CEPHALIC VEIN ANATOMY IN ANTECUBITAL FOSSA DURING THE CONSTRUCTION OF ARTERIOVENOUS FISTULA

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Abstract- In order to create an effective arteriovenous fistula (AVF) in patients with sustained chronic renal failure (CRF), surgeons need to become familiar with various anatomical variations of venous structures in the operating field. Because of variety and different types of cubital venous anatomies, there is more than a 90% possibility of creating suitable AVFs in the cubital fossa , but in the wrist and forearm, due to old injections and thrombophlebitis, there is less chance to do so. Since cephalic vein is the main venous conduit for constructing an AVF in the antecubital region, this study focuses on the various anatomical variations of cephalic vein and its communicating branches. We studied the cubital cephalic anatomy of 103 patients with CRF during construction of an AVF from July 1999 to June 2001. Five types of cephalic vein anatomy were seen: type A (44.66%), type B (30.1%), type C (18.44%), type D (3.88%) and type E (2.29%) in 39 right and 64 left arms. Seventy-six anastomoses were performed to brachial trunk, 25 to the radial and 2 to the ulnar artery. Eleven cases with progressive swelling after AVF were uneventfully cured by hand elevation. No infection, false aneurysm, venous hypertension or steal syndrome was detected. In order to obtain the best results and select appropriate operative technique for reliable vascular access in CRF, it is necessary to understand the anatomical variety of cephalic vein.
Acta Medica Iranica, 42(3): 218-222; 2004

INTRODUCTION

Arteriovenous fistula (AVF) is the best conventional technique for creating vascular access for patients with chronic renal failure (CRF). An efficient fistula should be an available and suitable (diameter, length, function) arterialized venous limb access from at least 3 weeks after construction. In this procedure, superficial veins and preferably, in the upper extremities, the cephalic veins, are used for anastomosis with regional arteries. It is customary to

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first create AVFs at the anatomical snuffbox, or in the wrist, and then as a second choice in the cubital fossa. The suggested technique is anastomosis between radial artery and cephalic vein at the wrist (Brescia-Cimino type) (1,2); but possibility of creating an efficient arteriovenous fistula in the wrist and forearm is limited due to presence of thrombophlebitis and fibrosis caused by previous injections; grafting the antecubital veins to the brachial artery, because of anatomical variety and the number of veins in this region is more successful (1-6). Unfortunately, among inexperienced surgeons and those who operate only occasionally on CRF patients (7,8) this success is confined to producing a bruit or a thrill of an anastomosis, without considering distal venous limb runoff or anatomy which may result in an inefficient fistula. Exploring and following the

selected vein in order to guide distal arteriovenous circulation through fistula's venous limb by elimination of deep or other communicator veins which drain to the basilic or central veins provides increasing efficacy and long-lasting AVFs. Cephalic vein is the best native available conduit for AVF (1-6,9) with 90% patency during one year (3) and 50-80% during 3-5 years (2,4,5,10,11) and its preference for AVFs had been confirmed.

MATERIALS AND METHODS

All the CRF patients referred from July 1999 to June 2001, regardless of age and sex, were considered for evaluation (site, capability for using cubital veins, left or right upper extremity, determining runoff and vein patency with tourniquet) for creating an AVF. One hundred twenty three cases were initially evalueted, and 103 cases were selected for this study. All cases were informed and consent form was taken according to Helsinki protocol. The incision was made one inch below the elbow crease and exploration was extended to at least 3 cm around it for searching the cephalic vein and brachial artery and drawing their anatomical figures and variations. The venous limb was followed 1-2 cm above the crease to be sure about deep or main branches for

necessity of ligation. Also, all the patients were followed during the first 3 weeks and until beginning the dialysis for edema or other complications and efficiency of their fistulas. The targets for the study were: 1) determining the various anatomic forms of cephalic vein in the cubital fossa, 2) determining the anatomic situation of the brachial artery at anastomosis site, 3) determination and selection of anastomosis sites based on anatomy and its selective technique, 4) presentation of right or left arm usage ratio in aforementioned circumstances, and 5) presentation of common complications, *e.g.,* edema, infection, false aneurysm, steal syndrome and venous hypertension syndrome.

RESULTS

Five various anatomic types was recognized: type A (cephalic- median cephalic vein) in 46 cases (44.66%), type B (cephalic- median cubital-median ante brachial) in 31(30.1%), type C (single- branched cephalic vein) in 19 (18.44%), type D (cephalic-median cubital vein) in 4 (3.88%) and type E (cephalic-median vein-basilic) in 3 (2.29%) (Fig. 1).

The selected techniques based on anatomical types are shown in figure 2, and table 1.

Table 1. Operative and postoperative results*

Results	Cephalic vein anatomy					Total
	Type A	Type B	Type C	Type D	Type E	
Side						
Right arm	18	12	7	2	-	39
Left arm	28	19	12	2	3	64
Artery used for anastomosis						
Brachial artery	36	23	13	3	1	76
Radial artery	10	7	5	1	2	25
Ulnar artery	-	1	1	-	-	2
Complications						
Edema[†]	4	-	5	2	-	11
Venous hypertension	-	-	-	-	-	0
Steal syndrome[‡]	-	-	-	-	-	0
False aneurysm	-	-	-	-	-	0
Infection	-	-	-	-	-	0

*Data are presented as number of cases.

[†] Wrist, forearm or arm edema in the first week that was managed with elevation.

[‡] Marked reduction of distal pulses, tingling, coldness, nail bed cyanosis or pain.
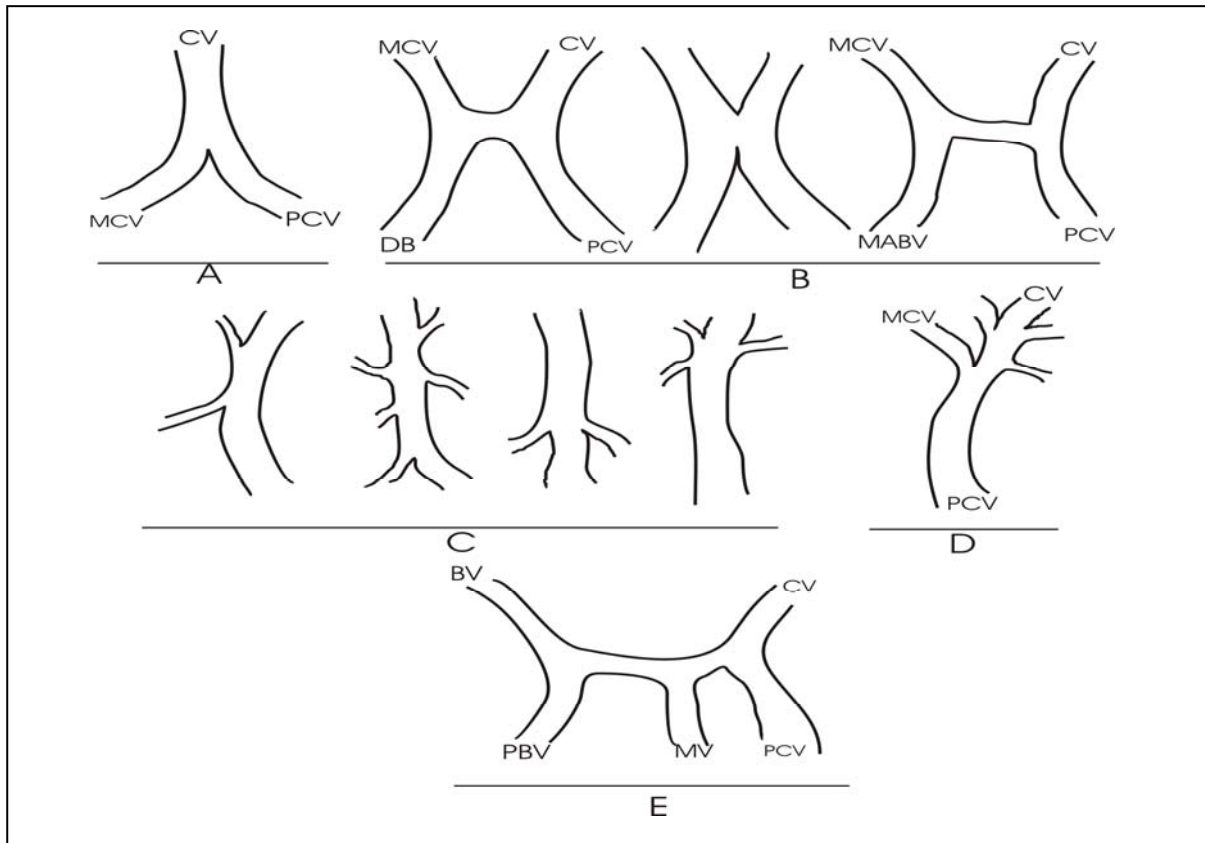
Fig. 1. The five various venous types found during the study. MCV, median cubital vein and median cephalic vein; CV, cephalic vein; PCV, proximal cephalic vein; DB, deep branch; MABV, median antebrachial vein; BV, basilica vein; PBV, proximal basilica vein; MV, median vein.
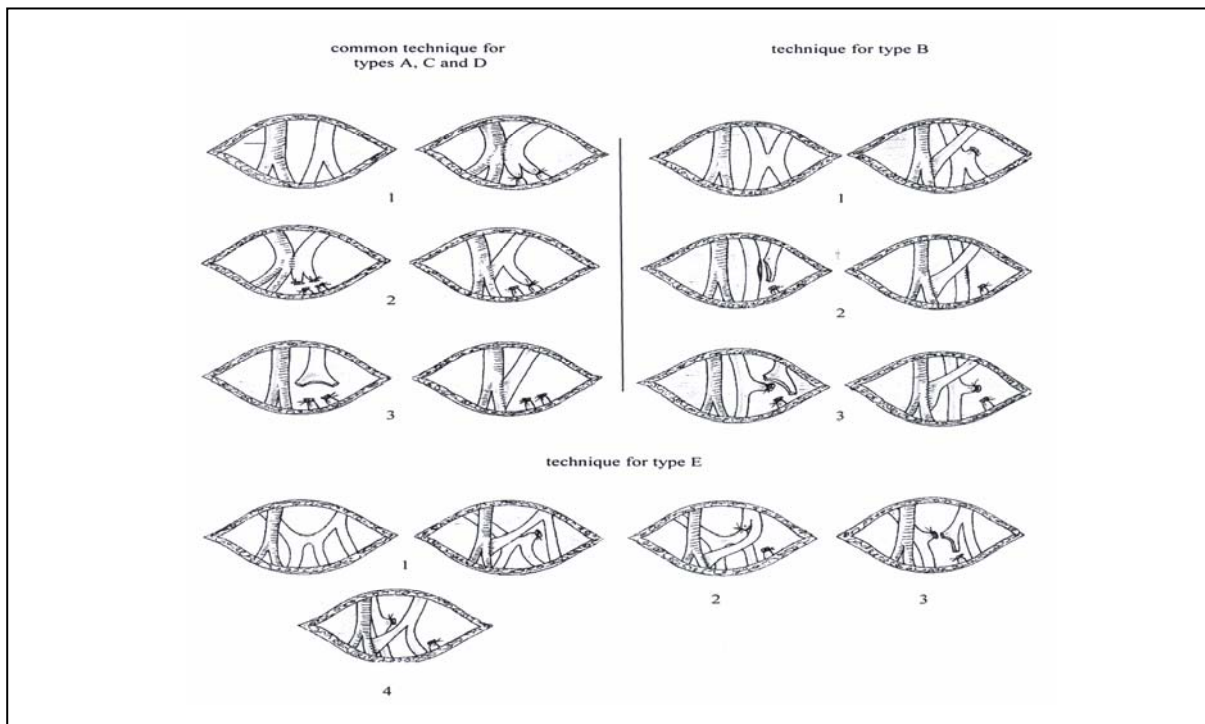

Fig. 2. The selected techniques based on variety of venous anatomy.

DISCUSSION

Considering possible complications, recognition of all five various types of cephalic vein are important, and deserve the surgeon's attention during the operation. Types A, C and D are branch-independent forms, which provide the surgeons with better exposure and surgical convenience for anastomosis (end to side). Because of the absence of marked communication with deep venous system, these types produce less complications using end to side technique (1-4). However, this would depend on the sparing of wrist and forearm's vein from long-standing cannulation and injections. On the other hand, if the basilic vein is occluded, elimination of the cephalic vein from the extremity's venous draining system by AVF, may increase the likelihood of edema and venous hypertension in the limb. Type B, the second common anatomic form, can also be divided into a new branch-independent vein by ligation or incisional separation for anastomosis and then repairing the medial branch as depicted in the figure 2, type B techniques. The advantage of this type is sparing branches related to deep and basilic veins, with reduced likelihood of impaired venous draining. In spite of its rarity, type E is managed as type B, and the same techniques with more variations can be used. Therefore, with an end to side method, after preparing the anastomotic limb (Fig. 2, type E technique), it is possible to reduce complications; whereas, if the side to side technique is used, or if the surgeon is not aware of distal venous limb runoff in AV anastomosis, in this type as in types A, B, D, the risk of edema, venous stasis and steal syndrome will increase, more seriously so in diabetic patients (1-4,12).

The probability of steal syndrome and its problems emphasizes importance of proper selection of artery and vein and using a suitable technique. As a result, selection of technique must be based on practical principles and are explained: 1) considering specific anatomic features of vein, 2) to proceed and guide arterial circulation toward the distal venous limb and through it, 3) to prevent the communication of flow with central or giant deep veins near the fistula and prevent producing run away flowing, 4) choosing the convenient available native artery. Also,

with emphasis on suggested techniques, no complications considering the optimum (taking the first 3 weeks as the most common period of producing complications) were seen. Consequently, knowledge and understanding of the variety of regional venous anatomy responsible for supporting an efficient AVF, combined with choosing the suitable and available artery for anastomosis, are required for success. Under these circumstances, we achieve an ideal procedure in which the patients will not face any problems; otherwise failure would sooner or later be inevitable.

REFERENCES

1. Gelabert HA, Freischlag JA. Angioaccess, hemodialysis access. In: Rutherford RB,editor. Vascular Surgery. 5th edition. Philadelphia: W B Saunders Company; 2000 . p. 1466-1476.

2. Schanzer H, Skladany H. Vascular access for dialysis. In: Ascher E, Hollier LH, Strandness DE, et al, editors. Haimovici's vascular surgery. 4th edition. Cambridge, Mass: Bkackwell Science Company; 1996. p. 1028-1041.

3. Akoh JA, Hakim NS, editors. Dialysis access, current practice. New York: Imperial College Press; 2001.

4. Dunlop MG, Mackinlay JY, Jenkins AM. Vascular access: experience with the brachiocephalic fistula. Ann R Coll Surg Engl. 1986 ; 68(4): 203-206.

5. Kinnaert P, Janssen F, Hall M. Elbow arteriovenous fistula (EAVF) for chronic hemodialysis in small children. J Pediatr Surg. 1983 Apr;18(2):116-9.

6. Burdick JF, Maley WR. Update on vascular access for hemodialysis. Adv Surg. 1996; 30: 223-232.

7. Lazarides MK, Iatrou C, Tzilalis VD, Ekonomou CS, Afentakis N, Fragedaki EJ, Simopoulos CE. Influence of surgenos' specialty on the selection of vascular access for hemodialysis treatment. Blood Purif 2002; 20(4): 338-341.

8. Paulson WD, Ram SJ, Zibari GB. Vascular access: anatomy examination, management. Semin Nephrol. 2002 ; 22(3): 183-194.

9. Hill SL, Seeger JM. The arm as an alternative site for vascular access for dialysis in patients with recurrent access failure. South Med J. 1985 ; 78(1): 37-40.

10. Polo JR, Vazquez R, Polo J, Sanabia J, Rueda JA, Lopez-Baena JA. Brachiocephalic jump graft fistula: an alternative for dialysis use of elbow crease veins. Am J Kidney Dis. 1999; 33(5): 904-909.

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11. Rubens F, Wellington JL. Brachiocephalic fistula: a useful alternative for vascular access in chronic hemodilysis. Cardiovasc Surg. 1993 ; 1(2): 128-130.

12. Elfstrom J, Lindell A. Limitations of the use of arteriovenous fistula in the cubital fossa. Scand J Urol Nephrol. 1994 ; 28(2): 123-126.