Transition to All-autogenous Hemodialysis Access: The Role of Preoperative Vein Mapping

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Safe, reliable, and efficient hemodialysis access (DA) remains an unrealized ideal. Autogenous dialysis access (ADA) may improve outcome for renal failure patients. We now place ADA in 9 out of 10 new patients in an effort to maximize primary patency and minimize access-related complications. We reviewed our recent DA experience to determine whether our increased reliance on autogenous access (ADA) has improved outcomes, and to evaluate the impact of preoperative duplex venous imaging (vein mapping) on early and intermediate results. We conducted a retrospective database review of 108 consecutive patients undergoing initial permanent DA between 10/97 and 8/01. Mean follow-up was 13.1 months. Our results showed that increased ADA utilization decreases the need for secondary access procedures. The functional superiority of ADA vs. prosthetic dialysis access (PDA) in this series may be due to optimal autogenous conduit selection facilitated by preoperative vein mapping.

INTRODUCTION

The population of end-stage renal disease (ESRD) patients initiating hemodialysis for renal replacement therapy in the United States continues to increase at a rate of 4.6%/year (United State Renal Data System [USRDS] 1995-1999 data, Table D.4).1 The initiation and maintenance of reliable and efficient hemodialysis access (DA) for these patients present an ongoing challenge to access surgeons.

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The original2 and recently updated3 National Kidney Foundation Dialysis Outcome Quality Initiative (DOQI)/Clinical Practice Guidelines for Vascular Access define “increasing placement of native arteriovenous fistulae” as the primary solution for improved quality of life and overall outcome for hemodialysis patients. Considering that the median age of ESRD patients initiating hemodialysis is >70 years of age (USRDS, Fig. 1.6),1 eventual renal transplantation is not practical or likely for most. Under these circumstances DA represents the definitive and “final” surgical solution for renal replacement therapy.

The DOQI guidelines have influenced recent national DA trends; the number of “simple fistu-
lae” placed for chronic hemodialysis access increased 34.5% between 1996 and 1999 (placement rates 1000 patient years at risk, USRDS, Section 4, p. 81).1 In our own practice, between August 2000 and 2001 over 90% of our initial permanent hemodialysis access procedures were “native,” or autogenous arteriovenous fistulae (AVF). Despite
this “all-autogenous, all-the-time” emphasis, pa-
tients continue to require secondary procedures to
continue hemodialysis. Although less likely than
prosthetic accesses to spontaneously thrombose,
autogenous accesses may fail to mature, or may
develop flow-reducing stenoses before or after the
initiation of hemodialysis. Reviewing their large
experience, Brothers and associates concluded that
secondary procedures were required with equal
frequency for autogenous or prosthetic accesses.4
Our growing enthusiasm for autogenous access has
been enabled by adoption of preoperative can-
date vein selection protocols using upper extremity
venous duplex imaging, or vein mapping. Previous
comparisons between prosthetic and autogenous
procedures have not considered the impact of
preoperative vein mapping as a distinct variable on
functional outcome of both forearm and upper
extremity transposition procedures.5-7 We decided
to review trends in our system-wide hemodialysis
access program to determine whether our increased
reliance on autogenous access (ADA) has measur-
bly improved overall outcomes. We were also in-
terested to learn whether the initiation of
preoperative vein mapping coincided with im-
proved autogenous access primary patency.

PATIENTS AND METHODS

A retrospective database was constructed from op-
erative logs, vascular laboratory image libraries,
nephrology, general medicine and vascular surgery
clinic notes, Department of Veterans Affairs De-
pendant and Decedent Affairs databases, and fee
basis claims for all patients undergoing initial
placement of permanent hemodialysis access (DA)
procedures in the Veterans Affairs Palo Alto Health
Care System between October 1997 and August
2001. Primary access success was defined as a pa-
tent fistula or shunt judged on clinical criteria to
contain sufficient flow for efficient hemodialysis.
Access performance was determined by review of
medical center records and, when necessary, in-
dependent dialysis center records and fee-basis
claims for community services deemed necessary
for revising or restoring access function. Matura-
tional failure for autogenous access was defined as
inability to support regular hemodialysis access (or
< 250 mL/min flow) within 4 months of place-
ment. Any episode of thrombosis or diminished
flow requiring additional interventions to maintain
function, access-related infection, or symptomatic
steal requiring revision or removal were recorded
as access failures.

Dialysis access procedures performed included
polytetrafluoroethylene (PTFE) bridge grafts be-
tween the brachial artery and antecubital veins
(forearm), or cephalic, basilic, or axillary veins
(upper arm). All upper arm PTFE grafts were ta-
pered from 4 to 6 or 7 mm to minimize postoper-
ative ipsilateral distal arterial steal syndromes.
Autogenous access procedures performed included
radial cephalic fistulae and upper arm cephalic and
basilic vein transposition procedures.8-11 Technical
modifications included the use of arterial punches
(4 mm) to optimize the brachial arteriotomy con-
tour for arteriovenous and arterial-PTFE anasto-
moses, extension of the basilic vein harvest well
onto the forearm (when available and of sufficient
diameter) to ensure adequate transposition length,
vein graft routing to minimize external constriction
from deep fascial closure following basilic vein
transposition, and avoidance of excessive tension
on the vein graft from elbow movement or arm
positioning early after upper arm transposition
procedures. Antimicrobial prophylaxis consisted of
vancomycin, 1 g IV prior to surgery. Anesthesia
was accomplished via local 1% lidocaine infusion,
with additional intravenous sedation given as
necessary for anxiety. Basilic vein transposition
procedures were occasionally performed under
general anesthesia.

Vein mapping (Sequoia, Acuson, Mountain
View, CA) was employed beginning in April 2000
to facilitate increased autogenous access utilization
and optimize subsequent outcome. Patients were
examined upright with the index arm in a depen-
dent position using an 8-5 MHz linear transducer.
The subclavian, axillary, brachial, radial, and ulnar
veins were insasoned to identify focal thrombotic,
stenotic, or atretic segments. The cephalic and
basilic veins were assessed for compressibility, pa-
tency, and wall thickening or other evidence of
previous phlebitis. Continuous segments of su-
perfi cal vein ≥3 mm in diameter extending from the
wrist to the antecubital fossa or antecubital fossa
to the deltopectoral groove or axilla were considered
suitable potential access candidates. Images were
archived on a local area network server (Kin DSX®,
Acuson) for operative planning and intraoperative
reference. Expanded knowledge of preoperative
venous anatomy catalyzed a distinct change in
operative strategies for optimizing access; operative
planning became primarily dependant on conduit
considerations (vein diameter, length, location and
compressibility, Fig. 1-4, rather than potential im-
plications of using the dominant or nondominant
arm as the preferred extremity, the use of distal
sites in preference to more proximal locations, or