

Original Research Article

Effectiveness of hydropathic compress of dandelion in ameliorating complications of arteriovenous fistula

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Abstract

Purpose: To investigate the effect of dandelion hydropathic compress on the complications of autologous arteriovenous fistula (AVF).

Methods: From January to June 2019, a total of 162 patients treated with arteriovenous fistula for hemodialysis in the blood purification department of Affiliated Hospital of Jining Medical University were enrolled. They were randomly assigned at a ratio of 1:1 to receive either conventional infrared irradiation (control group) or conventional irradiation plus dandelion hydropathic compress (study group). The clinical endpoint was the amelioration of the complications of arteriovenous fistula after 6 months of treatment.

Results: Dandelion hydropathic compress combined with conventional infrared irradiation was associated with a significantly higher clinical efficacy (96.30 %) than conventional infrared irradiation alone (77.78 %). The application of dandelion hydropathic compress plus infrared irradiation resulted in significantly reduced pain, a better quality of life, and a lower incidence of complications ($p < 0.05$).

Conclusion: Dandelion hydropathic compress plus routine nursing and infrared irradiation lower the incidence of complications, improve blood flow, relieve pain, and enhance the quality of life of patients. Further clinical trials are needed to confirm the usefulness of this therapeutic strategy.

Keywords: Arteriovenous fistula, Dandelion hydropathic compress, Quality of life

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INTRODUCTION

Hemodialysis (HD) is the most common treatment for patients with end-stage renal disease (ESRD), accounting for 91.0 % of all dialysis patients [1]. Arteriovenous fistula (AVF) is the preferred vascular pathway for hemodialysis in ESRD patients [2]. Autologous arteriovenous fistulas provide sufficient blood flow for hemodialysis, with a long-term application, maintenance of blood flow, and few

complications [3]. Clinically, repeated punctures at the arteriovenous endovascular fistula in dialysis patients are associated with complications such as hematoma, stenosis, and infection, which compromise the quality of dialysis and life of the patient. Dandelion is a widely used medicinal and food plant for the treatment of respiratory infections, skin diseases, gastrointestinal disorders, diabetes, gynecological disorders, and other diseases. The main active components of dandelion are

phenolic acids, flavonoids, polysaccharides, sterols, terpenoids, and pigments. [4,5], and the pharmacological effects mainly include antibacterial, antioxidant, anti-gastric damage, anti-diabetes, anti-tumor, and anti-virus [6,7]. This study was conducted to assess the effect of dandelion hydrophatic compress on the complications of autologous arteriovenous fistula. The results are reported as follows.

METHODS

General profile of patients

From January to June 2019, 162 patients with AVF and scheduled for hemodialysis in Affiliated Hospital of Jining Medical University were enrolled and randomized to the control group or the study group. The study protocol was in line with Declaration of Helsinki [8].

Inclusion criteria

Patients who met the diagnostic criteria [9], and needed long-term hemodialysis at a frequency of 2 to 3 times a week; showed fistula located at the wrist joint and without any treatment in addition to routine care during its use; have complete medical records and follow-up data; patients and their families provided written informed consent.

Exclusion criteria

Patients who received hemodialysis without AVF; showed allergies to drugs used in this study; experienced communication disorders or mental illness, and inability to complete the experiment. The two groups showed similar baseline profile ($p > 0.05$, Table 1).

Ethical approval

This study was approved by the ethics committee of Affiliated Hospital of Jining Medical University (approval no. 2019-5-26), and followed international guidelines for human studies [8].

Treatments

Patients in both groups underwent hemodialysis using Fresenius and Berang hemodialysis machines (German), polysulfone hollow fiber dialyzer (1.4 m² - 1.8 m²), and bicarbonate (dialysate flow rate of 500 ml/min). The infrared irradiation was performed for the eligible patients using the same type of infrared machine (Shenzhen Pumen Technology Co. Ltd). The hemodialysis specialist nurses were responsible for the assessment, observation, and recording

of the occurrence of the complications in the two groups. The patients were then instructed by the nurses to complete the questionnaire for quality-of-life assessment.

Control group

The patients in the control group were given routine functional exercise and infrared radiation for 40 min (15 min after the beginning of dialysis and 30 min before the end of dialysis) during dialysis, 20 cm away from the heat source.

Study group

The patients in the study group were given routine functional exercise, infrared radiation for 40 min (15 min after the beginning of dialysis and 30 min before the end of dialysis) during dialysis, 20 cm away from the heat source, and dandelion hydrophatic compress. 20g of dandelion was macerated in 250 mL ethanol (75 %) (Shandong Lircon Disinfection Technology Co., Ltd.) for 7 days.

24 h after the dialysis, the soaked aseptic gauze was applied to the vessels along their course and covered with cling film, and a hot towel with a temperature of 40-45°C was applied externally to the internal fistula vessels for 20 - 30 min, 2 - 3 times a day.

Evaluation of treatment indicators

Complications experienced by patients

Vascular stenosis: 10 minutes after the beginning of dialysis, the blood flow was adjusted to 200 ml/min. The arteriovenous pressure was monitored to eliminate puncture and coagulation. A low arterial pressure accompanied by blood flow aspiration indicated stenosis at the arterial end of the fistula, and high venous pressure indicated stenosis at the venous ends of the fistula [10].

Internal fistula embolism: Pulsation was weakened or disappeared in severe cases at the position of AVF. Blood flow decreased during dialysis. Poor fixation of the AVF vessels, rigidity of the cords, and high difficulty of fixation were found. The AVF position was red and swollen, and painful when touched. No murmur was detected on auscultation of the AVF.

Infection: Redness, swelling, heat, and painful infection of the skin near the internal fistula were observed.

Table 1: General profile of patients

Items		Study group (n = 81)	Control group (n = 81)	χ^2/t	P-value
Gender	Male	43	46	0.22	0.636
	Female	38	35		
Age (years)		57.47±14.38	58.65±18.71	0.45	0.653
Types of diseases	Chronic glomerulonephritis	25(30.86)	21(25.93)	0.69	0.952
	Diabetic nephropathy	21(25.93)	23(28.40)		
	Hypertensive nephropathy	19(23.46)	21(25.93)		
	Polycystic kidneys	5(6.17)	4(4.94)		
	Others	11(13.58)	12(14.81)		
Fistula use duration (years)	< 5	52(64.20)	48(59.26)	0.91	0.636
	5-10	20(24.70)	21(25.93)		
	> 10	9(11.11)	13(16.05)		

Vascular induration: A streaky and hard nodule to palpation of the arteriovenous endovascular fistula or a localized hard nodule greater than 1 cm in diameter was found at the puncture site.

Aneurysm: the dilated blood vessel was an arterialized vein with a diameter of more than 3 cm.

Subcutaneous hematoma: subcutaneous hemorrhage with a diameter larger than 1mL was found.

Clinical efficacy

Clinical efficacy of treatment was categorized as cured, markedly effective, effective, and ineffective according to the degree of vasomalacia, hemodialysis blood flow, and absorption of hematoma [11].

Cured: The vessels around the AVF were softened with good vascular elasticity, blood flow was 200 - 250 mL/min, and hematoma absorption was less than 5 days.

Markedly effective: The vessels around the AVF were softened, the blood flow in dialysis was 200 - 250 mL/min, and the hematoma was absorbed for 6 - 10 days.

Effective: No significant softening of the vessels was seen, and there were still hard nodes with blood flow of 180 - 200 mL/min and hematoma absorption time of 11-14 days.

Ineffective: Localized perivascular stiffness, petechiae, and spots, poor vascular elasticity were found, with blood flow <150 mL/min and hematoma absorption for over 14 days. Overall efficacy was expressed as the sum of cured, markedly effective and effective cases, divided by total cases, and expressed as a percentage.

Pain

The visual analogue scale [12] was used for pain assessment. (0 points: painless; 1 - 3 point(s): mild pain, 4 - 6 points: moderate pain, 7 - 10 points: severe pain).

Quality of life

SF-12 scale [13] was divided into physical component summary (PCS) and mental component summary (MCS) [6]. The PCS includes general health (GH), physical functioning (PF), role physical (RP), and bodily pain (BP). MCS includes vitality (VT), social function (SF), role emotional (RE), and mental health (MH). The scores of each domain were converted into standardized scores according to the formula. The total scores of MCS and PCS ranged from 0 to 100 points. The higher the score, the better the quality of life.

Statistical analysis

The data were analyzed by SPSS 20.0. Count data were processed by chi-squared test while measurement data are expressed as mean ± standard deviation (SD); *t*-test was used for inter-group comparison, while paired *t* test was applied for comparisons between pre- and post-intervention data. Differences were considered statistically significant at $p < 0.05$.

RESULTS

Complications of arteriovenous fistula

The incidence of stenosis, embolization, infection, vascular induration, aneurysm, and subcutaneous hematoma in the study group were significantly lower than those in the control groups ($p < 0.05$, Table 2).

Table 2: Comparison of complications of arteriovenous fistula between the two groups

Variable	Control group (n = 81)	Study group (n = 81)	χ^2	P-value
Stenosis	14(17.28)	4(4.94)	162.00	0.000
Embolism	9(11.11)	2(2.47)	162.00	0.000
Infection	5(6.17)	1(1.23)	162.00	0.000
Vascular scleroma	17(30.30)	5(9.09)	163.00	0.000
Arterial aneurysm	11(13.80)	3(18.18)	162.00	0.000
Subcutaneous hematoma	26(32.10)	9(11.11)	163.00	0.000

Table 3: Comparison of clinical efficacy between the two groups

Variable	Control group (n = 81)	Study group (n = 81)	χ^2	P-value
Cured	27(33.33)	38(46.92)		
Markedly effective	21(25.92)	24(29.63)		
Effective	15(18.52)	17(20.99)	14.99	0.002
Ineffective	18(22.22)	2(2.47)		
Overall efficacy	77.78%	96.30%		

Table 4: Comparison of pain level between the two groups

Item	Severe	Moderate	Mild	No pain	Incidence of adverse reactions
Control group (n = 81)	13(16.05)	25(30.86)	31(38.27)	12(14.81)	85.19%
Study group (n = 81)	7(8.64)	18(22.22)	21(25.93)	35(43.2)	56.79%
χ^2	16.12				
P-value	0.001				

Table 5: Comparison of incidence of adverse reactions between the two groups

Variable	Control group (n = 81)	Study group (n = 81)	T-value	P-value
GH	65.01±21.94	73.21±24.84	2.23	0.027
PF	61.72±25.94	69.97±24.64	2.08	0.039
RP	64.5±28.97	73.43±27.47	2.01	0.046
BP	61.09±26.57	69.41±25.71	2.03	0.045
MH	49.46±27.03	58.41±27.78	2.09	0.039
VT	65.94±20.78	72.86±21.66	2.07	0.039
SF	56.41±23.69	67.75±24.48	2.99	0.003
RE	63.74±29.64	74.48±30.04	2.29	0.023
Overall score	58.61±10.85	63.92±11.34	3.05	0.003

Clinical efficacy

In the experimental group, blood flow was improved ($p < 0.05$), the number of cases decreased, the time of vasomalacia and hematoma absorption was also shortened. dandelion hydrophatic compress plus infrared irradiation was associated with a significantly higher clinical efficacy (96.30 %) versus infrared irradiation alone (77.78 %, Table 3).

Pain level in arterial and venous punctures, and pain level after hematoma

Dandelion hydrophatic compress plus infrared irradiation was associated with a lower incidence of pain (Table 4) and better quality of life (Table 5) of patients versus infrared irradiation ($p < 0.05$)

DISCUSSION

Patients on hemodialysis with AVF are mostly associated with underlying diseases such as hyperlipidemia and diabetes, which are predisposed to complications such as skin infections, redness, and swelling, and severe complications of AVF will result in discontinuation of proper dialysis treatment. Clinical studies have confirmed [14,15] that infrared irradiation is currently the optimal method for fistula repair, allowing heat to penetrate deep into the vascular-rich dermis and subcutaneous tissue [16] and diffuse with the flow of blood, resulting in increased tissue temperature, capillary dilation, accelerated blood flow, increased cellular viability, and regenerative capacity of material metabolism, microvascular dilation, and endovascular function repair, which increases endovascular blood flow, dilates the internal

diameter of the vessel and restores the elasticity of the vessel wall. Infrared irradiation significantly improves the 1-year utilization of the fistula, maintains blood flow, and reduces complications. However, infrared therapy is required during dialysis, which fails to meet the patient's needs for home care of the arteriovenous fistula.

Pharmacological studies have shown that dandelion can inhibit various pathogenic microorganisms such as bacteria, fungi, and pathogens [17,18], and especially its flavonoids are effective in suppressing various pathogenic microorganisms and dilating blood vessels. Dandelion hydrophatic compress scavenges excessive free radicals in human skin tissue and superoxide radicals that are extremely damaging to the skin, thereby reducing hematoma and thrombosis and decreasing the incidence of internal fistula stenosis and embolism. Dandelion can prevent and control vascular sclerosis. In the present study, dandelion hydrophatic compress plus infrared irradiation was associated with a lower incidence of subcutaneous hematoma, vascular sclerosis, fistula occlusion, and fistula stenosis infection versus infrared irradiation alone.

Frequent punctures in hemodialysis will repeatedly stimulate the vessel wall, which is susceptible to inflammatory reactions in the local vessel wall, resulting in striated changes in the arteriovenous endovascular vessels, significant redness, swelling, and pain, which in severe cases leads to damage to the nerves on the side of the fistula and severely compromises the treatment efficacy [19]. Previous research has pointed out that the flavonoids in dandelion exhibit good systemic and peripheral analgesic and skin antioxidant effects [20]. Dandelion hydrophatic compress contributes to promoting vascular repair, improving local microcirculation and vascular permeability, boosting the metabolism of harmful substances, reducing the local temperature, and relieving patients' pain and discomfort. Moreover, it reduces the sensitivity of nerve ends in patients and promotes the dissipation of local inflammation [21]. Herein, dandelion hydrophatic compress plus infrared irradiation resulted in a significantly higher clinical efficacy versus single treatment of infrared irradiation, indicating that the combined therapy can better promote the absorption of subcutaneous hematoma, reduce the duration of local swelling and the compression of surrounding tissues, provide rapid pain relief, and lower the incidence of complications associated with fistulae, thus prolonging their service life [22].

CONCLUSION

Dandelion hydrophatic compress along with routine nursing and infrared irradiation lower the incidence of complications, improve blood flow, relieve pain, and enhance the quality of life of patients. Initial exploration on the effect of hydrophatic application of dandelion in clinical practice provides a new idea for improving the complications of arteriovenous fistula and is worthy of reference and further research. Further clinical trials are needed to confirm the usefulness of this therapeutic strategy.

DECLARATIONS

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Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them.

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