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KEY WORDS: Maturation, Primary Patency.

VEIN DIAMETER AS AN INDICATOR OF BETTER OUTCOME OF BRACHIOCEPHALIC ARTERIO-VENOUS FISTULA-- A Retrospective study

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ABSTRACT

Objectives : Preoperative assessment of arteries and veins by duplex ultrasound is advocated for creation of primary arteriovenous fistula (AVF) for hemodialysis access, but reliable diameter criteria is still debatable . In this study we have tried to determine the diameters and their outcome for fistula maturation in initial hemodialysis access.

Methods: All patients undergoing AVF creation from JANUARY 2016 to APRIL 2018 were retrospectively reviewed. We analyzed fistula type and functional maturation rates .

Results: From January 2016 to April 2018, 512 AVF procedures were performed. Out of which 250 Wrist radio cephalic AVF, 220 brachiocephalic AVF had adequate follow-up and were included in the analysis. RCAVF, and BCAVF had 60% and 90% maturation rates, respectively.

Conclusion: Qualitative study suggested that both the type of fistula type and vein size significantly affected maturation.

Main text

Native arteriovenous fistula (AVF) is the preferred modality for hemodialysis access due to lower rates of thrombosis, infection, and need for secondary interventions, as well as longer survival and functional patency rates [1,2]. The National Kidney Foundation Kidney Disease Outcome Initiative (NKFK/DOQI) recommends that the first choice for native AVF is a wrist radio-cephalic fistula, second is at elbow brachiocephalic fistula, and third is either a brachial basilic vein fistula or a forearm arteriovenous graft.

Despite the known higher incidence of failed maturation for radiocephalic fistulas[3], the ease of placement and the preservation of proximal vessels for future access out weigh such disadvantages. In addition to a complete history and physical examination, routine preoperative duplex ultrasonography (DUS) is also recommended by NKFK/DOQI guidelines in all patients planned for hemodialysis access. This has led to the increase of native AVF placement and use[3-6]. However, the role of duplex ultrasound in predicting maturation varies in the literature.

The purpose of this study is to evaluate the role of preoperative DUS to assess artery and vein sizes in relation to fistula maturation. We suspect that patient factors such as age, gender, presence of diabetes, small vein sizes, and radial-cephalic fistulas would have lower maturation rates and would parallel similar failure rates in the literature [7,8].

METHODS

Patients permanent hemodialysis access from January 2016 to April 2018 had their records retrospectively reviewed .Patients who needed permanent hemodialysis access were included in the analysis. The presence of a temporary dialysis catheter was not an exclusion criterion. Information on patients with initial arterio venous fistula (AVF) were stored in microsoft excel sheets of OT records . Demographic data such as age, gender, race, and body-mass index BMI, in addition to co-morbidities such as diabetes, hyperlipidemia, hypertension, tobacco use, human immune deficiency virus (HIV) status, and history of intravenous drug abuse, were documented.

Etiology of renal failure was noted along with the absence or presence of prior central catheter access during fistula placement. Arterial assessments included pulse examination, segmental blood pressures in both upper extremities, and the Allen test for continuity of the palmar arch. Venous assessment included gross evaluation of the veins in the dependent position with tourniquet enhancement in the upper arm.

Duplex ultrasonography (DUS) of arteries and veins was an adjunct to physical examination .These noninvasive imaging were performed using a 6 MHz scanning probe by radiologist in IGIMS PATNA. Vein assessments included diameter, compressibility ,depth, and continuity. Vein sizes were recorded at the wrist,forearm, ante-cubital fossa, upper arm.Extremity arterial duplex assessment, included the radial and brachial arterial size, calcification, segmental pressure, and velocity waveforms.

The choice of operation for native AVF was based on the overall assessment of patient . A uniform size threshold for acceptable vein diameter was not used during the study period. All operations were performed under local anesthesia. All anastamoses were performed using monofilament non absorbable polypropylene running sutures. Patients were then seen routinely 7 to 14 days postoperatively and then 6 to 8 weeks thereafter to assess for adequate maturation .All data were entered into Excel sheet.

The primary endpoint was fistula maturation and fistula functional maturation. Functional maturation is defined as successful cannulation of the fistula with the ability of the access to deliver a flow rate of 350 to 400 ml/min and maintain dialysis for 4 hours or less[9]. Primary fistula failure is defined as fistula abandonment prior to cannulation regardless of patency status.

RESULTS

Patients from January 2016 to April 2018, 512 permanent dialysis access procedures were performed. 250 Wrist radiocephalic AVF , 220 brachiocephalic AVF had adequate follow-up .Patients with no follow up after fistula placement were not included in analysis (42).Mean follow up was 8 weeks**.** 150 RCAVF matured, and 200 BCAVF matured and had 60%, and 90% maturation rates, respectively. Both the type of fistula type and vein size significantly affected maturation by univariate analysis. BCAVF had better maturation rate than RCAVF due to larger vein size. Of 512 access procedures, 42 fistulas did not follow up and 100 RCAVF AND 15 BCAVF did not mature. The total number of fistulas that matured was 350(74.4%). Overall mean time to fistula maturation was 45-60 days, in both fistula type.

Table I. Patient population by procedure type and maturation

Procedure	Number	Mean days to mature
WRCAVF	250	60
BCAVF	220	50

BCAVF, Brachial-cephalic arteriovenous fistula WRCAVF, Wrist radial-cephalic arteriovenousfistula.

DISCUSSION

A functionally mature AV fistula is clearly defined, and widely accepted as the primary goal, but there is no consensus in defining fistula maturation. BCAVF had better maturation rate than RCAVF due to good vein sizes. Dember et al identifies functional maturation, in a randomized control trial for the Dialysis Access Consortium, as fistula suitability with two needles to maintain an optimal dialysis flow rates of 300 ml/min during eight of 12 dialysis

sessions. NKF K/DOQI glossary has fistula maturation as "the process by which a fistula becomes suitable for cannulation" and focuses on the Rules of Sixes: blood flow greater than 600 ml/min; a diameter greater than 0.6 cm; and a depth of approximately 0.6 cm. SVS reporting standards for hemodialysis access do not define fistula maturation, but rather define AV access as "patency" and "functional." *Functional patency* is defined as is the ability of a hemodialysis access to deliver a flow rate of 350 to 400 ml/min without access recirculation to maintain a treatment time of less than 4 hours .We defined fistula maturation as time from access creation to a time an assessment by a vascular surgeon to determine a fistula can be cannulated. K/DOQI recommends that a fistula should be placed at least six months before initiation of hemodialysis.

CONCLUSIONS

Preoperative venous mapping and size plays an important role as the vein size is the major predictor for a successful brachiocephalic fistula.

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