper catheter insertion and insertion site and subsequent care (8-10).

*Staphylococcus epidermis* is part of the normal human skin flora, and 75% of infections are caused by coagulase-negative staphylococci associated with these bacteria. *Staphylococcus epidermis* connects to foreign objects (e.g., artificial heart valves, venous catheters and the central nervous system shunts) by glycocalyx.

A study conducted on this issue showed that 47% of hemodialysis patients had one or more positive cultures of this kind of bacteria (7). This bacteria may enter the bloodstream and cause heart valve complications and

ultimately, endocarditis. Most strains of staphylococcus epidermis isolated in hospitals, are resistant to penicillin and methicillin. Staphylococcus epidermis is sensitive to the polymyxin B antibiotic (11, 12). However, using antibiotic prophylaxis in these patients is not appropriate (13, 14).

Infection in the vascular access of hemodialysis patients is reduced when nurses disinfect the skin with an appropriate solution before onset. Nursing reference texts, journals and scientific articles have disparate opinions regarding selecting an appropriate disinfecting solution (4, 8). In 2011, the Infection Prevention Society declared alcohol antiseptics, betadine and chlorhexidine the best solutions for preventing vascular access infection. The most important factors in the nurses' selection of an appropriate antiseptic are the patient's condition, rapid and sustained effect and reduced risk of bacterial resistance against it (5, 13).

Patient characteristics include a weakened immune system and frequent needle insertion at the vascular access. After an evaluation of the prevalence and severity of inflammation, appropriate measures for reducing complications should be taken to help protect the patients' health and ensure better hemodialysis performance. Aseptic techniques, patient self-care and compliance with infection control protocols are some of the proposed guidelines to protect patients against this complication.

## Materials and Methods

This cross-sectional analytical study was conducted to assess the prevalence, severity and incidence of inflammation of the vascular access in patients undergoing hemodialysis. The study was carried out on 90 patients at Emam Reza and Montaserie Hospitals in Mashhad, June, 2014.

The inclusion criteria was as follows: 1) not having inflammation at the vascular access and having 3 dialysis sessions per week; 2) not having diseases such as leukemia, infection and immunodeficiency; and 3) no previous use of antibiotics or drugs that suppress the immune system based on the duration of drug effect.

The study method was briefly described, and informed written consent was obtained from the subjects. Data were collected through observation, interviews and review of medical records. The appropriate sample size, based on guidelines and a comparative formula of averages with a confidence factor of 95% and a power of 80%, was calculate to be 90. However, due to anticipated loss of subjects, 101 cases were analyzed, since absence for more than one session resulted in exclusion from the study.

Iran's Inflammation Association criteria were used to assess the severity of inflammation of the vascular access of patients in both groups during the 12 sessions. This tool has a rating scale of five levels. During each session, each patient was rated as: no clinical signs (0), redness without pain (1), pain/edema,

or both together (2), distinctive and varicose veins (3) and severe inflammation more than 2.5 cm (4).

The data were analyzed using SPSS, version 16.5.

Normal distribution was determined using Kolmogorov-Smirnov and Shapiro-Wilk tests. T-test, Mann-Whitney and Chi-square tests were also performed. Descriptive statistics were used to examine the disease and demographic information. ANOVA test was used to determine the relationships between variables and the severity and incidence of inflammation. 95% confidence and 80% power were considered significant in all tests.

## Results

This study was conducted on 90 patients undergoing hemodialysis. The mean and standard deviation of age was  $42.8 \pm 1.7$  years, and 39.1% of the studied patients were aged over 49 years. The majority of the subjects (60%) were male. In addition, the majority of patients

**Table1: Profile of hemodialysis patients**

Mean±standard deviation of age	42.8±1.8
<b>Gender</b>	Male 54 (60%)
	Female 36 (40%)

(78.3%) had a middle school education (Table 1).

The majority of patients (92.4%) had vascular access in the fistula, and 78.3% (72 cases) had vascular access

**Table2: Vascular access variables for patients**

Location of vascular access	Wrist 72 (78%)
	Elbow 18 (22%)
Type of vascular access	Shunt 5 (8%)
	Fistula 85 (92%)
	Graft 0%
Failure vascular access	Dominant 21 (13%)
	Recessive 69 (77%)

in the wrist (Table 2).

Moreover, 22 (19 patients) and 60% (54 patients) had diabetes and hypertension, respectively (Table 3).

**Table3: History of disease for patients undergoing hemodialysis**

<b>History of disease</b>	Diabetes 19 (22%)
	Hypertension 54 (60%)

The incidence of inflammation of the vascular access was 20% in the second session, 60% in the third session and 100% in the eleventh session. The mean and standard deviation of the incidence of inflammation in the first session was  $3.2 \pm 1.3$ . The mean and standard deviation of the severity of inflammation in the twelfth session was  $12.5 \pm 4.7$  (Table 4). Two-way ANOVA results showed that gender had a significant relationship with the incidence of inflammatory changes in the vascular access in hemodialysis patients ( $P < 0.048$ ). The location of vascular access did not have a significant effect on the changes in inflammation severity of the vascular access ( $P > 0.488$ ). Diabetes had a significant effect on the changes of inflammation severity of the vascular access ( $P < 0.028$ ).

**Table4: Incidence and severity of inflammation of the vascular access in hemodialysis patients**

Mean severity of inflammation and (mean±standard deviation )	12.5±4.7
Incidence of inflammation in the final session (percent)	100%

## Discussion

Except for the first session, in which patients showed no inflammation as per the inclusion criteria, an increasing trend in frequency of inflammation grade of zero in the groups starting from the second session until the end of the study was found. As the study progressed, the frequency of inflammation gradually increased, and the most frequently observed degrees of severity of inflammation were 1 and 2.

With the exception of one case with inflammation degree of 3 in the second session, 1 or 2 degrees of inflammation were observed in all the subjects until the seventh session. During the entire study period, degree of inflammation of 4 was not observed which may be due to the short study time or mitigation measures provided by nurses and doctors following elementary degrees of inflammation. These results are consistent with a study by Sarani et al. (3). The mean age in a study by Zinn (2010) (14) was 56.48±13.0 years, and in a study done by Boot (2005) in the Netherlands, it was 14.8±54.6 years (15). The mean age of the present study was about 18 years less than the aforementioned studies, which is probably due to the lower age of renal failure in Iran. The majority of participants were male (60%, or 66 participants). In terms of gender, this study was consistent with the results of Godsi et al. (55.1%), Taghinejad (56.7% or 51 participants), Adib (54.26% or 204 participants), Frasca (64.6%) and Brunicardi (71.4%) (17-21). This may be due to the fact that men are less concerned with their health and well-being,

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which changes their condition from acute to chronic disease. However, no study on incidence of renal failure in men was not found. Fistula was the most frequent vascular access type, which is consistent with the study by Khaninzadeh et al. In terms of vascular access failure and inflammation, the highest incidence of inflammation was observed in the recessive hand, which might be due to higher strength and blood flow of the dominant hand.

## Conclusion

According to the results of this study, inflammation in the vascular access for hemodialysis patients is a common complication. Paying attention to the severity of inflammation, even low degrees of it, is of utmost importance in patient-care. Because patients are susceptible to infection and vascular access failure, it is necessary to give special care to the patient's vascular access, and as a result, help to improve health and increase longevity. Guidelines such as nosocomial infection prevention, patients' use of masks and appropriate antiseptics and use of an appropriate antiseptic before starting dialysis may be helpful in reducing complications. Further studies in other parts of the country are recommended.

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