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### RESEARCH ARTICLE

#### VASCULAR ACCESS FOR HEMODIALYSIS IN PEDIATRIC AGE

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#### Manuscript Info

#### Abstract

##### Manuscript History

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#### Introduction:-

Chronic kidney disease (CKD) is a disorder in which an early damage is outdated by a further steady, prolonged progression of declining function that, in the furthestmost life-threatening cases, eventually leads to the necessity for renal replacement therapy. A vital attention is that, even though the starting reasons are fairly different, as chronic kidney disease advances the mechanisms elaborated turn into progressively similar, so that ultimately a cascade of usual proceedings pays to inevitable damage of working nephron mass (Gansevoort and de Jong 2010).

Initial recognition of kidney disorders is of ultimate significance aiming to decrease the problem of disease. Systematic screening programme for recognition of hematuria and /or proteinuria approved by certain countries need to be asked as regard its effectiveness. Although, antenatal recognition of fetal kidney abnormalities and quick interference in post-natal and early childhood period still grips true in reducing the problem of chronic kidney disease and then end stage renal disease in future life. Moreover, firm control of hypertension, correction of metabolic acidosis and reduction of proteinuria are mandatory to delay the progression of chronic kidney disease as they are the self-determining risk features (Ingelfinger et al, 2016).

#### Hemodialysis Access:

##### Definition of vascular access:

The NKF-KDOQI and the SVS Clinical Practice Guidelines both recommend that patients be referred to a vascular access surgeon for permanent dialysis access when their creatinine clearance is less than 25 mL/min. Once preoperative evaluation is completed, if the patient is felt to be an adequate candidate for autogenous AV access, the access should be constructed as soon as possible to give it adequate time to mature; ideally this should be greater than 6 months before the anticipated need for dialysis. However, since prosthetic access patency is limited by the duration of access placement, not time of access use, if a patient is felt to require a prosthetic access, the access placement should be delayed until 3 to 6 weeks prior to the initiation of dialysis (Sidawy et al, 2008).

Despite this, nationwide data suggest that only 25% of hemodialysis patients initiate dialysis with permanent AV access. Lenz et al. reported that 93% of patients in an academic medical center with a well-established dialysis unit and vascular surgery service initiated hemodialysis with the use of a central venous catheter. In a retrospective review, they identified the reason as inadequate predialysis care in 45% of patients, acute illness with failure to recover from an episode of acute renal failure in 31% of patients, and noncompliance with medical and surgical appointments in 17% of patients. These studies stress the need for early referral and education for predialysis patients to prevent the use of central venous catheters and their subsequent complications (Lenz et al, 2006).

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**Pediatric Vascular Access:**

The preferred renal replacement therapies for the pediatric patient population are renal transplantation and peritoneal dialysis. According to the US Renal Data System (USRDS), approximately 38% of pediatric patients with end-stage renal disease receive a kidney transplant within the first year (U.S. Renal Data System, 2012).

There are three principle forms of vascular access available for the treatment of children with end stage kidney disease (ESKD) by haemodialysis: tunnelled catheters placed in a central vein (central venous lines, CVLs), arteriovenous fistulas (AVF), and arteriovenous grafts (AVG) using prosthetic or biological material. Compared with the adult literature, there are few studies in children to provide evidence based guidelines for optimal vascular access type or its management and outcomes in children with ESKD (Shroff et al, 2019).

Hemodialysis is considered by many as a bridge to transplantation or as a treatment of last resort. Since the occurrence of end-stage renal disease is less

common in children than adults and hemodialysis is not the preferred treatment modality, few surgeons have a sizable experience with pediatric vascular access. As a result, the literature on pediatric vascular access is limited to a few single-institution, retrospective reviews of experiences acquired over many years. Standard methods for reporting outcomes such as patency are not used for the majority of those reports. The chief limitation of the pediatric vascular access literature is the way in which studies define a pediatric patient. Most of the "pediatric" vascular access case series are primarily composed of adolescents whose body sizes approximate those of small adults rather than children. Given the limitations of the pediatric vascular access literature, it is difficult to determine the outcome of autogenous AV access procedures or to derive algorithms for vascular access for the small child younger than 10 years of age. Therefore only broad concepts related to vascular access for the pediatric patient population can be elicited from the available literature (Gandhi and Carsten, 2019).

**Kidney Disease Outcomes Quality Initiative:****Recommendations and Recent Trends:**

Given the technical challenges of autogenous or prosthetic AV access placement in very small children, the KDOQI guidelines recommend peritoneal dialysis or hemodialysis via a tunneled dialysis catheter for patients weighing less than 20 kg. Peritoneal dialysis or hemodialysis via a tunneled dialysis catheter is also recommended as a bridge to kidney transplantation if the transplant is expected to occur in less than 1 year. The KDOQI guidelines emphasize the importance of matching the length and diameter of the tunneled dialysis catheter to the size of the patient and provide a table for reference. Catheter placement considerations in pediatric patients are similar to those in adults. The most recent USRDS report shows that the rates of vascular access infection and hospitalization for infection/sepsis among hemodialysis patients younger than 10 years of age are increasing (U.S. Renal Data System, 2012).

This is due in part to catheter infections resulting from patients spending more time on transplant waiting lists. A commonly used argument against the placement of permanent access is the relative short time for renal transplantation. Catheter placement is used as a bridge to renal transplantation, which is the ideal goal of treatment, but this cannot always be achieved. Furthermore due to the finite life span of an allograft, planning for vascular access poses a unique challenge in this population. As a result, any intervention that could compromise future access must be avoided. Catheters frequently lead to stenosis or thrombosis of central veins, particularly in children who have smaller-diameter veins. These trends support the KDOQI recommendations that an autogenous or prosthetic AV access is preferred for pediatric patients on maintenance hemodialysis (Vascular Access Work Group, 2006).

**Autogenous Arteriovenous Access:**

Autogenous AV access is considered the ideal hemodialysis access in children. The outcomes in pediatric patients have been published for the following autogenous AV access procedures: radial-cephalic access, ulnar-basilic access, radial-basilic transposed access, brachial-basilic transposed access, brachial-cephalic access, and femorofemoral transposed access (Jennings et al, 2009).

The distal radiocephalic arteriovenous fistula at wrist is the initial option for vascular access establishment. Once effectively becomes mature, radiocephalic arteriovenous fistula could be used for long time with a least of drawbacks, reconsiderations and hospitalization. Radiocephalic arteriovenous fistula is specially formed in the non-dominant extremity. The advice to do a distal radiocephalic arteriovenous fistula determined by the result of clinical

assessment and further U/S assessment. A least inner vessel size for cephalic vein and radial artery of two millimeters with a proximal tourniquet is well-thought-out to remain sufficient for effective AVF formation and to become mature. For brachio basilic arteriovenous fistula and brachiocephalic arteriovenous fistula a least artery and vein size of three millimeters is adequate (Schmidli et al, 2018).

**Synthetic Arteriovenous Graft:**

Once no available choices for forming an arteriovenous fistula, an arteriovenous graft vascular access with insertion of prosthetic (polytetrafluoroethylene (ePTFE) graft) or biological graft could be formed. Polytetrafluoroethylene is commonly employed as arteriovenous graft with sensible short span survival but long span survival is disadvantaged through thrombotic obstructions, because of stenosed segments due to advanced neointimal hyperplasia. Repeated interferences to avoid and manage thrombotic obstructions are mandatory to accomplish these results (Garcia-Pajares et al, 2003).

**Lower extremity vascular access:**

The necessities for lower limb vascular access are bilateral CVOD or incapability to make VA in the upper limb. Principal choices are great saphenous vein (Correa et al, 2010) and femoral vein transpositions (Gradman et al, 2005), and synthetic graft insertion. Thigh vascular accesses have satisfactory survival, on the other hand the drawback of elevated hazard of infection and ischaemia (Geenen et al, 2010).

**Technique:**

The same concerns and diagnostic modalities used to select the proper autogenous or prosthetic AV access procedure in adults apply to children. The more distal anatomic sites should be used as a first access, preserving the more proximal sites for access later in life. There are key differences in the procedures used for arteriovenous access assignment in children compared with adults. arteriovenous access assignment is eased in pediatric patients by the use of microsurgical techniques and microsurgical tools, satisfactory magnification, and an interrupted suture technique. The arteriovenous anastomosis is done with 8-0 to 10-0 polypropylene suture. Second, to diminish vessel dissection and vasospasm, vascular control is achieved with a sterile tourniquet (Bourquelot et al,2003).

**Permanent central venous catheter:**

Temporary central venous catheters are commonly used for urgent hemodialysis or as linking vascular access throughout AVF maturation and drawbacks. Permanent tunneled cuffed central venous catheters might be required in cases with massive vascular access tempted ischaemia, heart failure or restricted lifetime expectation. Cases suffering from peritoneal dialysis peritonitis or on preparation for a scheduled associated kidney transplantation could also continue dialysis via a central venous catheter for a restricted time. The cause for augmented central venous catheter usage is the incapability to order working arteriovenous fistulas due to reduced vessel size in elder cases, associated comorbidities (Schmidli et al, 2018).

**Maturation of arteriovenous fistula:**

Arteriovenous fistulas are commonly not eagerly functioning when formed, however the vessel wall variations make the AVF to develop proper for insertion of dialysis needles by time, a progression identified as maturation. AVF is well-thought-out maturing once it is supposed to become suitable for insertion of dialysis needles with least drawbacks, and to carry the suggested flow during the hemodialysis process. It is recognized through clinical assessment of the vascular access and/or through duplex ultrasonography scan by skilled operator earlier to vascular access usage and expects effective usage and adequate blood flow throughout hemodialysis. It would occur rather four to six weeks next to arteriovenous fistula or two to four weeks next to ordinary arteriovenous graft formation (Jemcov, 2013).

Maturation could be recognized through clinical assessment of venous channel and blood flow rate. It is frequently evaluated through existence of a sufficient vein size (to allow proper site identification and insertion of dialysis needles), a lenient simply compressible venous wall, adequate thrill close to the anastomosis spreading throughout the venous wall for a variable distance, a constant bruit, accompanied by acceptable length with minor depth sufficient for insertion of dialysis needles (Sidawy et al, 2008).

**Time to cannulation of the arteriovenous graft:**

Due to its firmer wall, arteriovenous graft generally had a weak thrill on intact graft than arteriovenous fistula. In arteriovenous grafts, the maturing access is depending on interval desired for tissues to grafts combination and for

tissues distension to reduce later grafts insertion, reasonably than blood flow rise by time (since the flow is higher since insertion of AVG with least alterations by time) (Shemesh et al, 2007).

It is frequently definite as two to four weeks. Here were no important alteration in possibility of AVG dysfunction among those needled initially and those needled late (van Loon et al, 2009). Certain AVGs permit for quick needling in 1-3 days deprived of main drawbacks (both multilayer ePTFE grafts, and polyurethane grafts permitting self-sealing), to avoid CVCs in cases which require quick hemodialysis and that had no appropriate veins for AVF. Still, that type of AVG advises no added advantage except quick needling (Schild et al, 2011).

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