One- or Two-Stage Basilic Vein Transposition Fistula: What Does the Data Say?

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DISCLOSURE

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- **No relevant financial relationship reported**

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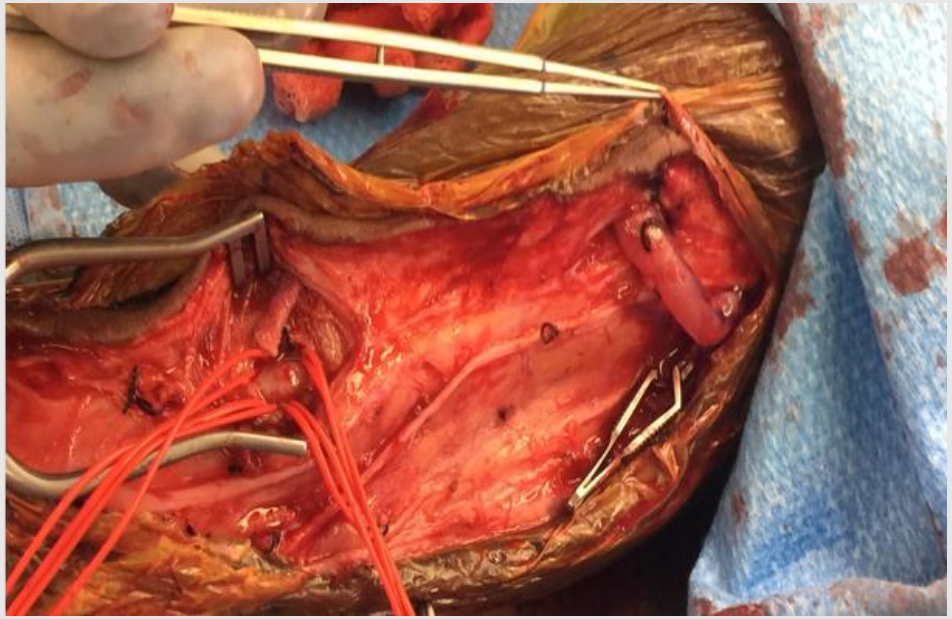
Background

- Upper arm basilic vein transposition fistula is an excellent tertiary autologous vascular access
  - After radio-cephalic and brachio-cephalic fistula



Background

- Primary patency (1-year): 50% to 90%
- Secondary patency (1-year): 47% to 96%
- Maturation rate: 62% to 100%
- Wound infection: 2% to 15%
- Access-related ischemia: 0% to 15%

Tan et al. Semin Vasc Surg 24:63-71 (2011)

BVT vs. AVG

Table 3 Comparison of Patency Complications Rates for the BBAVF and AVG

		n		Primary Patency at 2 Years (%)		Hematoma (%)		Access-Related Ischemia (%)		Infection (%)	
First Author	Year	BBAVF	AVG	BBAVF	AVG	BBAVF	AVG	BBAVF	AVG	BBAVF	AVG
Coburn[51]	1994	59	47	86	49	7	2	3	8	3	16
Matsuura[52]	1998	30	68	70	46					0	10
Oliver[32]	2001	59	80	65	32			2	9	2	12
Gibson[33]	2001	181	66	28	25						
Weale[53]	2007	71	114	40	43			0	2	0	6
Kakkos[54]	2008	41	76	78*	58*	23	10	7	0	0	7
Keuter[55]	2008	52	53	46†	22†	6	2	8	6	2	12
Chemla[56]	2008	34	42	69	54						
Pflederer[57]	2008	118	281	44	5			4	3		
Maya[16]	2009	67	289	55	45					0	9.7/year
Woo[58]	2009	119	168	60	24	4	2	3	5	2	8

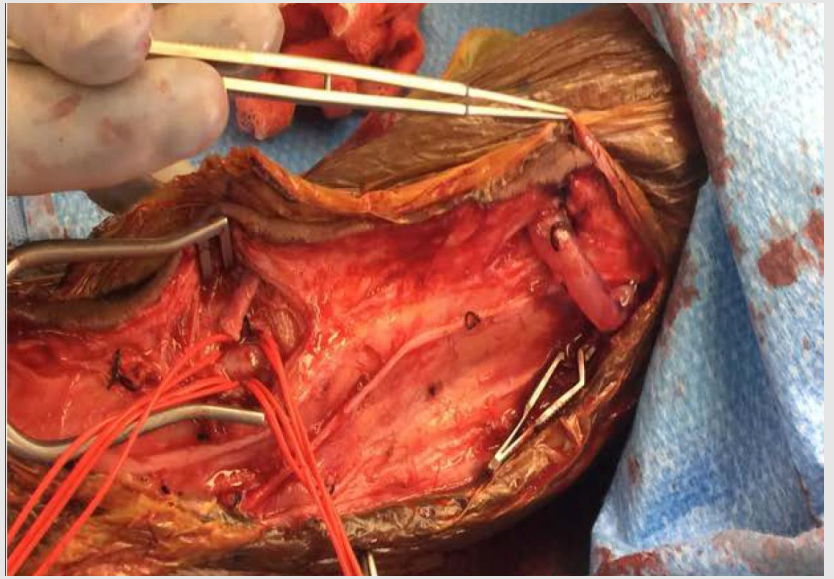
Abbreviations: AVG, arteriovenous grafts; BBAVF, brachial-basilic arteriovenous fistula.
*Patency at 18 months.
†Patency at 12 months.

Tan et al. Semin Vasc Surg 24:63-71 (2011)

One-stage vs. Two-stage

- One-stage procedure
  - vein is exposed - antecubital to axilla
  - Vein is tunneled superficially
  - anastomosis in the brachial artery

- Advantage
  - Shorter time from creation to cannulation
  - Avoidance of second procedure
  - Longer incision if fistula failed to mature (compared to two-stage)



One-stage vs. Two-stage

- Two-stage procedure
  - Creation of AVF (1st stage)
  - Superficialization vs. transposition of arterialized vein (2nd stage)

- Advantage
  - Easier mobilization of the arterialized vein
  - Need for a second procedure
  - Longer time from access creation to cannulation

Study (year)	Outcome measure (Design)	Key findings
Ghaffarian et al. (2018)	Primary and secondary functional outcomes, cost effectiveness ratio (retrospective cohort)	Two-stage procedure are more durable and cost-effective than one-stage procedure
Agarwal et al. (2014)	Maturation rates, primary and secondary patency rates. (retrospective cohort)	Modest reduction in primary and secondary rates in the two-stage procedure.
Robertson et al. (2013)	Primary patency and time to maturation. (retrospective cohort)	No significant difference in functional patency rates between two methods.
Vrakas et al. (2013)	Primary, primary assisted and secondary functional patency rates. Perioperative complications. (retrospective cohort)	Two-stage procedure had better functional primary, primary assisted and secondary patency at 1 and 2 years. Perioperative complication rates were similar.
Ozcan et al. (2013)	Primary and secondary patency rates, perioperative outcomes. (retrospective cohort)	Two-stage procedure had a higher rate of maturation but one-stage procedure matured faster. Thrombosis, bleeding and hematoma were lower with two-stage procedure.
Syed et al. (2012)	Primary, primary assisted and secondary patency up to 3 years. Complication rates. (retrospective cohort)	Primary patency and assisted patency rates were better with one-stage group. Other outcomes were similar.
Kakkos et al. (2010)	Maturation rates and perioperative outcomes (retrospective cohort)	Maturation rates were similar with both approaches although one-stage procedure had significantly higher complication rates.
Hossny et al. (2003)	Complication rates, cumulative secondary patency. (retrospective cohort)	The one-stage procedure had a lower complication rates and was favored by dialysis staff compared to two-stage approach.
El Mallah et al. (1998)	Patency at 4 weeks and at end of follow-up. Aneurysm formation and infection. (randomized-controlled trial)	No significant difference in patency.

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Meta-analysis

Study (year)	Outcome measure	Key findings
Cooper et al. (2015)	Failure rate, 1-year primary and secondary patency rates (8 studies: 1 randomized-controlled trial)	No difference in failure and patency rates
Bashar et al. (2015)	Maturation rate and postoperative complication rates (8 studies: 1 randomized-controlled trial, 2 cohort studies, 5 retrospective studies)	No statistically difference between two techniques in the rate of maturation and postoperative complication
Wee et al. (2018)	Failure rate, 1-year and 2-year patency rates (11 studies: 2 randomized-controlled trial, 9 cohort studies)	2-year primary patency rate improved with two-stage technique; Failure, complication, and 1-year patency rates were similar

Limitations of Studies

- Small case series (n < 200)
- Failure to adequately risk adjust
- Functional patency

Methods

- Retrospective review of the SVS Vascular Quality Initiative (VQI) dataset

- 3498 upper arm BVTs (2010 to 2016)
- 850 BVTs were excluded
  - without any follow up, axillary artery anastomosis
- 2648 BVTs included in the study
  - One-stage 1234 (47%)
  - Two-stage 1414 (53%)

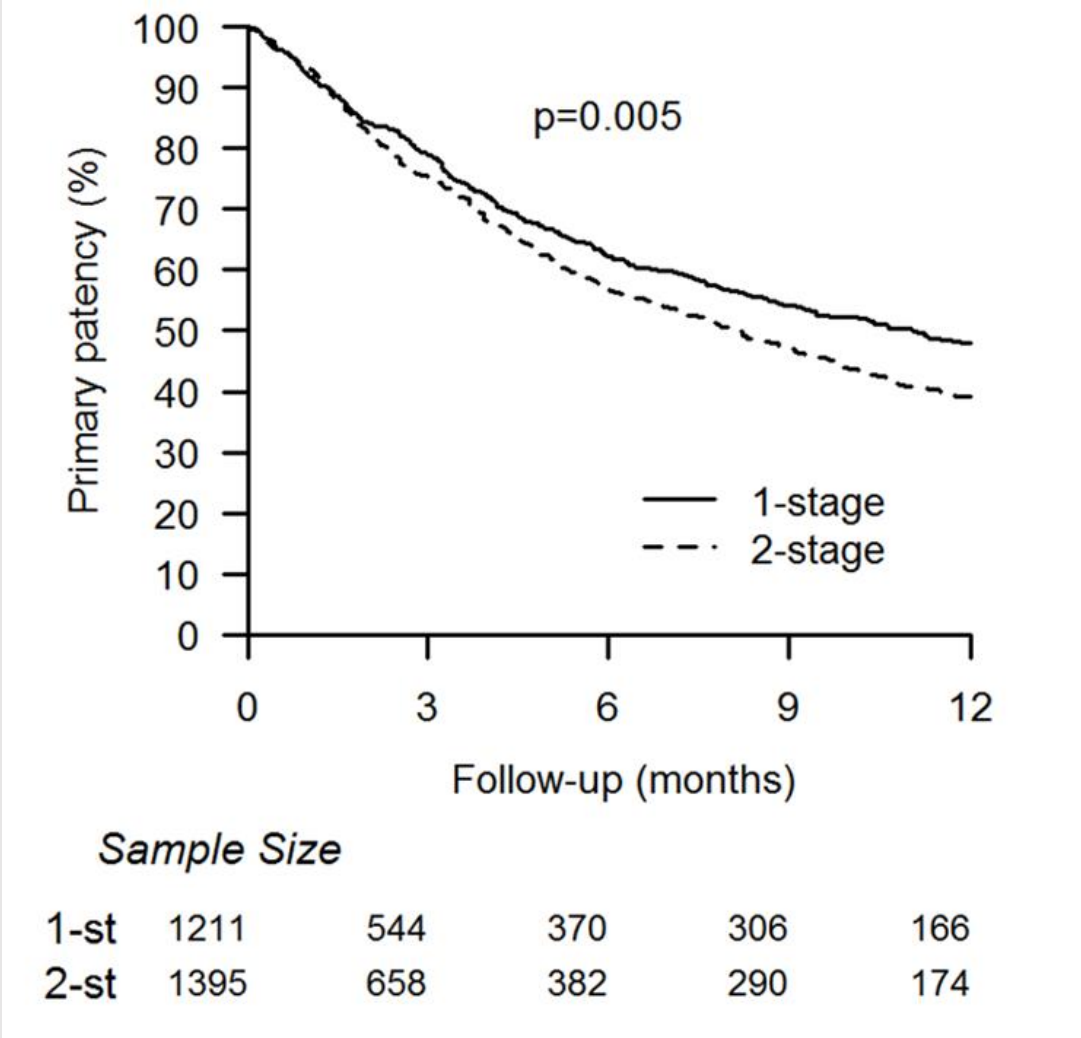
Characteristics

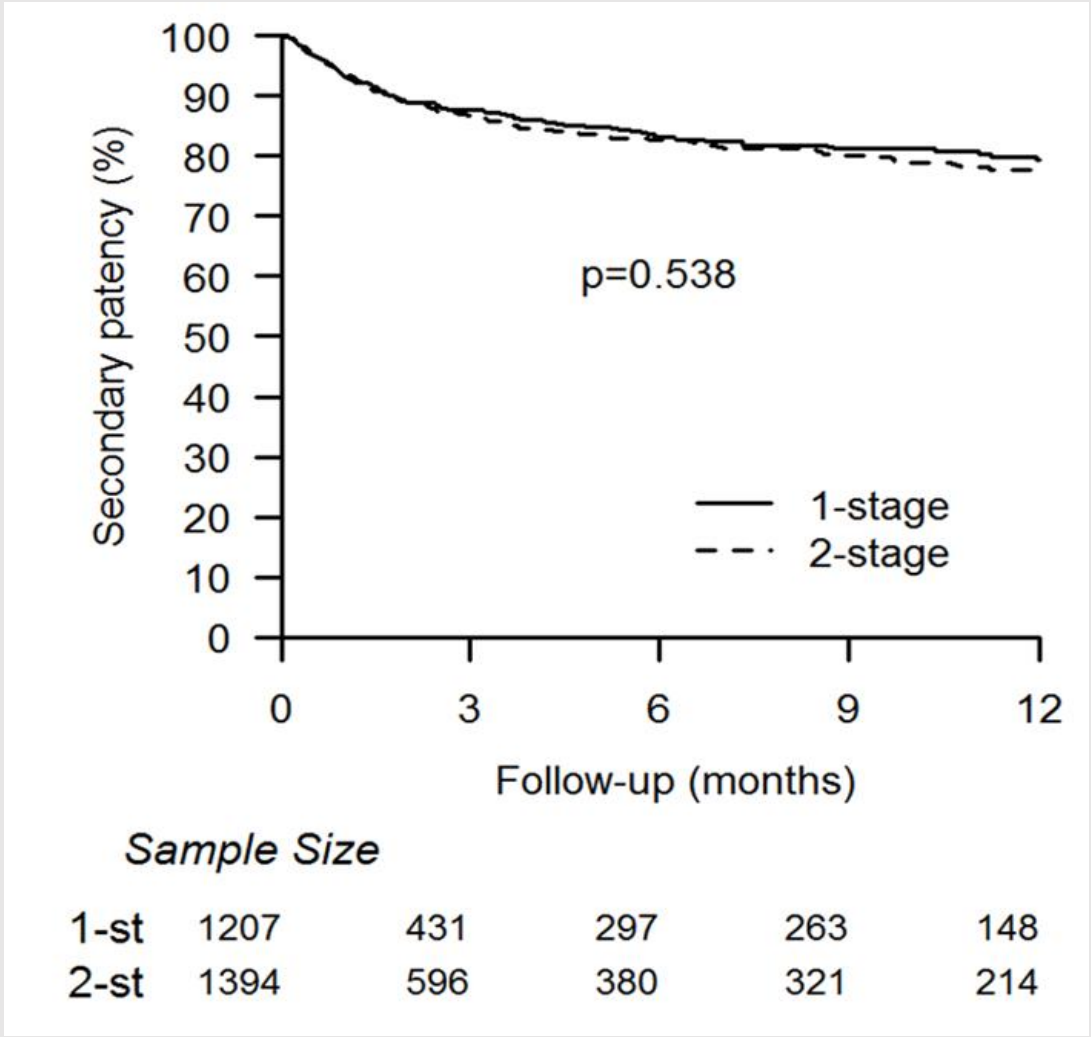
	Overall (N=2648)	One-stage (N=1234)	Two-stage (N=1414)	p-value
Demographics				
Age				
Mean ± SD	61.1±14.7	61.5±14.7	60.8±14.7	0.187
Gender				
Male	1297 (49.0%)	663 (53.7%)	634 (44.8%)	<0.001
Female	1351 (51.0%)	571 (46.3%)	780 (55.2%)	
Race				
White	1255 (49.6%)	701 (60.0%)	554 (40.6%)	<0.001
Hispanic/Latino	171 (6.5%)	103 (8.4%)	68 (4.8%)	<0.001
BMI				
Mean ± SD	28.5±7.5	28.4±7.3	28.7±7.6	0.286
Smoking	1360 (51.5%)	646 (52.5%)	714 (50.5%)	0.307
Primary Insurer				
Medicare	1439 (57.0%)	638 (55.7%)	801 (58.0%)	0.060
Medicaid	283 (11.2%)	143 (12.5%)	140 (10.1%)	
Commercial	709 (28.1%)	326 (28.5%)	383 (27.8%)	

Procedure Detail

	Overall (N=2648)	One-stage (N=1234)	Two-stage (N=1414)	p-value
Settings				
Out-patient	2201 (83.1%)	973 (78.8%)	1228 (86.8%)	<0.001
In-patient	447 (16.9%)	261 (21.2%)	186 (13.2%)	
Side				
Left	1751 (66.2%)	815 (66.0%)	936 (66.2%)	0.915
Target Artery Diameter (mm)				
Mean ± SD	4.1±1.1	4.2±1.1	4.1±1.1	0.343
Target Artery Diameter				
1-2 mm	124 (4.7%)	39 (3.2%)	85 (6.0%)	0.001
3-4 mm	1667 (63.0%)	802 (65.0%)	865 (61.2%)	
5+ mm	857 (32.4%)	393 (31.8%)	464 (32.8%)	
Target Vein Diameter (mm)	3.8±1.2	4.1±1.2	3.4±1.0	<0.001
Target Vein Diameter				
1-2 mm	300 (11.3%)	64 (5.2%)	236 (16.7%)	<0.001
3-4 mm	1819 (68.7%)	793 (64.3%)	1026 (72.6%)	
5+ mm	529 (20.0%)	377 (30.6%)	152 (10.7%)	

KM Analysis (unadjusted)





Loss of Primary Patency (12-month)

	Adj. Hazard Ratio	Lower Confidence Limit	Upper Confidence Limit	p-value
Two-stage vs. One-stage	1.121	0.970	1.296	0.121
Female vs. Male	1.036	0.903	1.190	0.611
Smoking	1.056	0.923	1.208	0.425
Diabetes	1.012	0.883	1.161	0.859
CAD	0.996	0.838	1.184	0.964
Previous access	1.165	1.004	1.353	0.044
Anastomosis: antecubital vs. upper arm brachial	0.938	0.821	1.072	0.348
Target artery diameter	0.934	0.873	0.999	0.046
Target vein diameter	0.927	0.866	0.992	0.029

Loss of Secondary Patency (12-month)

	Adj. Hazard Ratio	Lower Confidence Limit	Upper Confidence Limit	p-value
Two-stage vs. One-stage	0.983	0.774	1.248	0.888
Female vs. Male	1.113	0.883	1.402	0.366
Smoking	1.109	0.886	1.389	0.367
Diabetes	1.012	0.806	1.270	0.919
CAD	0.864	0.642	1.161	0.331
Previous access	1.194	0.930	1.534	0.164
Anastomosis: antecubital vs. upper arm brachial	0.840	0.672	1.050	0.126
Target artery diameter	1.011	0.906	1.128	0.845
Target vein diameter	0.928	0.830	1.036	0.184

Multivariable Analysis

Two-Stage vs. One-Stage	Adj. Hazard Ratio	Lower Confidence Limit	Upper Confidence Limit	p-value
Arm Swelling (3-month)	0.354	0.163	0.770	0.009
Percutaneous Intervention (12-month)	0.685	0.557	0.841	<0.001
Surgical Revision (12-month)	2.527	1.962	3.255	<0.001

Summary

- Comparable fistula patency: one-stage and two-stage approaches
- Patients with a prior history of access surgery and a smaller basilic vein diameter were more likely to undergo a two-stage BBAVF procedure
- One-stage procedure had more arm swelling, more endovascular intervention, and less open surgery

Limitation

- Limited by incomplete follow-up data; unable to calculate functional patency
- Unable to account for primary fistula failure
- Unable to assess decision to perform one-stage vs. two-stage procedure
- No data on CVC dependency and exact timing of the second procedure for two-stage approach

Future Study

- University of Michigan's George M. O'Brien Kidney Translational Research Core Center – funded study
  - Qualitatively understand patients' preferences and perspectives
  - Patient reported outcomes (PROs)

- Need for a well-designed randomized-control trial
  - Adequately powered
  - Intention to treat
  - Catheter-related complications

Take Home Message

- Upper arm BBAVF can be performed with a one-stage or a two-stage procedure with comparable patency rates
- Surgeons favor a two-stage procedure for patients with history of previous access surgery and a smaller basilic vein

Question?

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