



Creating Autogenous Hemodialysis Access In Children And Adolescents

William Jennings M.D. FACS

VEITHsymposium
New York, New York. November 18-23, 2024.




Physicians VASCULAR & ENDOVASCULAR SURGERY




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St. John Medical Center



University of Oklahoma, Tulsa

No disclosures

2 million children worldwide are affected by CKD (roughly the same number of children with type one diabetes or those with childhood cancers).

- 500,000 children worldwide have ESKD.

(Hundreds of thousands of children around the world have died in recent years due to ESKD.)

- In the United States, roughly 15,000 children are receiving RRT.

Harambat J et al. What is the true burden of chronic kidney disease in children worldwide? *Pediatr Nephrol.* 2023 May;38(5):1389-1393.
Harambat J et al. Inequalities in access to pediatric ESRD care: a global health challenge. *Pediatr Nephrol.* 2016 Mar;31(3):353-8.
<https://doi.org/10.1007/s00430-016-0440-7>
Saran R et al. US Renal Data System 2017 Annual Data Report: Epidemiology of Kidney Disease in the United States. *Am J Kidney Dis.* 2018 Mar;71 (3 Suppl 1):A7.

- **Kidney transplant is the ideal therapy for RRT in children and adults.**
- Children without a transplant usually start with PD,although, *many will require hemodialysis.*
- NKF-KDOQI guidelines have limited recommendations for children. However, the *European Society for Paediatric Nephrology Dialysis Working Group* compiled a thorough review and recommendations for younger patients*.
- Understandably, there are few reports regarding childhood dialysis vascular access.

*Shroff R, et al. European Society for Paediatric Nephrology Dialysis Working Group. Vascular access in children requiring maintenance haemodialysis: a consensus document by the European Society for Paediatric Nephrology Dialysis Working Group. *Nephrol Dial Transplant.* 2019 Oct 1;34(10):1746-1765.




AVFs offer the most durable hemodialysis vascular access in children.

Childhood hemodialysis with AVFs is associated with:

- Improved overall survival
- Fewer access complications relative to those with catheter or AVGs
- Improved quality of life with fewer symptoms of depression.

• Kamath N et al. Clinical profile and outcome of arteriovenous fistulae in children on maintenance hemodialysis from a low-resource setting. *J Vasc Surg.* 2022 Dec;78(8):1659-1703.
• Raina R. Challenges of long-term vascular access in pediatric hemodialysis: Recommendations for practitioners. *Hemodial Int.* 2021 Jan;25(1):3-11.
• Chesnoye NC et al. Survival in children requiring chronic renal replacement therapy. *Pediatr Nephrol.* 2018 Apr;33(4):585-604.
• Mak RH, Wazady BA. Dialysis: Vascular access in children—arteriovenous fistula or CVC? *Nat Rev Nephrol.* 2013 Jan;9(1):9-11
• Do Hyoung Kim,a Ji In Park,b,c Jung Pyo Lee,c,d,e Yong Lim Kim,c,f Shin Wook Kang,c,g Chul Woo Yang,c,h Nam-Ho Kim,c,i Yun Su Kim,c,e and Chun Soo Lim,c,d,e. The effects of vascular access types on the survival and quality of life and depression in the incident hemodialysis patients. *Ren Fail.* 2020; 42(1): 30-39.

- The consensus document from the European Society for Paediatric Nephrology Dialysis Working Group found AVGs were placed in only two of 111 children.
- Similarly, the International Pediatric Hemodialysis Network Registry noted only 2% of the 870 patients reported overall had an AVG placed for vascular access.
- Onder et al found conversion of a catheter to an AVF or graft access showed significant improvement in markers for dialysis effectiveness in AVF patients. However, these benefits were not present in children converted to a graft access.

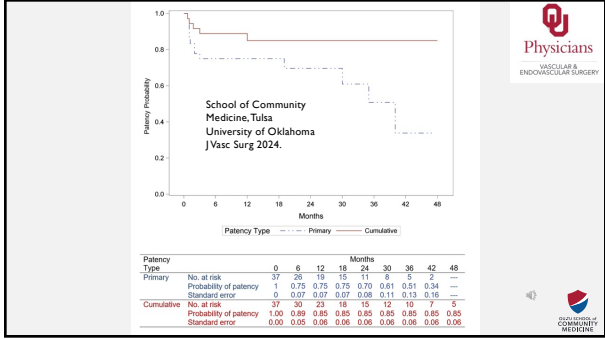
Shroff R et al. European Society for Paediatric Nephrology Dialysis Working Group. Vascular access in children requiring maintenance haemodialysis: a consensus document by the European Society for Paediatric Nephrology Dialysis Working Group. *Nephrol Dial Transplant*. 2019 Oct;34(10):1746-1765.
 Borzych-Duziak D et al. Vascular Access Choice, Complications, and Outcomes in Children on Maintenance Hemodialysis: Findings From the International Pediatric Hemodialysis Network (IPHN) Registry. *Am J Kidney Dis*. 2019 Aug;74(2):193-202.
 Onder AM et al. Midlevel Pediatric Nephrology Consortium. Predictors of patency for arteriovenous fistula and grafts in pediatric hemodialysis patients. *Pediatr Nephrol*. 2019 Feb;34(2):329-335.
 Onder AM et al. Pediatric Nephrology Research Consortium. Conversion to permanent vascular access is associated with improved markers of hemodialysis efficacy in children. *Pediatric nephrology research consortium study*. *Clin Nephrol*. 2021 Nov;96(5):270-280.

Our two pediatric vascular access reports in 2024:

University of Oklahoma, J Vasc Surg 2024.

- 37 new AVFs created in 35 patients, no grafts were used.
- Ages 6-19 years (mean 15 years)
- Distal radial artery, mid-forearm or proximal radial artery inflow in 26 patients.
- Primary and cumulative patency rates were 75% and 85% at 12 months, 70% and 85% at 24 months
- 5 AVFs failed, of these: 2 had new successful AVFs created, 2 regained renal function, one was transplanted and one declined other procedures.
- No patients developed hand ischemia, three later required banding for high flow.
- Intervention for dysfunction readily available.

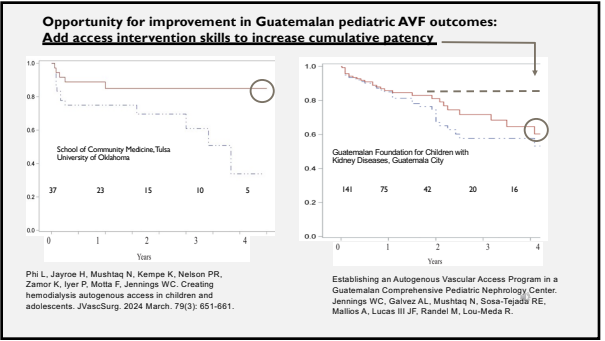
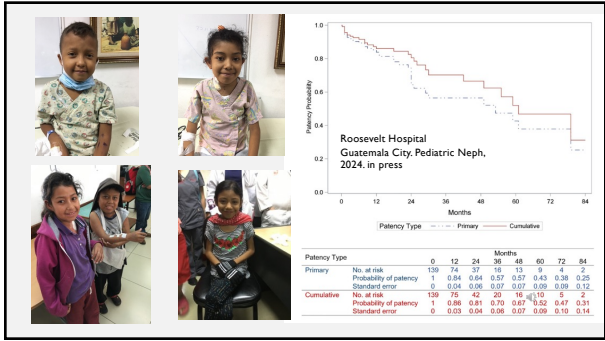
-Phi L, Jayroe H, Mushtaq N, Kempe K, Nelson PR, Zamor K, Iyer P, Motta F, Jennings WC. Creating hemodialysis autogenous access in children and adolescents. *JVascSurg*. 2024 March. 79(3): 651-661.



Roosevelt Hospital, Guatemala City. Pediatric Neph, 2024.

- 141 new patients had AVF procedures
- 12 other established-patient access operations included revisions, aneurysm repairs and flow-reduction procedures.
- Ages 7-19 years (mean 13 years)
- Distal radial artery, mid-forearm or proximal radial artery inflow in 101 patients.
- Primary and cumulative patency rates were 85% and 86% at 12 months and 67% and 81% at 24 months, respectively.
- No patients developed hand ischemia, six later required banding for high flow.
- Intervention for dysfunction NOT available.



Establishing an Autogenous Vascular Access Program in a Guatemalan Comprehensive Pediatric Nephrology Center. Jennings WC, Galvez AL, Mushtaq N, Sosa-Tejada RE, Mallios A, Lucas III JF, Randel M, Lou-Meda R. *Pediatr Neph*, 2024. in press



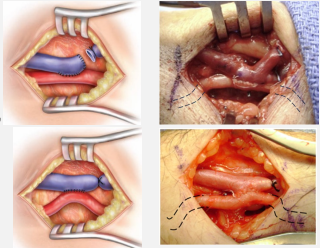
Common technical points in our experience:

- 1.5 mm inflow artery and 2mm vein is adequate in children
- Distal RC-AVF first, consider mid-forearm AVFs as second choice.
- Mobilize/Elevate the radial artery
- Proximal radial artery AVF when distal options not likely to succeed.
- Interrupt heel of anastomosis for smaller vessels.
- Laryngeal mask or regional anesthesia in most children, bupivacaine decreases anesthetic requirements and makes recovery much more comfortable.
- Cannulate with buttonhole technique*. **Key element: establish three-four sites.**

*PH L, Jayroe H, Mushtaq N, Kempe K, Nelson PR, Zamer K, Iyer P, Motta F, Jennings WC. Creating hemodialysis autogenous access in children and adolescents. J Vasc Surg. 2024 March; 79(3): 651-661.
 *Garza B, et al. Good outcomes for arteriovenous fistula with buttonhole cannulation for chronic hemodialysis in children and adolescents. Pediatr Nephrol. 2022 May 5.
 *Moore T, Brightman S, Dodson DL, Vlasady BA. Arteriovenous Buttonhole Access Cannulation in Pediatric Patients on Hemodialysis. Nephrol Nurs J. 2019 Jul-Aug; 46(4):407-411.

Broad elevation of the radial artery is an important component of many distal AVFs, using cautery to divide small branches well away from the artery.



*Jennings WC, Glazer SM. J Vasc Surg. 2017; 65(3): 933-934
 *Zamor K, Jennings WC. Avoiding Early Failure in Arteriovenous Fistulas. Textbook of Comprehensive Dialysis Access. 2023, Karl Illig editor. Springer Nature, In press.
 *Jennings WC, Gálvez AL, Mushtaq N, Sosa-Tejada RE, Mallios A, Lucas III JF, Randel M, Lou-Meda R. Establishing an Autogenous Vascular Access Program in a Guatemalan Comprehensive Pediatric Nephrology Center. Pediatr Nephrol. 2024 In press.

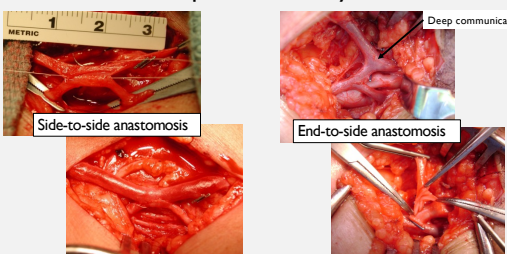
Mid-forearm AVFs may offer better outcomes than a marginal distal access. Your US vein mapping the key element for identifying such opportunities.



Jennings WC, et al. Creating Radiocephalic Arteriovenous Fistulas: Technical and Functional Success. J Am Col Surg. 2009 Mar;208(3):419-25
 *Zamor K, Jennings WC. Avoiding Early Failure in Arteriovenous Fistulas. Textbook of Comprehensive Dialysis Access. 2023, Karl Illig editor. Springer Nature, In press.




Antecubital proximal radial artery AVFs



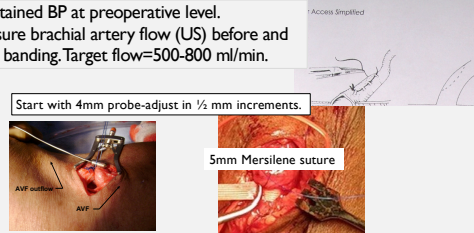
*Jennings WC, Turman MA, Taubman KE. Arteriovenous fistulas for hemodialysis access in children and adolescents using the proximal radial artery inflow site. J Pediatr Surg. 2009 Jun;44(7):1377-81.
 *Jennings WC, Turman MA. Vascular Access in Children and Adolescents. Dialysis Access, Contemporary Management. Editors: Drs. Alan B. Lumsden and Mark Davies. 2010, Cardiotec.

Precision banding



- Maintained BP at preoperative level.
- Measure brachial artery flow (US) before and after banding. Target flow=500-800 ml/min.

Start with 4mm probe-adjust in 1/2 mm increments.


5mm Mersilene suture



Jennings WC, Miller GA, Coburn MZ, Howard CA, Lawless MA. Vascular access flow reduction for arteriovenous fistula salvage in symptomatic patients with central venous occlusion. J Vasc Access. 2012;13(2):157-162.
 *Glazar G, Jennings WC, Mado J, Mallios A, Taubman K. Treatment of high flow arteriovenous fistulas after successful renal transplant using a simple precision banding technique. Ann Vasc Surg. 2015

To be continued.....



New Hospital de Villa Nueva: Guatemala City.
 Focus on kidney care with vascular access center and training facilities.