EFFECT OF HEPARIN ON THE PATENCY OF ARTERIOVENOUS FISTULA

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Abstract- Patients with end stage renal disease need a good vascular access for hemodialysis. Arteriovenous fistula is the method of choice for vascular access in these patients. However, failure of arteriovenous fistula due to thrombosis is a major problem. The aim of this study was to evaluate the effect of the heparin on the patency of the arteriovenous fistula. This prospective interventional case control study was performed from November 2003 through May 2005 in vascular surgery ward in Imam Reza Hospital. All the patients who underwent a surgery in order to perform an arteriovenous fistula in cubital or snuff box areas for the dialysis means were enrolled. They were randomly divided into two groups. The case group (n = 96) received intraoperative heparin whereas the controls (n = 102) did not. Early observation of arteriovenous fistula (immediately after surgery) showed patency in 89% of heparin group and in 87% of the control group. The patency rate 2 weeks after the surgery was 85% in heparin group versus 74% in the control group, resulting in a statistically significant difference (*P* value = 0.046). According to higher patency rate of arteriovenous fistula in 2 weeks following surgery in case group, we recommend intraoperative use of heparin in arteriovenous fistula operations.

Acta Medica Iranica 2008; 46(5): 379-382.

Key words: Arteriovenous fistula, heparin, complications, hemodialysis

INTRODUCTION

The number of the patients who need long term vascular access for hemodialysis is increasing nowadays. On the other hand, having a patent vascular access is necessary for a sufficient blood flow in order to achieve a good hemodialysis.

Received: 11.Nov. 2007, Revised: 14 Feb. 2008, Accepted: 13 May 2008

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In order to perform vascular access, different methods have been introduced. Native arteriovenous fistula is accepted to be the method of choice. In this method, an arteriovenous anastomosis is established in an extremity through which blood flows from artery to vein and so a considerable amount of blood with a convenient velocity enters the hemodialysis machine. Creating a patent arteriovenous fistula is a complex procedure as it requires finding the best location, most accurate technique and at last an efficient post operational care (1). Patency and long term function of a arteriovenous fistula depends on several factors including patients blood pressure,

coagulation state, the site of the fistula, type of the fistula, the technique of the operation and the drugs being used. Using the anticoagulant drugs and dilators during or after the operation yet remains controversial (2-4).

Early failure in the function of arteriovenous fistula is the most common complication reported in these patients. This can be the result of thrombosis or insufficient blood flow due to technical problems or the characteristic of the artery or vein used. Diabetic patients were shown to be more prone to thrombosis (5).

Prior studies were unable to show an acceptable report on the efficacy of heparin in patients who had undergone an operation to establish an arteriovenous fistula. In addition, most of them had been carried out retrospectively (6-10). The aim of this study was to evaluate the effect of the heparin on the patency of the arteriovenous fistula.

MATERIALS AND METHODS

This prospective interventional study was performed from November 2003 through May 2005 in vascular surgery ward in Imam Reza Hospital. After approval in our Institutional Ethics Committee, the patients who underwent a surgery in order to perform an arteriovenous fistula in brachio-cephalic (cubital) or snuffbox (radio-cephalic) areas for the hemodialysis means were enrolled. We obtained informed consent from all patients.

The suitable vessel for anastomosis was selected based on the physical examination findings. Veins greater than 2 mm in size were considered as suitable. In addition, palpation of radial and ulnar pulses prior to anastomosis was necessary. The patients with a positive history of coagulopathy and vasculitis, those with an arteriovenous fistula in an area rather than brachio cephalic or snuffbox, those with a prior attempt to perform a fistula in the same site and those who were not accessible for the postoperative follow up were excluded.

The patients were randomly divided in two groups. Randomization was achieved using sealed envelopes: group 1 received 5000 IU of heparin intravenously (after dissection and before anastomosis); the control group did not receive any drug. The patency of the arteriovenous fistula was then observed in different periods: after the operation, and 2 weeks following the operation in an outpatient clinic. In each visit patency of the arteriovenous fistula checked and evaluation was done for any complications. The patency of the arteriovenous fistula controlled by touching the thrill and auscultation the bruit.

The gathered data were entered in computer. Statistical analysis was performed by computer employing Chi square and Student's *t* test in the SPSS program.

RESULTS

A total of 198 patients were enrolled in this study: 96 (48.5%) in case and 102 in control group. The mean age of the patients in case and control groups was 48.4 ± 14.5 and 48.5 ± 16.4 years, respectively. There was no significant difference in the age of the two groups ($P = 0.941$).

Out of 123 males enrolled in this study, 60 (48.8%) were classified in group 1 (cases) and 63 (51.2%) in group 2 (controls); where as for the females this results was 36 (48%) versus 39 (52%). There was no a statistically significant correlation between gender and heparin injection in this study ($P = 0.915$).

The frequency of the heparin injection in patients with different sites of arteriovenous fistula is demonstrated in Table 1. No significant relation was found between the site of arteriovenous fistula and heparin injection ($P = 0.128$).

Table 1. The frequency of the heparin injection in patients with different sites of arteriovenous fistula

Site of Arteriovenous fistula	Received heparin		Did not received heparin		Total
	Frequency	Percent	Frequency	Percent	
Left brachio-cephalic	26	40.6	38	59.4	64
Left snuff box (radio-cephalic)	55	59.8	37	40.2	92
Right brachio-cephalic	10	47.6	11	52.3	21
Right snuff box (radio-cephalic)	11	52.4	10	47.6	21

Table 2. The patency of arteriovenous fistula in each group immediately and in 2 weeks of the surgery*

Patency of arteriovenous fistula		Received heparin	Did not received heparin
Immediately after the surgery	Patent	86 (89.6)	89 (87.3)
	Failure	10 (10.4)	103 (12.7)
Two weeks following the surgery	Patent	82 (85.4)	143 (74.5)
	Failure	14 (14.6)	49 (25.5)

*Data are given as number (percent).

Patency rate of arteriovenous fistula in the ward was 89% in heparin group and 87% in the control group; this difference was not found to be significant ($P = 0.609$).

In addition, the patency rate 2 weeks after the surgery was 85% in heparin group versus 74% of the other group, resulting in a statistically significant difference ($P = 0.046$). Table 2 outlines the patency rate in each group in the ward and 2 weeks of the surgery.

During this study hematoma occurred in four cases (three cases in heparin group and one in control group). There was no significant difference between the frequency of the hematoma in each group ($P = 0.173$). There was no evidence of heparin induced thrombocytopenia.

DISCUSSION

Heparin inhibits the coagulation. Effect of heparin on the patency of arteriovenous fistula has not been clarified in literature. However, the effect of heparin in preventing arteriovenous fistula's thrombosis has been appraised indirectly in several studies. Rollo *et al.* have compared the effect of heparin, aspirin and dipyridamole in preventing the thrombosis in arteriovenous fistula (3). In another study, the predictive factors for accomplishing a patent arteriovenous fistula were observed. In this study, the technique of the operation rather than the heparin injection was reported to be the most important factor in influencing this success (6).

Ciancio *et al.* have reported several cases of iatrogenic arteriovenous fistula as vascular complications in transplant surgeries. Heparin therapy was suggested in theses patients because they had a relatively higher risk of thrombosis in the transplanted organ (4).

The effect of the heparin on the survival of the vascular bypass has been observed in two studies; Ascer *et al.* suggested heparin to be an important therapeutical component in cases of synthetic infrapopliteal bypass, which should be prescribed in all these cases (5). Similarly, in another study carried out in Pennsylvania, heparin was shown to improve the outcome of the operation in cases with distal infrapopliteal synthetic bypass that needed additive arteriovenous fistula (6).

Present prospective interventional study has compared the patency rate of arteriovenous fistula in two intervals, early and 2 weeks after the surgery. A patent arteriovenous fistula was reported in 89.6% and 87.3% of group 1 and 2 early after the operation while the result was changed to 85.4% versus 74.5% in 2 weeks following the surgery. The difference between the two groups was found to be significant after 2 weeks (P value = 0.046). The arteriovenous fistula became non-functional in three of the four cases who developed hematoma (two cases in heparin group and one in control group).

In conclusion, this study has shown a higher patency rate of arteriovenous fistulas in patients who had received heparin intraoperatively. In other words, according to this study, intravenous intra-operative injection of heparin is recommended in the patients who need an arteriovenous fistula.

Acknowledgement

We are indebted to the Research and Development Center of Sina Hospital for their support.

Conflict of interests

The authors declare that they have no competing interests.

REFERENCES

1. Gordon E. Development of vascular access surgery. In: Wilson ES, editor. Vascular access. St. Louis: Saunders; 2002. P. 2-6.
2. Yerdel MA, Kesenci M, Yazicioglu KM, Döşeyen Z, Türkçapar AG, Anadol E. Effect of haemodynamic variables on surgically created arteriovenous fistula flow. Nephrol Dial Transplant. 1997 Aug;12(8):1684-1688.
3. Rollo HA, Maffei FH, Yoshida WB, Lastória S, Curi PR, Mattar L. Heparin, heparin plus ASA and dipyridamole, and arteriovenous fistula as adjuvant methods to prevent rethrombosis after venous thrombectomy. Experimental study in rabbits. Int Angiol. 1991 Apr-Jun;10(2):88-94.
4. Ciancio G, Lo Monte A, Julian JF, Romano M, Miller J, Burke GW. Vascular complications following bladder drained, simultaneous pancreas-kidney transplantation: the University of Miami experience. Transpl Int. 2000;13 Suppl 1:S187-190.
5. Ascer E, Gennaro M, Pollina RM, Ivanov M, Yorkovich WR, Ivanov M, Lorensen E. Complementary distal arteriovenous fistula and deep vein interposition: a five-year experience with a new technique to improve infrapopliteal prosthetic bypass patency. J Vasc Surg. 1996 Jul;24(1):134-143.
6. Syrek JR, Calligaro KD, Dougherty MJ, Raviola CA, Rua I, DeLaurentis DA. Do distal arteriovenous fistulae improve patency rates of prosthetic infrapopliteal arterial bypasses? Ann Vasc Surg. 1998 Mar;12(2):148-152.
7. Feldman HI, Joffe M, Rosas SE, Burns JE, Knauss J, Brayman K. Predictors of successful arteriovenous fistula maturation. Am J Kidney Dis. 2003 Nov; 42(5):1000-1012.
8. Asif A, Roy-Chaudhury P, Beathard GA. Early arteriovenous fistula failure: a logical proposal for when and how to intervene. Clin J Am Soc Nephrol. 2006 Mar; 1(2):332-339.
9. Palder SB, Kirkman RL, Whittemore AD, Hakim RM, Lazarus JM, Tilney NL. Vascular access for hemodialysis. Patency rates and results of revision. Ann Surg. 1985 Aug;202(2):235-239.
10. Miller PE, Tolwani A, Luscy CP, Deierhoi MH, Bailey R, Redden DT, Allon M. Predictors of adequacy of arteriovenous fistulas in hemodialysis patients. Kidney Int. 1999 Jul;56(1):275-280.