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Hemodialysis outcome associated with basilic vein transposition or synthetic vascular grafting: a single-center study

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Abstract. ***Background.*** *For hemodialysis, an autogenous radiocephalic or brachiocephalic fistula is the preferred types of vascular access, while basilic vein transposition (BVT) fistula followed by prosthetic grafting is suggested if unsuitable veins are present. The purpose was to compare the outcome of BVT versus synthetic vascular graft used for dialysis in a single centre.* ***Materials and methods.*** *This study includes total of 148 patients that subdivided into two groups: group one (n = 127; 69 male and 58 female patients, mean age 49 years) operated with BVT and group two (n = 21; 15 male and 6 female individuals, mean age 58 years) operated with synthetic vascular graft.* ***Results.*** *Seven patients with hematoma were treated with exploration within 7 days of operation (p = 0.001). Venous hypertension was present in 3 patients of group one and no patient in group two (p = 0.001). In group one, the complication rate was 13.38 %, while in group two, it was 28.57 % with statistically significant difference (p = 0.001). In group one, primary patency rate is 96.85 versus 90.47 % in group two (p = 0.07). The assisted primary in group one was 75 % versus no patient assisted in group two (p = 0.001).* ***Conclusions.*** *This study concludes that use of synthetic graft for dialysis is associated with more complications regarding thrombosis rate, ischemic steal syndrome and infection rate compared to using the basilic vein. In addition to that, the successful rate of embolectomy was low with synthetic graft use.*

Keywords: *hemodialysis; basilic vein; synthetic graft; chronic kidney disease*

Introduction

With improvements of medical care, the increasing number of end stage renal diseases (ESRD) patients and with limited number of kidney donors, the demand for long-term dialysis was increased to reach about 70 % of patients require either hemodialysis or peritoneal dialysis [1]. Many authors prefer an arteriovenous graft for hemodialysis because of complexity of other procedures like basilic vein transposition or graft [2].

In patients with chronic kidney disease (CKD), according to Kidney Disease Outcome Quality Initiative (KDOQI) guidelines, an autogenous radiocephalic or brachiocephalic fistula is the preferred types of vascular access, while basilic vein transposition (BVT) fistula and followed by prosthetic grafts is suggested if unsuitable veins are present [3–6]. According to KDOQI guidelines, adequate AVF maturation time is 4–6 weeks with that resides approximately 0.6 cm from the skin surface, has a flow > 600 mL/min, and has a diameter > 0.6 cm, while the synthetic graft can be used within 2 weeks [7, 8]. The use of antiplatelets and length of period postoperatively is controversy [9, 10].

This study compares the outcome of basilic vein transposition versus synthetic vascular graft used for dialysis in single centre.

Materials and methods

Study design and setting

This is a cohort comparative prospective study that was done in Najaf cardiothoracic and vascular surgery department of Al-Sadder Teaching Medical City of Najaf, Iraq from January 2020 to January 2022.

Participants

This includes total of 148 patients that subdivided into two groups, group one operated with basilic vein transposition and group two operated with synthetic vascular graft.

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Group one includes 127 patients and group two includes 21 patients. All patient's data are collected regarding age, gender, side of surgery, type of intervention and previous access for two years duration.

Follow-up

The outcome was followed for one year (from December 2021 to December 2022) later clinically and with duplex study by both surgeon and nephrologist.

Including/excluding criteria

During the two years of study, a total of 661 patients have a CKD referred from Nephrology Centre to vascular surgery clinic for making an vascular access for dialysis, from them 583 patients underwent a arteriovenous fistula (AVF) for dialysis in form of radio-cephalic (RC) or brachiocephalic (BC) fistula. 61 patients were RC or BC AVF were failed and 66 patients have unsuitable veins for fistula of less than 2 mm (total of 127 patients), a single stage basilic vein transposition can be done. Twelve patients have unsuitable basilic vein of less than 2 mm and 9 patients have failed basilic vein transposition (total of 21 patients), a synthetic vascular graft could be used. The study flowchart showed in Fig. 1.

Investigation

All patients underwent a doppler study to assess the diameter and patency of cephalic vein, basilic veins, axillary veins and brachial artery of both sides. Also, to assess both subclavian vein, jugular veins and innominate vein if they are stenosed or thrombosed as this contra-indicated to surgery (they excluded from the study) and may need for preoperative endovascular intervention.

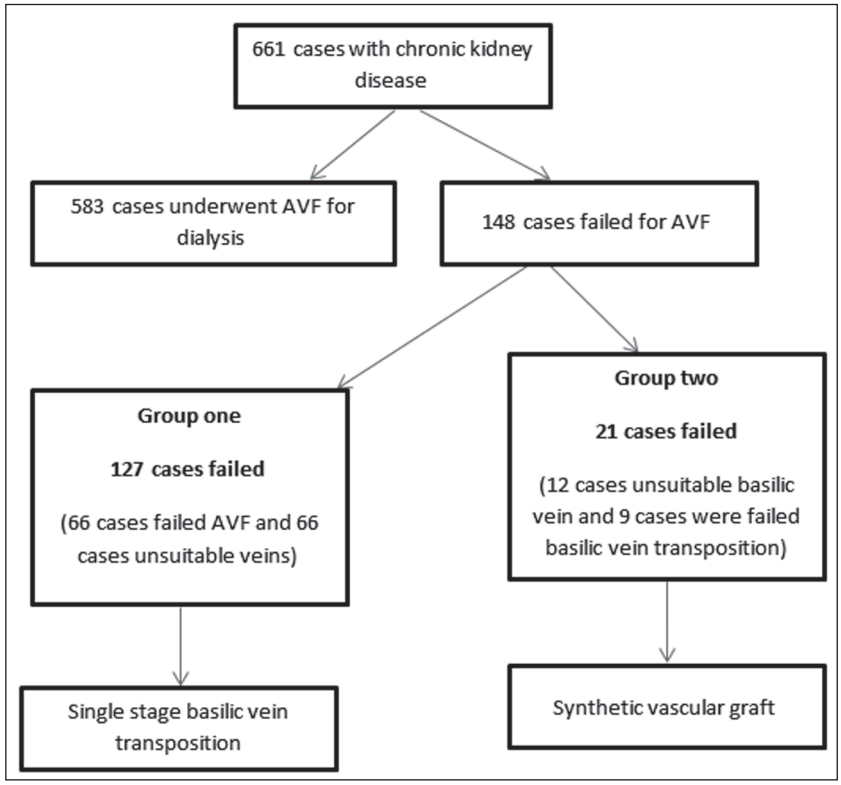

Figure 1. The study flowchart

Procedures

After an intra-venous antibiotic use, basilic vein transposition was done under local anaesthesia and sedation with arm extend away from the body. After scrubbing, two incisions were done, one longitudinal along the basilic vein at mid arm and another curve incision at medial cubital area. Mobilisation and change the course of basilic vein along its length more superficially and more laterally, then made end to side anastomoses to brachial artery with 0/6 proline. The fistula was used after 6–8 weeks for dialysis after criteria of maturation was reached (flow > 600 ml/min, diameter > 6 mm and depth < 6 mm).

After an intra-venous antibiotic use, synthetic vascular graft was operated under local anaesthesia and sedation with arm extended laterally. In 12 patients, two incisions were done, one longitudinal incision and another transverse one in cubital area. In nine patients, single incision in mid arm was done. In both, the 6th sized graft of different length with end to side anastomoses between brachial artery and third part of axillary vein was used with 0/6 proline. The graft was used after 2 weeks for dialysis. Anti-platelets were given for 3 months later on.

Patients complications were assessed postoperatively and followed for one year later on in form of thrombosis, infection, hematoma formation, non-maturation of fistula, ischemic steal syndrome, removal of fistula or graft and embolectomy surgery as an assisted primary patency procedure.

Ethical approval and compliance

This study was approved by the Ethical Board Committee of the Department of Surgery, Jabir Ibn Hayyan Medical University (No. 305 in 12/1/2022). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The oral consent was taken from all patients and data between both groups was analysed.

Statistical analysis

Statistical analyses were conducted using SPSS v22 (IBM Inc., Chicago, IL, USA). Numerical measurements including percentages and frequencies. Calculations performed for categorical data included means, ranges, and standard deviations (SD). The association between variables was evaluated using the chi-squared test and unpaired t-test. Statistical significance was set at $P < 0.05$.

Results

The median age for group one treated with basilic vein transposition for dialysis is 49 years and for group two treated with synthetic vascular graft is 58 years. There

are 69 patients male and 58 patients female in group one, while 15 patients were male and 6 patients were female in group two. In group one, the surgery was done in 50 patients on right side and 77 patients on left side, while the surgery was done in group two in 16 patients on right side arm, four patients on left side arm and one patient on right sided thigh, as in Table 1 below.

Regarding the outcome and complications, in group one, the complication rate was 13.38 % in 17 patients as 3 patients with wound infection, 4 patients with thrombosis within one month that treated with embolectomy and 7 patients with hematoma that were treated with exploration within 7 days of operation (p = 0.001). Venous hypertension was presented in three patients of group one (p = 0.001). In group two, the rate of complications was 28.57 % in six out of 21 patients. The complications (Fig. 2) are distributed as one patient with superficial wound infection of right arm, two patients with graft thrombosis (one after one month and another one after 9 months of both right arm, both were removed) and one patient with ischemic steal syndrome of left arm that was treated with saphenous grafted distally after one week of surgery, as showed in Tables 2, 3. The algorithm of actions of this study was showed in Fig. 3.

Regarding the patency rate might be either primary or assisted primary (with interventions). In group one, primary patency rate is 96.85 versus 90.47 % in group two (p = 0.07). The assisted primary of group one was 75 % versus no patient assisted in group two (p = 0.001), as listed in Table 4.

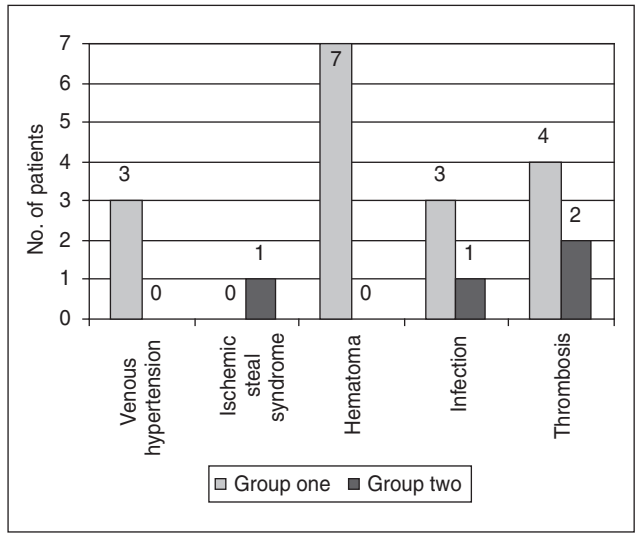

Figure 2. Complications of study

Table 1. Data collection of patients, n (%)

Data		Group one	Group two	P-value
Age (years), range (median)		23–73 (49)	45–77 (58)	0.12
Gender	Male	69 (54.33)	15 (71.42)	0.23
	Female	58 (45.66)	6 (28.57)	
Side of surgery	Right arm	50 (39.37)	16 (76.19)	0.001
	Left arm	77 (60.62)	4 (19.04)	
	Right thigh	0	1 (4.76)	
Previous access		61 (48.03)	9 (42.85)	0.24

Table 2. Complications of both procedures, n (%)

Outcome	Group one	Group two	P-value
Thrombosis	4 (3.14)	2 (9.52)	NA
Infection	3 (2.36)	1 (4.76)	NA
Hematoma	7 (5.51)	0	0.001
Ischemic steal syndrome	0	1 (4.76)	NA
Venous hypertension	3 (2.36)	0	0.001
Total complications	17 (13.38)	6 (28.57)	0.001

Note: NA — not applicable.

Table 3. Postoperative procedure management for variable complications, n (%)

Procedure	Group one	Group two	P-value
Successful embolectomy for thrombosis	3 (75)	0	0.001
Removal	1 (25)	2 (100)	0.08
Re-vascularisation	0	1 (100)	0.001

Table 4. Patency rate of both groups, n (%)

Patency rate	Group one	Group two	P-value
Primary	96.85	90.47	0.07
Assisted primary	75	0	0.001

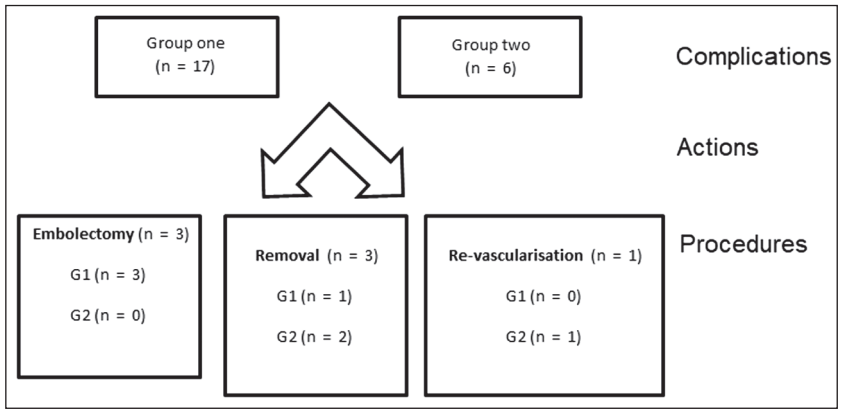

Figure 3. The algorithm of actions of this study

Discussion

This is a cohort comparative prospective study that was done in single centre for two years duration and followed the outcome for one year. This includes total of 148 patients that subdivided into two groups, group one operated with Basilic vein transposition (127 patients) and group two operated with synthetic vascular graft (21 patients).

According to KDOQI guidelines, BVT and synthetic vascular graft were done after exhausted other sites for autologous options [11, 12]. Although the two-stage technique for BVT with interval arterialisation and thickening of the basilic vein wall is superior and the complications in single stage BVT were more like steal syndrome, venous hypertension and hematoma formation [13–15], in this study, single stage BVT was used to decrease morbidity of high risk and commonly tired patients and to decrease the time needed for dialysis. As a results, in Table 1, the BVT was done in 48.03 % with previous access and the synthetic graft was done in 42.85 % with previous access.

The mean of age of patients involved in group one is 49 years while in group two is 58 years. In both groups, male percentage was more than in female (54.33 versus 71.42 %). In Keuter et al. study, the mean age in group one and two was (60 versus 66 years) and the male percentage was 50 and 57 % in both groups [16].

The infection rate was more with PTFE group with incidence of 2.36 % in group one and 4.76 % in group two, that is comparable to Dix et al. study which is 3.6 % and Coburn et al. study [17, 18]. The infection may be due to preoperative contamination or puncture site contamination due to bad sterilisation in low immunity patients.

The thrombosis rate was more in group two of synthetic vascular graft as in Wijnen et al. study [19]. This thrombosis was due to either presence of infection or non-complained patients to anticoagulant or anti-platelets. The thrombosis was failed to treat in one patient (25 %) of group one and in both patients of group two (100 %), so the graft or fistula were removed. This complication affects both the primary and assisted primary patency rate with significant P-value. The primary patency rate that was dependent on patient condition, state of vein selection and close follow up of patients, is more than assisted primary patency rate and it is more in group one than group two [16, 20, 21].

In studies, the risk of post-operative hematoma 3.6–11 % [22–24]. In this study, hematoma was observed in 5.51 % of group one and in no patient of group two. This hematoma was more in group one as this a single stage procedure with more dissection of the tissue.

Ischemic steal syndrome occurred more in group two about 4.75 % (revascularisation was done successfully) and no patient in group one had it. In Abbas et al. study, ischemic steal syndrome was more in AVG group with significant P-value [25]. The incidence was 10–20 % and more with proximal basilic transposition than in distal type at the level of radial artery [26, 27].

Transient venous hypertension present with limb oedema, heaviness and delayed wound healing present only in group one in about 2.36 % that is treated conservatively. This may be due to stenosis of proximal veins because of fibrosis that results from multiple use of short-term double lumen catheter for dialysis. Venous hypertension has been reported to occur more than our study about 3.6–25 % [28].

Several studies discussed different topics of hemodialysis [29, 30], however, different limitation were recorded. In this work the limitation include a single-centre and difficult follow up to these patients. So, more studies, more patients need to be followed and multi-centres study required which is very important and hazardous complications of these patients.

Conclusions

This study concludes that use of synthetic graft for dialysis is more complications regarding thrombosis rate, ischemic steal syndrome and infection rate in comparison to using the basilic vein. In addition to that, the success rate of embolectomy is low with synthetic graft use.

References

1. Segura-Orti E, Koufaki P, Kouidi E. Bridging the gap from research to practice for enhanced health-related quality of life in people with chronic kidney disease. Clin Kidney J. 2021 May 6;14(Suppl 2):ii34-ii42. doi: 10.1093/ckj/sfaa268.

2. Kakkos SK, Lampropoulos GC, Nikolakopoulos KM, et al. A Systematic Review and Meta-Analysis of Randomized Trials Comparing Two-Stage with One-Stage Brachio-Basilic Vein Fistulas. Vasc Specialist Int. 2018 Sep;34(3):51-60. doi: 10.5758/vsi.2018.34.3.51.

3. Noori N, Sharma Parpia A, Wald R, Goldstein MB. Validation of the SMH Equations for the Estimation of the Total Body Water Volume in Hemodialysis Patients. Can J Kidney Health Dis. 2022 Nov 22;9:20543581221137180. doi: 10.1177/20543581221137180.

4. Porazko T, Piersiak A, Klinger M. The efficacy of single suture for exit site wound closure and stabilization of hemodialysis central tunneled catheter. SAGE Open Med. 2021 May 28;9:20503121211019889. doi: 10.1177/20503121211019889.

5. Almhanni G, Sen I, Vang S, et al. Midterm outcomes of endoscopic-assisted brachial-basilic arteriovenous fistula creation. J Vasc Surg Cases Innov Tech. 2023 Nov 26;10(2):101382. doi: 10.1016/j.jvscit.2023.101382.

6. Lu Y, Xiao J, Liu C, Wang Y. Comparison of wound complications between one-stage and two-stage brachiobasilic arteriovenous fistula: A meta-analysis. Int Wound J. 2023 Nov;20(9):3786-3793. doi: 10.1111/iwj.14278.

7. Li H, Jen S, Ramayya T, Bowers HG, Rotem E. Unanticipated late maturation of an arteriovenous fistula after creation of separate graft access. Quant Imaging Med Surg. 2018 May;8(4):444-446. doi: 10.21037/qims.2018.01.03.

8. Al Shakarchi J, Houston G, Inston N. Early cannulation grafts for haemodialysis: a systematic review. J Vasc Access. 2015 Nov-Dec;16(6):493-497. doi: 10.5301/jva.5000412.

9. Tanner NC, Da Silva A. Medical adjuvant treatment to increase patency of arteriovenous fistulae and grafts. Cochrane Database Syst Rev. 2015;7:CD002786. doi: 10.1002/14651858.CD002786.pub3.

10. Migliori M, Cantaluppi V, Scatena A, Panichi V. Antiplatelet agents in hemodialysis. J Nephrol. 2017 Jun;30(3):373-383. doi: 10.1007/s40620-016-0367-5.

11. Iglesias R, Lodi M, Rubiella C, Teresa Parisotto M, Ibeas J. Ultrasound guided cannulation of dialysis access. J Vasc Access. 2021 Nov;22(Suppl 1):106-112. doi: 10.1177/11297298211047328.

12. Kaller R, Russu E, Arbănași EM, et al. Intimal CD31-Positive Relative Surfaces Are Associated with Systemic Inflammatory Markers and Maturation of Arteriovenous Fistula in Dialysis Patients. J Clin Med. 2023 Jun 30;12(13):4419. doi: 10.3390/jcm12134419.

13. Deguchi J, Sato O. Transposed Brachial-Basilic Arteriovenous Fistula for Vascular Access in Japan. Ann Vasc Dis. 2018 Jun 25;11(2):181-190. doi: 10.3400/avd.ra.18-00009.

14. Patel RJ, Willie-Permor D, Zarrintan S, Elsayed N, Al-Nouri O, Malas MB. Two-Stage Offers No Advantages over Single-Stage Arteriovenous Creation: An Analysis of Multicenter National Data. Ann Vasc Surg. 2023 Oct;96:308-315. doi: 10.1016/j.avsg.2023.03.020.

15. Kakkos SK, Tsolakis IA, Papadoulas SI, et al. Randomized controlled trial comparing primary and staged basilic vein transposition. Front Surg. 2015 Apr 29;2:14. doi: 10.3389/fsurg.2015.00014.

16. Sadasivan K, Kunjuraman U, Murali B, Yadev I, Kochunarayanan A. Factors Affecting the Patency of Radiocephalic Arteriovenous Fistulas Based on Clinico-Radiological Parameters. Cureus. 2021 Mar 3;13(3):e13678. doi: 10.7759/cureus.13678.

17. Sadeghi A, Setayesh Mehr M, Esfandiari E, Mohammadi S, Baharmian H. Variation of the cephalic and basilic veins: A case report. J Cardiovasc Thorac Res. 2017;9(4):232-234. doi: 10.15171/jcvtr.2017.40.

18. Van Dellen D, Junejo M, Khambalia H, Campbell B. Transposition of brachiobasilic arteriovenous fistulae: improving the cosmetic effect without compromising patency. Ann R Coll Surg Engl. 2016 Jan;98(1):24-28. doi: 10.1308/003588414X14055925061757.

19. Laranjinha I, Matias P, Azevedo A, et al. Are high flow arteriovenous accesses associated with worse haemodialysis? J Bras Nefrol. 2018 Apr-Jun;40(2):136-142. doi: 10.1590/2175-8239-JBN-3875.

20. Moosa MA, Shaikh FA, Ali M, Salam A, Sophie Z, Siddiqui N. Comparison of Upper Limb Translocated Femoral Vein and Prosthetic Arteriovenous Bridge Grafts. Cureus. 2019 Nov 22;11(11):e6219. doi: 10.7759/cureus.6219.

21. Xiao Y, Vazquez-Padron RI, Martinez L, Singer HA, Woltmann D, Salman LH. Role of platelet factor 4 in arteriovenous fistula maturation failure: What do we know so far? J Vasc Access. 2024 Mar;25(2):390-406. doi: 10.1177/11297298221085458.

22. Jairath A, Singh A, Sabnis R, Ganpule A, Desai M. Minimally invasive basilic vein transposition in the arm or forearm for autogenous haemodialysis access: A less morbid alternative to the conventional technique. Arab J Urol. 2017 Mar 6;15(2):170-176. doi: 10.1016/j.aju.2017.01.004.

23. Jeong H, Bae M, Chung SW, Lee CW, Huh U, Kim MS. Videoscopic Surgery for Arteriovenous Hemodialysis Access. Korean J Thorac Cardiovasc Surg. 2020 Feb;53(1):28-33. doi: 10.5090/kjtcs.2020.53.1.28.

24. Kahraman N, Demir D. Outcomes of arteriovenous fistula reconstruction in vascular access dysfunction. Am J Transl Res. 2019 Feb 15;11(2):1058-1065.

25. Saroukhani A, Rafiee Zadeh A, Ahmadi SM. Incidence of steal syndrome following arteriovenous fistula and arteriovenous graft. Int J Burns Trauma. 2022 Jun 15;12(3):121-126.

26. Lookstein RA, Haruguchi H, Ouriel K, et al.; IN.PACT AV Access Investigators. Drug-Coated Balloons for Dysfunctional Dialysis Arteriovenous Fistulas. N Engl J Med. 2020 Aug 20;383(8):733-742. doi: 10.1056/NEJMoa1914617.

27. Karaca OG, Basal AN, Ecevit AN, Kalender M, Darcin OT, Sungur MA. Radiobasilic Versus Brachiobasilic Transposition on the Upper Arm to Avoid Steal Syndrome. Med Sci Monit. 2015 Dec 29;21:4090-4095. doi: 10.12659/msm.896642.

28. Sepas HN, Negahi A, Mousavie SH, Vosough F, Farazmand B. Patency and outcomes of tunneled hemodialysis catheter via femoral versus jugular vein access. J Adv Pharm Technol Res. 2019 Apr-Jun;10(2):81-84. doi: 10.4103/japtr.JAPTR_383_18.

29. Solanki PB. Autologous vein graft in living donor kidney transplant (case report). Kidneys. 2024;13(2):172-174. doi: 10.22141/2307-1257.13.2.2024.457.

30. Ivanova MD. The role of levocarnitine in the systemic therapy of patients of different profile of patients on chronic hemodialysis. Kidneys. 2014;(1):81-84. Ukrainian. doi: 10.22141/2307-1257.0.1.07.2014.76553.

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Conflicts of interests. Authors declare the absence of any conflicts of interests and own financial interest that might be construed to influence the results or interpretation of the manuscript.

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Результати гемодіалізу, пов'язані із транспозицією медіальної підшкірної вени руки або синтетичним судинним протезуванням: одноцентрове дослідження

Резюме. Актуальність. Для гемодіалізу кращим типом судинного доступу є автогенна радіоцефальна або брахіоцефальна фістула, тоді як фістула при транспозиції медіальної підшкірної вени руки (ТМПВР) і подальше використання протезного шунта пропонують, якщо присутні невідповідні вени. **Мета:** порівняти результат використання ТМПВР та синтетичного судинного протеза для діалізу в одному центрі. **Матеріали та методи.** У цьому дослідженні взяли участь 148 пацієнтів, розділені на дві групи: першу (n = 127; 69 чоловіків і 58 жінок, середній вік 49 років), у якій використано ТМПВР, і другу (n = 21; 15 чоловіків та 6 жінок, середній вік 58 років), пацієнтів якої прооперовано із застосовуванням синтетичного судинного протеза. **Результати.** Семи пацієнтам із гематомою проведено ревізію протягом 7 днів після операції (p = 0,001). Венозну гіпертензію діагностовано в трьох пацієнтів першої групи, у другій групі її не було (p = 0,001). У першій групі частота ускладнень становила 13,38 %, тоді як у другій — 28,57 % зі статистично значущою різницею (p = 0,001). У першій групі первинну прохідність зареєстровано в 96,85 % випадків проти 90,47 % у другій групі (p = 0,07). Частота асистованої первинної прохідності в першій групі дорівнювала 75 %, у другій — 0 % (p = 0,001). **Висновки.** Дослідження показало, що використання для гемодіалізу синтетичного протеза викликає більше ускладнень, як-от частота тромбозів, синдром ішемічного обкрадання та інфекції, ніж доступ через медіальну підшкірну вену руки. Крім того, успішність емболектомії була низькою при застосуванні синтетичного протеза.

Ключові слова: гемодіаліз; медіальна підшкірна вена руки; синтетичний протез; хронічні захворювання нирок