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Vascular Access Procedures for American Indian Dialysis Patients

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Background

More than 300,000 patients are currently receiving treatment for chronic renal failure with chronic dialysis in the United States.[1] Access complications are the leading cause for hospitalizations in this population.[2] This paper will examine renal failure and the complications of dialysis access in two groups of patients from two southwestern tribes.

In 1972, nationally, only 6% of patients with end-stage renal disease (ESRD) had diabetes mellitus, and less than 20% of ESRD patients were older than 65.[1] In the American Indian and Alaska Native (AI/AN) population, as in the United States in general, diabetes mellitus has become the leading cause of renal failure. In the general population, diabetes mellitus is the cause of 33.2% of treated ESRD, while 65.1% of incident cases of AI/AN ESRD is due to diabetes[1] (see Table 1). The prevalence of ESRD is higher in American Indians than in Caucasians with diabetes mellitus. When kidney failure develops, 25% of patients will die each year.[1]

Table 1. Leading Primary Causes of Renal Failure in Two Southwestern Tribes

	Tribe A (N=60)	Tribe B (N=58)
Diabetes Mellitus	83%	62%
Chronic Glomerulonephritis	5%	17%
Hypertensive Nephropathy	10%	5%
Other causes	2%	10%
Unknown	0%	5%

As in the general population, comorbid conditions were common in the patients in the two groups studied. In the group from Tribe A, 84% had diabetes and 97% had hypertension. In the Tribe B group, 66% had diabetes and 80% had hypertension. Renal failure associated with diabetes mellitus and hypertension is largely preventable by maintaining strict control of serum glucose and blood pressure.

Treatment Options for End-Stage Renal Disease

There are three general treatment approaches for ESRD.

No therapy. This alternative results in death in all cases when renal failure progresses to creatinine clearance of less than 15%.

Peritoneal dialysis. This modality is used less frequently than hemodialysis in the AI/AN population. It requires meticulous, sterile technique, and even with this, most catheters have to be removed within two years due to obstruction or infection; nevertheless, this technique has been successfully employed by

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patients without running water or electricity. Alternatives include continuous ambulatory peritoneal dialysis (CAPD), where exchanges are performed every six hours without a machine, or nighttime peritoneal dialysis, using a dialysis machine at home. Patients are often more independent on peritoneal dialysis than hemodialysis.

Hemodialysis: This therapy requires treatment attached to the dialysis machine at least four hours each session, three days a week, connected via arterial venous fistula, arterial venous graft, or central venous access.

Dialysis is expensive. Approximately one-half of Medicare's $6 billion annual budget for ESRD is spent on the procedural costs of delivering dialysis to ESRD patients. Almost $1 billion is spent annually on dialysis access procedures alone.[3]

Patency Rates for Grafts and Fistulas

The data on dialysis access procedures presented in this article are compiled from surgical data from consecutive patients cared for at the two hospitals serving the two patient groups. Results were reviewed from 60 patients from Tribe A who had 81 primary dialysis access procedures over a six-year period, and from 58 patients from Tribe B who had 94 primary dialysis access procedures over a three- year period. In the patients studied, 47% of those from Tribe A and 63% from Tribe B were male. The average age (mean ± standard deviation) of the Tribe A patients was 57 ± 15; for Tribe B, this figure was 61 ± 14.

Fifty-seven arterial venous polytetrafluoroethylene (PTFE) synthetic grafts were placed in Tribe A patients and 76 in Tribe B patients. Twenty-four native arterial venous fistulas (AVF) were placed in patients from Tribe A and 18 in those from Tribe B. The median primary synthetic graft patency (number of months before first thrombosis) was 31 months for PTFE grafts in Tribe A patient and 9 months in Tribe B patients ($p<.01$, log rank test). The median primary patency for AVF was 6 months for Tribe A and 8 months for Tribe B patients. However, unlike PTFE grafts, there was a large early loss, or failure to develop for AVF, but those that made it beyond six months had a slow rate of loss thereafter. These data are depicted in Figures 1 and 2.

The median secondary graft patency (number of months before the graft had to be abandoned despite revisions) was 48 months for PTFE grafts in Tribe A and over 26 months in Tribe B patients ($p<.02$, log rank test). The median secondary patency for AVF was 10 months for both Tribe A and Tribe B patients, but there was a leveling off of patency, unlike PTFE grafts (see Figures 3 and 4).

There was no difference in secondary patency for PTFE grafts between males and females, forearm vs. upper arm procedures, or right arm vs. left arm procedures. Furthermore, there did not seem to be differences in PTFE secondary graft patency related to age of the patient. There was a trend, which did not achieve statistical significance, for a shorter graft patency in patients with higher mean blood pressures recorded at the time of graft insertion.

Figure 1. Secondary Patency For AVF

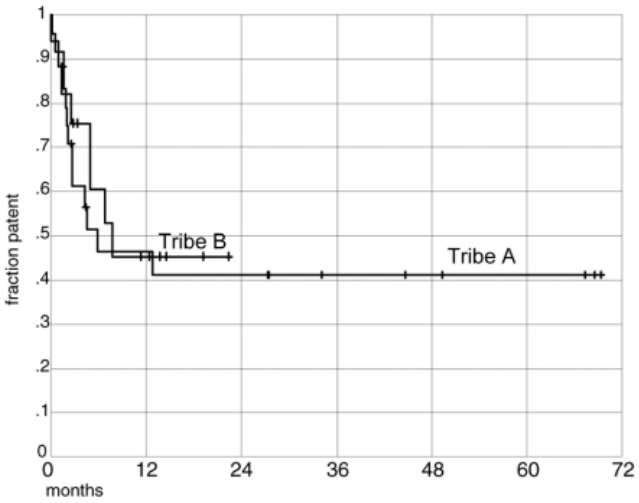


Figure 2. Primary Patency For PTFE Grafts

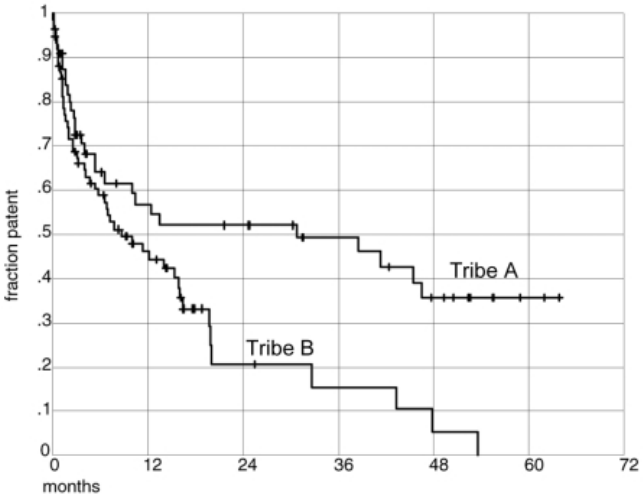


Figure 3. Secondary Patency For AVF

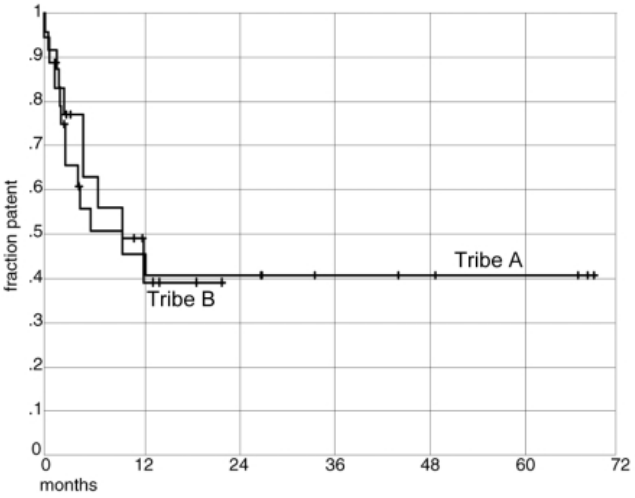
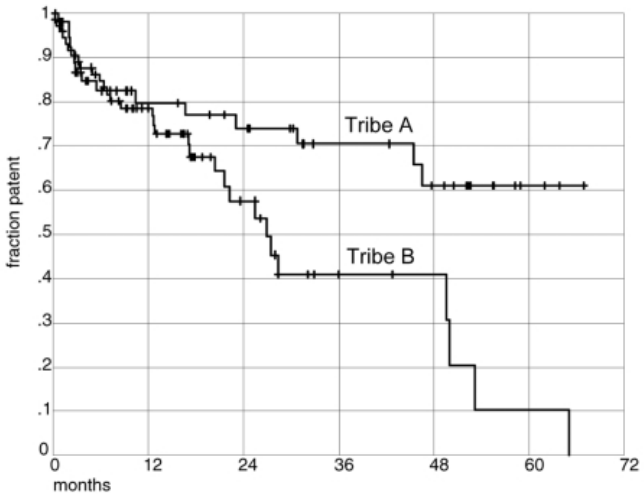


Figure 4. Secondary Patency For PTFE Grafts



Secondary patency of AVF tended to be slightly longer in males than females and in patients younger than 60 compared to those older than 60, but this was not statistically significant.

Comparison to national patency rates may be observed in Tables 2 and 3.

Table 2. Secondary Patency of Arterial Venous Fistulae

Reference Number	1 yr	2 yr	3 yr	Mean Patency
2	46%	40%	30%	
24	65%			
25	60- 88%	53- 88%	45-82%	
30				2.85 yrs

Table 3. Secondary Patency of PTFE Grafts

Reference Number	6 Months	1 yr	2 yr	3 yr	Mean Patency
2	75%	59%	50%	42%	
3		63- 90%		42- 60%	
11					21 mos
16		64%			
17		56%	50%		
24		79%	69%		
25		67- 80%	50- 68%	45- 82%	
26	80%	70%			
27	90%	78%	62%	50%	36 mos
28	95%	90%	85%		

Types of Access for Hemodialysis

Forearm loop (PTFE) graft. This was the most commonly performed procedure in our patient population. It is generally placed on the non-dominant arm. These grafts should not be used in the first two to three weeks following insertion.

Straight forearm (PTFE) graft. These have lower patency rates in most series.

Upper arm curved (PTFE) graft. This is a secondary procedure in the United States, but is sometimes used as a primary procedure in Europe. You need to wait two to three weeks before using it.

AV fistula. Procedures include the Cimino (radial artery to cephalic vein at the wrist), snuff box, or occasionally an upper arm connection between the cephalic or basilic (transposed to a more superficial location) veins and the brachial artery. These procedures give a lower immediate patency rate than PTFE grafts, but are self healing and can last years longer than grafts. They have lower complication rates (infection, steal, etc.) than PTFE grafts, but one should wait at least six weeks following surgery before they can be used for dialysis.

AV fistulas are used in less than 25% of patients in the United States, except in New England, where almost 60% of patients undergo these procedures. The primary failure rate is 9- 30%.[3,4] The published patency rates show reduced access survival in females and diabetics (mean primary patency 2.4 years in females vs. 5.1 years in males, and only 0.9 years in diabetics).[5] Upper arm AV fistulas require transposition of the vein if the basilic vein is used, and are associated with an increased risk for "steal" syndromes and arm swelling.[6]

Short or long term central line access may be accomplished using one of a number of products including tesio, permacath, vascath, ashcath, etc. These can be used immediately after placement, and the silastic cuffed catheters have a lower thrombosis rate and lower rate of infectious complications than other designs. The average patency is 12 months for the long term catheters.[7] Central vein stenosis occurs in 50% of veins that have had subclavian vein catheters.[8]

Complications

Thrombosis is more common in women than men, more common in diabetic patients than non-diabetic ones. Rates are higher if the serum albumen level is <3 g/dL, and are possibly increased in patients receiving erythropoietin.[9] A more detailed discussion of thrombosis will be found below.

"Steal" syndrome and arterial insufficiency are more common in diabetic patients. This complication occurred in 1/24 (4%) of patients from Tribe A and 0/18 (0%) of patients from Tribe B having AVF, and required ligation of the fistula in the one Tribe A patient. Steal occurred in 5/57 (9%) Tribe A and 2/76 (3%) Tribe B patients having PTFE grafts. One of the Tribe B patients required banding of his graft, and the graft had to be removed in two Tribe A patients for this condition. The nationally reported incidence of this complication is 2-3%.

The incidence of infection in the literature is 16% for PTFE

grafts vs 4% for AVF.[10] Management is controversial, and might include graft removal, partial graft removal, long term antibiotics, etc. The actual incidence of infection is hard to determine, as most patients have some swelling and redness due to tissue reaction and venous hypertension during the first two to three weeks after the insertion of PTFE grafts. It is common for physicians to prescribe antibiotics for them during this time. Cellulitis over a graft can usually be treated without graft removal, but infections at anastamotic sites with external drainage generally require removal of part or all of the graft.

In the AI/AN patients studied, there were no infections after AVF, but 9% of patients developed infections after PTFE placement and 60% of those so infected required removal of part or all of the graft. All of our patients receive prophylactic antibiotics with vancomycin for PTFE grafts and cefazolin for AVF.

The incidence of pseudoaneurysms in the literature is 6% for PTFE grafts. Aneurysms in AVF are common, but seldom require treatment.[11]

Venous hypertension is generally troublesome only for two to three weeks after insertion, but may persist, particularly in patients who have subclavian vein thrombosis or stenosis. Other complications include congestive heart failure or carpal tunnel syndrome.[12]

Cause of Thrombosis

The cause of thrombosis is neointimal hyperplasia, which is caused by elaboration of extracellular matrix from smooth muscle cells in response to platelet aggregation. Of occluded grafts, 90% have venous stenosis at the graft to vein junction, 29% have both venous and arterial stenosis, and only 1% have isolated arterial stenosis. Fourteen percent will have an upstream venous stenosis. Secondary causes include compliance mismatch (grafts are rigid compared with native vessels), shear forces related to turbulent flow and dp/dt pressure effects, and hypercoagulable state caused by decreased protein c activity, lupus anticoagulant, heparin induced thrombocytopenia, decreased antithrombin III activity, or antiphospholipid antibodies. Generally the function of proteins is deficient, but the quantity is normal, so routine testing is not helpful.

Thromboses may be delayed by avoiding central lines, since central vein stenosis is associated with a prior subclavian line in 42-50% of cases, and internal jugular lines in 0-10% of cases. Repeated antecubital vein punctures may also lead to vein stenosis. In general, the use of a primary AVF is recommended, when possible. While blood pressure must be controlled, dehydration should be avoided; vasodilators are the antihypertensive agent of choice. Doppler surveillance may prolong graft patency by allowing repair of grafts before they clot.[13] The sensitivity of this test to detect problems is 80-95%.[14] However, a controlled trial of surveillance and prophylactic angioplasty failed to prolong secondary graft patency.[15,16]

Anticoagulants such as aspirin are not helpful. Patients with very low albumin levels[17] or those with a history of repeated thromboses and normal radiologic studies may benefit from coumadin. Low dose radiation is not effective in prolonging patency.[18]

Treatment of Thrombosis

Generally, satisfactory results are obtained if intervention occurs within two weeks of clotting. Success has been reported up to four months following thrombosis, but the highest success is achieved if it takes place within 48 hours.[19]

Mechanical fragmentation of the clot with thrombolysis and angioplasty of the associated stenosis is the treatment of choice (using Tissue Plasminogen Activator, or t-PA). This procedure takes about 20 minutes. Patency rates are comparable to surgical treatment in recent but not older studies, but costs may be higher.[21,22] An important advantage over surgical repair is that upstream stenosis can be identified.

Radiologic thrombolysis and angioplasty was first reported in 1983; short term success rates were 85-94%[10]; long term rates were 41-76% at 6 months and 31-45% at 12 months.[20] Stenting is only useful for subclavian vein stenosis, where six month patency is 76% and 12 month patency is 35%. Generally, surgical thrombectomy alone is unsuccessful, especially if the graft is older than six months. The primary patency rate in the literature for thrombectomy alone is 32% at six months.[20] The best results for surgical repair occur when a segment is added to the graft to jump above the level of the venous stenosis. This may require jumping above a joint.

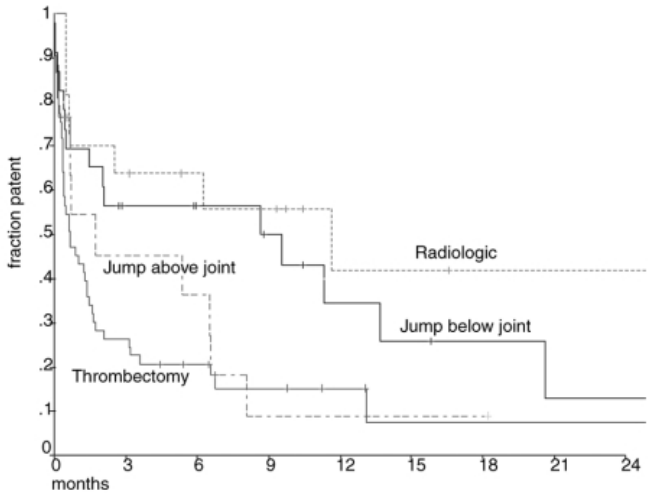
The secondary patency rate is good for primary procedures and for first revisions, but becomes progressively worse for subsequent revisions. The success rates for first, second, and third revisions reported in the literature are 65%, 53%, and 44%, respectively.[20]

In our patients, there were 124 procedures done for clotted access. Sixty one were first occurrences, 33 second occurrences, 18 third occurrences, and 12 were for four or more occurrences. The success rate fell progressively after the first revision.

A variety of procedures were performed to restore patency

of thrombosed PTFE grafts. The most commonly performed procedures were thrombectomy (56 patients), jump graft below a joint (23 patients), jump graft above a joint (12 patients), and radiologic thrombolysis and angioplasty (19 patients). Nine patients had other procedures performed. The best patency rates were for a jump graft below a joint and radiologic thrombolysis with angioplasty. These two procedures were comparable in patency rates. Thrombectomy alone had the worst success. The success rates of these procedures is depicted in Figure 5.

Figure 5. Time To First Thrombosis After Procedure



Treatment of Steal Syndromes and Arterial Insufficiency

Banding often has poor success or results in thrombosis of the graft. Currently, bypass is the favored technique, when possible, as it works the best and does not risk graft loss.[23] Ligation of the graft is required in 2-3% of patients.[17]

Infection

Prevention is best achieved by the use of prophylactic antibiotics and sterile technique, and the avoidance of too many procedures on same graft. The most common infections are *Staphylococcus aureus* (50-70%) and *Staphylococcus epidermidis*. Other infections include enterococcus, enterobacter, and pseudomonas.[25]

Pseudoaneurysms

Pseudoaneurysms almost never rupture in AVFs, but should be fixed in PTFE grafts if they are greater than 2 to 3 cm in size.

Future Trends

It is likely that there will be improvements in graft materials and that they will be used earlier, with less thrombosis. Kidney transplantation will be more accessible and will yield better results. More aggressive treatment of associated conditions will improve outcomes. Longer dialysis sessions, as is done in Europe, may become more commonly used in America.

Conclusions

In both Tribes considered in this paper, diabetes is now the leading cause of renal failure, and affects both women and men equally. Most of these patients end up receiving surgical procedures for hemodialysis. Arteriovenous fistulas had a higher initial failure rate than PTFE grafts in both patient populations, but those that last a year have longer patency than grafts. The primary and secondary patency rates for Tribe B are less than those for Tribe A patients for PTFE grafts. Radiologic thrombectomy with angioplasty has as good results as surgical revisions as a treatment for graft thrombosis.

There is a need for controlled studies to ascertain the role of graft surveillance, optimal blood pressure management, the identification of patients requiring anticoagulants for hypercoagulable states, and better means to identify those patients likely to benefit from arteriovenous fistula as opposed to PTFE grafts. Early placement of access in patients with progressive ESRD reduces the need for temporary access procedures and may reduce the incidence of subclavian vein stenosis.

References

1. U.S. Renal Data System, USRDS 1999 Annual Data Report NIH, NIDDK Bethesda, MD, 1999.
2. Hodges TC, Fillinger MF, Zwolak RM, et al. Longitudinal comparison of dialysis access methods: Risk factors for failure. *J Vasc Surg.* 1997;26:1009-1019.
3. Feldman HI, Kobrin S, Wasserstein A. Hemodialysis vascular access morbidity. *Journal of the American Society of Nephrology*. 1996;7(4):523-535.
4. Livingston CK, Potts JR. Upper arm arteriovenous fistulas as a reliable access alternative for patients requiring chronic hemodialysis. *The American Surgeon*. 1999;65:1038-1042.
5. Rodriguez JA, Armadans L, Ferrer E, et al. The function of permanent vascular access. *Nephrol Dial Transplant*. 2000;15:402-408.
6. National Kidney Foundation Dialysis Outcomes Quality Initiative 1997.
7. McLaughlin K, Jones B, Mactier R, Porteus C. Long-term vascular access for hemodialysis using silicon dual-lumen catheters with guidewire replacement of catheters for technique salvage. *American Journal of Kidney Diseases*. 1997;29(4):553-559.
8. Fan PY. Acute vascular access: new advances. *Advances in Renal Replacement Therapy*. 1994;1(2):90-98.
9. Windus DW. The effect of comorbid conditions on hemodialysis access patency. *Advances in Renal Replacement Therapy*. 1994;1(2):148- 154.
10. Burdick JF, Maley WR. Update on vascular access for hemodialysis. *Advances in Surgery*. 1997;30:223-232.
11. Lenz B, Veldenz HC, Dennis JW, Khansarinia S, Atteberry LR. A three-year follow-up on standard vs thin wall ePTFE grafts for hemodialysis. *Journal of Vascular Surgery*. 1998;28 (3):464-470.
12. Marx AB, Landmann J, Harder FH Surgery for vascular access. *Current Probl Surg.* 1990;6-47.
13. Roberts AB, Kahn MB, Bradford S, et al. Graft surveillance and angioplasty prolongs dialysis graft patency. *Journal of the American College of Surgeons*. 1996;183:486-492.
14. Sands J. Use of color doppler in vascular access. *Vascular Access for Hemodialysis*. V. 1996.
15. Lumsden AB, MacDonald MJ, Kikeri D, et al. Prophylactic balloon angioplasty fails to prolong the patency of expanded polytetrafluoroethylene arteriovenous grafts: Results of a prospective randomized study. *J Vasc Surg.* 1997;26:382 - 392.
16. Cinat ME, Hopkins J, Wilson SE. A prospective evaluation of PTFE graft patency and surveillance techniques in hemodialysis access. *Ann Vasc Surg.* 1999;13:191-198.
17. Miller PE, Carlton D, Deierhoi MH, Redden DT, and Allon M. Natural his-

tory of arteriovenous grafts in hemodialysis patients. *Am J Kidney Dis*. 2000;36:68-74.
18. Choen GS, Freeman H, Ringold MA, et al. External beam Irradiation as an adjunctive treatment in failing dialysis shunts. *J Vasc Intervent Radiology*. 2000;11:321-326.
19. Diskin CJ, Stokes TJ, Panus LW, Thomas J, and Lock S. The importance of timing of surgery for hemodialysis vascular access thrombectomy. *Nephron*. 1997;75:233-237.
20. Beathard GA. The treatment of vascular access graft dysfunction: a nephrologist's view and experience. *Advances in Renal Replacement Therapy*. 1994;1(2)131- 147.
21. Dougherty MJ, Calligaro KD, Schindler N, Raviola CA, Ntoso A. Endovascular versus surgical treatment for thrombosed hemodialysis grafts: A prospective, randomized study. *J Vasc Surg*. 1999;30:1016- 1023.
22. Bitar G, Yang S, Badosa F. Balloon versus patch angioplasty as an adjuvant treatment to surgical thrombectomy for hemodialysis grafts. *American Journal of Surgery*. 1997;174:140-142.
23. Katz S, Kohl RD. Treatment of hand ischemia by arterial ligation and upper extremity bypass after angioaccess surgery. *Journal of the American College of Surgeons*. 1996;183: 239-242.
24. Harland RC. Placement of permanent vascular access devices: surgical considerations. *Advances in Renal Replacement Therapy*. 1994;1(2)99-106.
25. Albers FJ. Causes of hemodialysis access failure. *Advances in Renal Replacement Therapy*. 1994;1(2):107-118.
26. Helling TS, Nelson PW, Shelton L. A prospective evaluation of plasma-TFE and expanded PTFE grafts for routine and early use as vascular access during hemodialysis. *Ann Surg*. 1992;216:596-599.
27. Rizzuti RP, Hale JC, Burkart TE. Extended patency of expanded polytetrafluoroethylene grafts for vascular access using optimal configuration and revisions. *Surg Gynecol Obstet*. 1988;166(1):23-27.
28. Hurlbert SN, Mattos MA, Henretta JP, et al. Long-term patency rates, complications and cost-effectiveness of polytetrafluoroethylene (PTFE) grafts for hemodialysis access: a prospective study that compares Impra versus Gore-tex Grafts. *Cardiovasc Surgery*. 1998;6(1):652-656.

COMMENTARY

Optimal Vascular Access for American Indian Dialysis Patients: The Primary Care Provider's Role

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Vascular access complications are a major cause of morbidity for patients treated with hemodialysis, and represent a large cost burden for the health care system. Current efforts to improve outcomes for patients are based on clinical practice guidelines developed by the National Kidney Foundation as part of the Dialysis Outcomes Quality Initiative (DOQI, *http://www.kidney.org/professionals/doqi/index.cfm*).

Guidelines on vascular access that IHS primary providers should be aware of include the following:

Guideline 7 - Preservation of Veins for AV Access

A. Arm veins suitable for placement of vascular access should be preserved, regardless of arm dominance. Arm veins, particularly the cephalic veins of the non-dominant arm, should not be used for venipuncture or intravenous catheters. The dorsum of the hand should be used for intravenous lines in patients with chronic renal failure. When venipuncture of the arm veins is necessary, sites should be rotated.

B. Instruct hospital staff, patients with developing ESRD (creatinine >3 mg/dL), and all patients with conditions likely to lead to ESRD, to protect the arms from venipuncture and intravenous catheters. A MedicAlert® bracelet should be worn to inform hospital staff to avoid IV cannulation of essential veins.

C. Subclavian vein catheterization should be avoided for temporary access in all patients with chronic renal failure due to the risk of central venous stenosis.

Guideline 8 - Timing of Access Placement

A. Patients should be referred for surgery to attempt construction of a primary AV fistula when their creatinine clearance is <25 mL/minute, their serum creatinine level is >4 mg/dL, or within 1 year of an anticipated need for dialysis. The patient should be referred to a nephrologist prior to the need for access to facilitate chronic renal failure treatment and for counseling about modes of ESRD care, including hemodialysis, peritoneal dialysis, and renal transplantation.

B. A new primary fistula should be allowed to mature for at least 1 month, and ideally for 3 to 4 months, prior to cannulation.

C. Dialysis AV grafts should be placed at least 3 to 6 weeks prior to an anticipated need for hemodialysis in patients who are not candidates for primary AV fistulae.

D. Hemodialysis catheters should not be inserted until hemodialysis is needed.

Guideline 9 - Access Maturation

A. A primary AV fistula is mature and suitable for use when the vein's diameter is sufficient to allow successful cannulation, but not sooner than 1 month (and preferably 3 to 4 months after construction.

B. The following procedures may enhance maturation of AV fistulae:

1. Fistula hand-arm exercise (e.g., squeezing a rubber ball with or without a lightly applied tourniquet) will increase blood flow and speed maturation of a new native AV fistula.
2. Selective obliteration of major venous side branches will speed maturation of a slowly maturing AV fistula.
3. When a new native AV fistula is infiltrated (i.e., presence of hematoma with associated induration and edema), it should be rested until swelling is resolved.

C. PTFE dialysis AV grafts should not routinely be used until 14 days after placement. Cannulation of a new PTFE dialysis AV graft should not routinely be attempted, even 14 days or longer after placement, until swelling has gone down enough to allow palpation of the course of the graft. Ideally, 3 to 6 weeks should be allowed prior to cannulation of a new graft.

D. Patients with swelling that does not respond to arm elevation or that persists beyond 2 weeks after dialysis AV access placement should receive a venogram or other non-contrast study to evaluate central veins.

E. Cuffed and noncuffed hemodialysis catheters are suitable for immediate use and do not require maturation time.

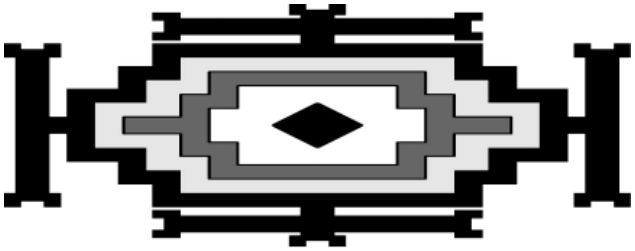
Guideline 29 - Goals of Access Placement - Maximizing Primary AV Fistulae

A. Primary AV fistulae should be constructed in at least 50% of all new patients electing to receive hemodialysis as their initial form of renal replacement therapy. Ultimately, 40% of prevalent patients should have a native AV fistula.

B. Patients should be reevaluated for possible construction of a primary AV fistula after failure of every dialysis AV access.

C. Each center should establish a database to track the types of accesses created and the complication rates.

The most important goal is to increase the proportion of patients with native AV fistulas. This is likely to occur if patients are referred early for vascular access placement. Indian health care physicians who refer patients to surgeons, nephrologists, and dialysis units should be aware of the success rates of individual providers in meeting the goals outlined in Guideline 29 above.



When Is A Glucose Not A Glucose?

An Overview of *L*ogical *O*bservation *I*dentifier *N*ames and *C*odes (LOINC), The Next Generation of Laboratory and Clinical Standards

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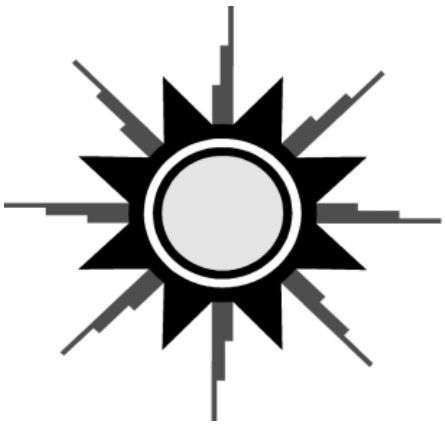
What is LOINC?

The **L**ogical **O**bservation **I**dentifiers **N**ames and **C**odes (**LOINC**) database provides a standard set of universal names and codes for identifying individual laboratory results (e.g., hemoglobin, serum sodium concentration), clinical observations (e.g., discharge diagnosis, diastolic blood pressure), and diagnostic study observations (e.g., PR interval, echocardiographic left ventricular diameter, chest x-ray impression). The purpose of LOINC is to facilitate the exchange and pooling of results, such as blood hemoglobin, serum potassium, or vital signs, for clinical care, outcomes management, and research.

LOINC is part of a larger movement that seeks to overcome a longstanding "islands of information" problem in health care by developing universal identifiers (names and codes), reference terminologies, and vocabularies for use in exchanging and analyzing data. Although it has wider implications, the development of LOINC to date has focused on developing standard codes and names for laboratory test results. The LOINC database currently contains over 15,000 codes for laboratory tests.



One of the key issues LOINC is intended to address arises from the lack of consistency in test naming conventions from laboratory to laboratory, a condition that complicates the process of interfacing and exchanging laboratory data. It can be exceptionally difficult for someone outside a given laboratory to unequivocally grasp what that laboratory's test descriptions mean. In short, laboratory test names tend to serve a highly parochial function and do not lend themselves to larger data communications needs.

History of LOINC

First released in April 1996, LOINC quickly met with strong interest and has been endorsed or adopted, or both, by a broad spectrum of organizations including the College of American Pathologists, the American Clinical Laboratory Association, Kaiser Permanente, Lab Corp, Mayo Medical Group, Quest Diagnostics, the US Navy, and several Canadian provinces.

The first goal of the LOINC committee was not to create test codes *per se*, but rather to define a formal structure for observations that would distinguish tests that were clinically different and then use this semantic structure to create a database of clinically distinct names. Thus, a "serum potassium" and a "24-hour urine potassium" would be separate observation names in the database. Once this database was populated, the production of test codes was a simple matter of assigning unique codes to the entries in this database.

The goal was to achieve a level of granularity in the test name definition that would map one to one to the separately reported observations on a clinical laboratory report. This was the rule of thumb used for creating LOINC names: if a test has its own column on a clinical report, or has a reference range that is significantly different from other tests, or has clinical significance distinct from other closely related names, it should be assigned a separate name.

Structure of a LOINC name

Each LOINC observation name identifies a distinct laboratory observation. The fully specified name of a test result or clinical observation has five or six main parts including the following: the name of the component or analyte measured (e.g., glucose), the property measured (e.g. substance concentration, mass, volume), the timing of the measurement (e.g., is it over

time or momentary), the type of sample (e.g., urine, serum), the scale or measurement (e.g., qualitative versus quantitative), and, where relevant, the method of measurement (e.g., immune blot, enzyme immunoassay). These can be described formally with the following syntax:

<analyte/component>:<kind of property>:<time aspect>:<system(sample)>:<scale>:<method>

Some examples of fully specified names would be:

6777	GLUCOSE:MCNC:PT:SER/PLAS:QN
1502	GLUCOSE:1H POST 100 G GLUCOSE PO:MCNC:PT:SER:QN
2947	SODIUM:SCNC:PT:BLD:QN

LOINC in electronic messages

Laboratories and managers of medical records systems should record the LOINC codes as attributes of their existing test/observation master files and use LOINC codes and names in the Observation ID field (OBX-3) of the HL7 OBX segment message to identify laboratory results. Most laboratories identify tests in these messages by means of their internal code values (test names). Receiving medical informatics systems cannot fully "understand" the results they receive unless they either adopt the producer's laboratory codes or invest in the work to map each laboratory's code systems to their internal code system.

If medical information producers who wish to communicate with each other used the LOINC codes to identify their results in data transmissions, this problem would disappear. The receiving system with LOINC codes in its master vocabulary file would be able to understand and properly file HL7 messages that identified clinical observations via LOINC codes. Similarly, government agencies would be able, within limits, to pool results for tests from many sites if they were reported electronically using LOINC codes. The LOINC codes should be of interest to hospitals, clinical laboratories, doctor's offices, state health departments, government health care providers, third-party payers, and organizations responsible for quality assurance and utilization review.

POSITION VACANCIES

Editor's note: As a service to our readers, The IHS Provider *will publish notices of clinical positions available. Indian health program employers should send brief announcements on an organizational letterhead to: Editor,* The IHS Provider, *The IHS Clinical Support Center, Two Renaissance Square, Suite 780, 40 North Central Avenue, Phoenix, Arizona 85004. Submissions will be run for two months, but may be renewed as many times as necessary. Tribal organizations that have taken their tribal "shares" of the CSC budget will need to reimburse CSC for the expense of this service. The Indian Health Service assumes no responsibility for the accuracy of the information in such announcements.*

Family Practice Physicians
Chapa-De Indian Health Program, Inc; Auburn, California

Chapa-De Indian Health Program is seeking two additional BC/BE family practice physicians, one to join our Auburn staff and one to join our Woodland staff. Chapa-De is a comprehensive community care system located in beautiful Northern California. We provide medical, dental, behavioral health, optometry, and pharmacy services for 18,000 registered patients in a four-county service area. Join our staff of four family practice physicians, a pediatrician, and a family nurse practitioner. Provide inpatient care at a nearby 100-bed hospital. Enjoy a competitive salary, excellent health benefits, every fourth night call, and an opportunity for IHS loan repayment. For more information please contact Darla Clark, Clinical Administrator, at (530) 887-2800; e-mail at *dccdihp@yahoo.com.* CVs can be faxed to (530) 887-2849.

NATIVE AMERICAN MEDICAL LITERATURE □

The following is an updated MEDLINE search on Native American medical literature. This computer search is published regularly as a service to our readers, so that you can be aware of what is being published about the health and health care of American Indians and Alaska Natives.

The Clinical Support Center cannot furnish the articles listed in this section of THE PROVIDER. *For those of you who may wish to obtain a copy of a specific article, this can be facilitated by giving the librarian nearest you the unique identifying number (UI number), found at the end of each cited article.*

If your facility lacks a library or librarian, try calling your nearest university library, the nearest state medical association, or the National Library of Medicine (1-800-272-47887) to obtain information on how to access journal literature within your region. Bear in mind that most local library networks function on the basis of reciprocity and, if you do not have a library at your facility, you may be charged for services provided.

Frisch L, Allen G, Padonu G, Dontje K, Burhansstipanov L. TI Social influences on Pap smear screening frequency. *Alaska Medicine.* 42(2):41-5, 47, 2000 Apr-Jun. 20373569

Michalek A, Mahoney M, Calebaugh D. Hypothyroidism and diabetes mellitus in American Indian population. *Journal of Family Practice.* 49(7):638-40, 2000 Jul. 20378078

Bolen J, Rhodes L, Powell-Griner E, Bland S, Holtzman D. State-specific prevalence of selected health behaviors, by race and ethnicity—Behavioral Risk Factor Surveillance System, 1997. *Morbidity & Mortality Weekly Report. CDC Surveillance Summaries.* 49(2):1-60, 2000 Mar 24. 20418929

Mayfield J, Reiber G, Nelson R, Greene T. Do foot examinations reduce the risk of diabetic amputation? [see comments]. *Journal of Family Practice.* 49(6):499-504, 2000 Jun. 20378050

Chelius C. Practicing medicine on the Navajo reservation proves eye-opening and rewarding. *WMJ.* 99(2):11-2, 2000 Apr. 20301834

Borchers A, Keen C, Stern J, Gershwin M. Inflammation and Native American medicine: the role of botanicals. [Review] [88 refs] *American Journal of Clinical Nutrition.* 72(2):339-47, 2000 Aug. 20380469

Golaz A, Lance-Parker S, Welty T, Schaefer L, Volmer L, LaFromboise C, Dixon J, Haase T, Kim C, Popovic T, Bisgard K, Strebel P, Wharton M. Epidemiology of diphtheria in South Dakota. *South Dakota Journal of Medicine.* 53(7):281-5, 2000 Jul. 20387983

Burger J, Roush D, Ramos R, Gochfeld M. Risk concerns, land use, stewardship, and the Idaho National Engineering and Environmental Laboratory: attitudes of the Shoshone-Bannock and other American Indians. *Environmental Research.* 83(3):298-310, 2000 Jul. 20398017

Lavallee C, Bourgault C. The health of Cree, Inuit and southern Quebec women: similarities and differences. *Canadian Journal of Public Health. Revue Canadienne de Sante Publique.* 91(3):212-6, 2000 May-Jun. 20382986

Vaughn J, Wolford J, Prochazka M, Permana P. Genomic structure and expression of human KCNJ9 (Kir3.3/GIRK3). *Biochemical & Biophysical Research Communications.* 274(2):302-9, 2000 Aug 2. 20374464

Tague R. Do big females have big pelves? *American Journal of Physical Anthropology.* 112(3):377-93, 2000 Jul. 20320471

Mattevi V, Fiegenbaum M, Salzano F, Weiss K, Moore J, Monsalve M, Devine D, Hutz M. Beta-globin gene cluster haplotypes in two North American indigenous populations. *American Journal of Physical Anthropology.* 112(3):311-7, 2000 Jul. 20320466

Greenwood C, Fujiwara T, Boothroyd L, Miller M, Frappier D, Fanning E, Schurr E, Morgan K. Linkage of tuberculosis to chromosome 2q35 loci, including NRAMP1, in a large Aboriginal Canadian family [see comments]. *American Journal of Human Genetics.* 67(2):405-16, 2000 Aug. 20349281

Hoeppner V, Marciniuk D. Tuberculosis in Aboriginal Canadians. [Review] [49 refs] *Canadian Respiratory Journal.*

7(2):141-6, 2000 Mar-Apr. 20319178

Novins D, Fleming C, Beals J. Manson S. Commentary: quality of alcohol, drug, and mental health services for American Indian children and adolescents. *American Journal of Medical Quality.* 15(4):148-56, 2000 Jul-Aug. 20404588

Daniel M, O'Dea K, Rowley K, McDermott R, Kelly S. Glycated hemoglobin as indicator of social environmental stress among indigenous versus westernized populations [see comments]. *Preventive Medicine*. 29(5):405-13, 1999 Nov. 20033937

Mitchell C, Plunkett M. The latent structure of substance use among American Indian adolescents: example using categorical variables. *American Journal of Community Psychology.* 28(1):105-25, 2000 Feb. 20284290

Willis D. In memoriam: Logan Wright, Jr., PhD (1933-1999). *Journal of Pediatric Psychology.* 25(5):359-61, 2000 Jul-Aug. 20341919

Lebowitz N, Bella J, Roman M, Liu J, Fishman D, Paranicas M, Lee E, Fabsitz R, Welty T, Howard B, Devereux R. Prevalence and correlates of aortic regurgitation in American Indians: the Strong Heart Study. *Journal of the American College of Cardiology.* 36(2):461-7, 2000 Aug. 20386489

NCME VIDEOTAPES AVAILABLE □

Health care professionals employed by Indian health programs may borrow videotapes produced by the Network for Continuing Medical Education (NCME) by contacting the IHS Clinical Support Center, Two Renaissance Square, Suite 780, 40 North Central Avenue, Phoenix, Arizona 85004.

These tapes offer Category 1 or Category 2 credit towards the AMA Physician's Recognition Award. These CME credits can be earned by viewing the tape(s) and submitting the appropriate documentation directly to the NCME.

To increase awareness of this service, new tapes are listed in The IHS Provider *on a regular basis.*

NCME #767
Breast Cancer Diagnosis and Treatment: An Update for the Primary Care Physician *(60 minutes)*

The past decade has witnessed dramatic changes in the diagnosis and treatment of breast cancer. Complex genetic testing, new imaging modalities and biopsy techniques, breast conservation surgery and reconstructive procedures, and new chemotherapy and radiation protocols are among the topics that primary care physicians need to know about in order to manage state-of-the-art care for their patients. In this video, Dr. Roses and his colleagues review the most recent advances in caring for patients with breast malignancies, keeping in mind the central role of the primary care physician.

NCME #770
Abnormal Uterine Bleeding: An Ultrasound Approach *(60 minutes)*

Abnormal uterine bleeding can be experienced by a woman at any age. If organic pathology is absent, the bleeding is either anovulatory in premenopausal women or atrophic in menopausal women. Sonography, in the form of saline infusion sonohysterography (SIS), has gained widespread use as a useful tool for diagnosing this problem in women. Once the domain of obstetricians, the use of endovaginal probes with fluid instillation can enhance the assessment of the endometrium. Dr. Goldstein offers a step-wise approach to the diagnosis, evaluation, and treatment of abnormal uterine bleeding with a special emphasis on using this procedure to its fullest advantage.

NCME #771
Domestic Violence: Intervention Strategies for the Physician *(60 minutes)*

Domestic violence can affect anyone — including your patients. It occurs in every age group, race, culture, social class, and in all types of relationships. For example, every year, one to two million women in the U.S. are victims of partner abuse. Elder abuse is also increasingly being reported. Since domestic violence is so common, physicians need to be prepared to routinely screen for it in their practices and intervene appropriately. Dr. Alpert provides an overview of the scope and complexities of domestic violence and offers practical measures to help physicians identify and manage patients who are victims. In addition, real-life survivors speak of their own experiences dealing with domestic violence and of their encounters with health care professionals.

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THE IHS PRIMARY CARE PROVIDER

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