Role of systemic anticoagulation in patients undergoing vascular access surgery

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ABSTRACT

The role of per-operative systemic heparin to improve primary patency rate of vascular access surgery is controversial. The aim of this study was to assess the risk and benefit of systemic heparin during creation of vascular access for hemodialysis in patients with chronic renal failure. Patients undergoing creation of side to end radio-cephalic arteriovenous fistula over distal forearm for hemodialysis were prospectively randomized into two groups. First group received 5000 IU of intravenous heparin during surgery whereas second group did not receive any anticoagulation. Post-operative complications and outcome of surgery were compared between the two groups. Among 50 patients, 25 received heparin and 25 did not. Although there was no significant difference in operative times between these two groups ($p=0.24$), early post-operative bleeding complication was more common in patients receiving heparin ($p<0.01$). The primary 6-week patency was 96.0% for patients receiving heparin and 92.0% for those not ($p=0.46$). Thus per-operative systemic anticoagulation during vascular access surgery is associated with increased incidence of bleeding complication and offers no benefit in terms of primary patency

Keywords: Anticoagulation, arteriovenous fistula, patency, hemodialysis.

INTRODUCTION

Vascular access is a prerequisite for hemodialysis in order to transport blood from the patient to the dialysis machine and back to the patient again. Quinton and Scribner introduced the first external arteriovenous shunt constructed of Teflon, that allowed repeated access to the vascular system.[1] Establishment of native vascular access has classically been initiated by Brescia et al in 1966 with creation of primary radio-cephalic arteriovenous fistula (RCAVF).[2] Arteriovenous fistulas still represent the best form of vascular access for chronic hemodialysis with long term patency rates because of low risk of thrombosis and infection.[3,4] Distal forearm RCAVF is the procedure of first choice among the native arteriovenous fistulas.

Any vascular access is of limited duration, and each patient has a limited number of sites for the creation of vascular access. Several factors including administration of heparin influence the survival of arteriovenous fistula in patients on chronic hemodialysis.[5]

Systemic anticoagulation with use of per-operative intravenous unfractionated heparin is a common practice in patients undergoing vascular surgery. The guidelines published by National Kidney Foundation – Dialysis Outcome and Quality Initiative (NKF-DOQI) do not address the need of systemic anticoagulation during vascular access surgery for hemodialysis.[6] Although per-operative systemic anticoagulation tend to decrease early thrombosis at anastomotic site, it can result in longer operative times to achieve hemostasis and also early post-operative bleeding complications. While earlier reports are in favor of heparin, recent publications do not support the use of systemic anticoagulation to prevent early thrombotic complications in patients undergoing vascular access surgery. We undertook this study to access the value of systemic anticoagulation during creation of primary native arteriovenous fistula between radial artery and cephalic vein

MATERIALS AND METHODS

The study was carried out in Nepal Medical College Teaching Hospital, Nepal from July 2005 to June 2007. All the patients undergoing RCAVF in distal forearm were prospectively enrolled in this study. Patients undergoing vascular access other than RCAVF or revision of a previous surgery were excluded from the study. Informed written consent was taken from all the patients prior to enrollment in the study. All procedures were performed by a single surgeon

Pre-operative venous mapping was done only in those patients where venous patency was doubtful clinically or the patient had history of ipsilateral subclavian vein catheterization. When choosing an access site, preference was given to the non-dominant extremity or presence of a larger diameter cephalic vein.

All operative procedures were performed under local anesthesia using 1.0% lignocaine without adrenaline. At

Table1: Patient demographics by study group

Demographics	Heparin	No heparin	p value
Age (±SD)	48±2.6	50±2.2	0.33
Sex (%male)	56	52	0.62

the time of surgery, patients were randomized to receive systemic heparin or not. Patients in heparin group received single bolus dose of 5000 IU of unfractionated heparin intravenously just prior to arterial occlusion. This intravenous heparin was not administered to patients in no heparin group. Local irrigation of vein and artery with heparinized saline was done in both the groups during anastomosis. Hydrostatic dilatation of the cephalic vein was done in all patients prior to anastomosis. All anastomosis were performed in end to side fashion using 7-0 polypropylene running stitches.

All the patients were admitted at least for 24 hours after surgery to watch for early post-operative bleeding. After discharge, they were followed up weekly and outcome of the study as primary patency of the fistula was assessed at the end of 6weeks. As a means of comparison, "Patency" was defined as useful function of an access and "Failure" was defined as any problem that required another surgical procedure to maintain dialysis access. Failure was defined on an intention to treat basis.

Statistical analysis was performed using SPSS version 12 and p-value <0.05 was considered statistically significant.

RESULTS

A total of 50 patients were included in the study, who were randomized into two groups: first group of 25 patients receiving 5000 IU of unfractionated systemic heparin and second group of 25 patients receiving no systemic heparin.

As illustrated in Table-1, the sex distribution was comparable in the two groups (p=0.62).

The mean age of patients in heparin group was 48±2.6 and that in no heparin group was 50±2.2, the difference being statistically not significant (p=0.33). The two groups were comparable in terms of presence of co-morbidities which could affect the fistula patency (Table-2).

The mean operative time for heparin group was 84±5.1 minutes and that for no heparin group was 76±4.2 minutes. This difference was not statistically significant (p=0.24).

There was no per-operative bleeding complication in both groups. Early post-operative bleeding complication was significantly higher in heparin group (p<0.01) although none of these patients required blood transfusions or operative intervention to control bleeding. Minor bleeding from the operative site occurred in 6 patients in the heparin group which needed change of dressing within 12 hours of surgery. None of the patients in no heparin group had post-operative bleeding requiring change of dressing. None of the patients had wound hematoma and there was no post-operative wound infection in both groups during the study period.

Two patients in no heparin group and one in heparin group lost the fistula patency by the end of 6 weeks. Among the two patients in no heparin group, one had atherosclerotic radial artery identified at the time of surgery while another had inadequate outflow in the cephalic vein. The patient who lost fistula patency in the heparin group had relatively smaller diameter radial artery. Fistula revision was not attempted in all these patients because of local unfavorable factors identified during surgery. Thus the 6 weeks primary patency rate was 96.0% for heparin group and 92.0% for no heparin group. The difference was not statistically significant (p=0.46).

DISCUSSION

The provision and maintenance of vascular access remains a major cost to end-stage renal failure programs.[7] In addition, vascular access occlusion results in significant morbidity in hemodialysis patients.

Traditionally, the initial approach to vascular access for dialysis has been the creation of RCAVF, followed by use of more proximal sites. This strategy maximizes the longevity of available fistulas for long term hemodialysis preserving more proximal vessels for future access placement.[8-11] In addition, it is simple to create and has few complications.[10,12,13] The NKF-DOQI guidelines also recommends the RCAVF as the first choice of access type.[6] Furthermore, the guideline also promotes the use of primary arteriovenous fistula whenever possible instead of arteriovenous graft.

Vascular access surgery is associated with a high early failure rate.[14-16] Although there is no consensus about acceptable early failure rate, up to 36.0%-56.0% of early failure rates have been reported.[14,16] The superior result of only 6.0% early failure rate may be because of inclusion of only RCAVF in this study.

Available literature shows variable practice pattern

Table-2: Presence of co-morbidities

Comorbidities	Heparin (n=25)	No heparin (n=25)	p value
Diabetes mellitus	10 (40.0%)	9 (36.0%)	0.77
Hypertension	22 (88.0%)	20 (80.0%)	0.44
Hyperlididemia	7 (28.0%)	5 (20.0%)	0.75
Coronary artery disease	6 (24.0%)	7 (28.0%)	0.74

Table-3: Outcome variables

Outcome	Heparin	No heparin	p value
Mean operative time (min) (±SD)	84±5.1	76±4.2	0.24
Post-op bleeding	24.0%	0%	<0.01
6-weeks primary patency	96.0%	92.0%	0.46

regarding the per-operative use of anticoagulants for vascular access surgery. While some surgeons routinely use systemic anticoagulation, others do not or use only heparinized saline solution locally during vascular access surgery.[17-19]

Flye *et al* in 1981 recommended to start aspirin and heparin the night before surgery and to continue post-operatively to improve patency of an arteriovenous fistula.[20] Few other reports also show favorable effect of heparin to improve the patency of arteriovenous fistula.[21] However, more recent reports do not show any beneficial effect of per-operative heparin on patency of arteriovenous fistula.[22]

We undertook this study to clarify the role of systemic anticoagulation in patients undergoing primary RCAVF. Although post-operative bleeding complication was significantly higher in those patients receiving systemic heparin, the overall early patency rate is not significantly different in the two groups. In addition, the bleeding complications were minor and none of these patients needed additional surgical procedures because of bleeding. Furthermore, the operative time was not significantly longer in patients receiving systemic heparin.

The reason of primary failure in two patients in no heparin group and one patient in heparin group could be attributed to the unfavorable artery or vein identified at the time of surgery rather than use of anticoagulation. This finding is consistent with the opinion that the inappropriate surgical procedure for fistula creation is primarily responsible for early fistula failure.[23]

In conclusion, per-operative systemic anticoagulation during vascular access surgery does not offer any benefit in terms of primary patency of native arteriovenous fistula. Use of systemic heparin does not significantly increase the operative time. However, it is associated with increased incidence of post-operative bleeding complications.

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