Evaluating Outcomes in Chronically Anticoagulated Patients Receiving Split-Thickness Skin Grafting for Diabetic Foot Ulcers

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INTRODUCTION

Split thickness skin grafting (STSG) is a commonly used method for wound closure in patients with diabetic foot ulcers (DFU). Many diabetic patients have comorbidities including peripheral vascular disease treated with long-term anticoagulant therapy. These medications may cause surgeons to avoid STSG, but our experience does not warrant such concerns. No published studies examine the risks of skin grafting in the setting of chronic anticoagulation. We hypothesize that anticoagulant therapy has no effect on STSG failure or other adverse outcomes.

METHODS

We queried the TriNetX Network, which provides access to electronic medical records for over 75 million patients from 57 healthcare organizations throughout the U.S., for patients with a history of diabetic foot ulcers treated with STSG. We divided those found into two groups: long-term anticoagulant use prior to grafting and no long-term anticoagulant use. Patients were propensity score matched by age and comorbidities. Outcomes following STSG were evaluated at 1 month and 5 years.

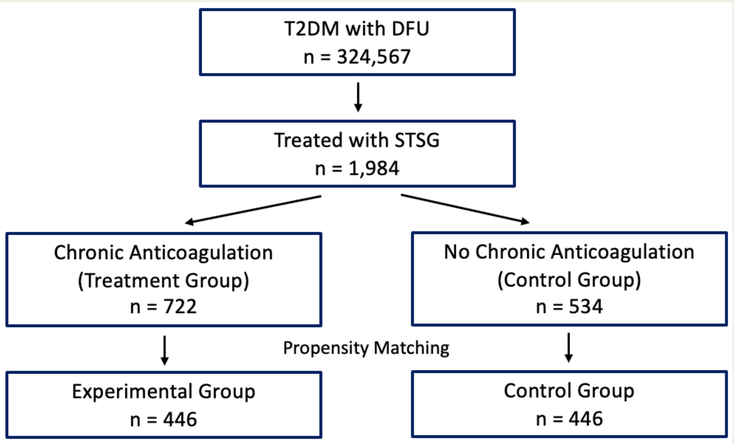

Figure 1) Stratification of Cohorts: Medications included the top 5 most prescribed anticoagulants: rivaroxaban, warfarin, apixaban, enoxaparin, dalteparin; T2DM = Type 2 Diabetes Mellitus; DFU = Diabetic Foot Ulcer

RESULTS

Demographics

	Prior to Propensity Match					Post Propensity Match				
	Treatment (n = 722)		Control (n = 534)		p-Value	Treatment (n = 446)		Control (n = 446)		p-Value
Age	57 +/- 13		55 +/- 13.1		< 0.0064*	55.7 +/- 13.1		55.9 +/- 13.1		0.8058
Ethinicity										
White	536	74.24%	374	70.04%	0.0995	314	70.40%	308	69.06%	0.6619
African American	126	17.45%	111	20.79%	0.1353	91	20.40%	99	22.20%	0.513
Hispanic/Latino	113	15.65%	157	29.40%	< 0.0001*	104	23.32%	97	21.75%	0.5748
Asian	10	1.39%	10	1.87%	0.4949	10	2.24%	10	2.24%	1
Native American	10	1.39%	10	1.87%	0.4949	10	2.24%	10	2.24%	1
Gender										
Male	482	66.76%	407	76.22%	0.0003*	326	73.09%	328	73.54%	0.8797
Female	240	33.24%	127	23.78%	0.0003*	120	26.91%	118	26.46%	0.8797
Diagnoses										
Essential HTN	622	86.15%	395	73.97%	< 0.0001*	355	79.60%	361	80.94%	0.6137
Hyperlipidemia	455	63.02%	238	44.57%	< 0.0001*	221	49.55%	225	50.45%	0.7888
CKD	288	39.89%	182	34.08%	0.0355*	157	35.20%	163	36.55%	0.6753
Ischemic Heart Disease	208	28.81%	95	17.79%	< 0.0001*	93	20.85%	92	20.63%	0.9342
Thrombosis	154	21.33%	32	5.99%	< 0.0001*	34	7.62%	32	7.18%	0.7981
PAD	277	38.37%	168	31.46%	0.0114*	151	33.86%	155	34.75%	0.7779
Venous Stasis	118	16.34%	54	10.11%	0.0015*	50	11.21%	52	11.66%	0.8333
Type 2 Diabetes	511	70.78%	347	64.98%	0.0291*	303	67.94%	294	65.92%	0.5218

Table 1) Stratification of Cohorts: This figure shows stratifications of the study and the number of STSG patients in each cohort both before and after matching for ethnicity, race, age, and significant comorbidities. HTN = hypertension; CKD = chronic kidney disease; PAD = peripheral arterial disease

Short Term Outcomes

Outcome	Treatment		Control		p-value	Odds Ratio	Odds CI
Death	10	2.20%	10	2.20%	1	1	(0.412,2.426)
Graft Failure	12	2.64%	10	2.20%	0.666	1.21	(0.515,2.819)
Re-grafting	18	3.97%	11	2.42%	0.1865	1.663	(0.776,3.561)
Infection	52	11.45%	84	18.50%	0.0029*	0.57	(0.392,0.828)
Hematoma	19	4.19%	18	3.97%	0.8667	1.058	(0.548,2.043

Table 2) Short-Term Outcomes: Short-term was defined as being within the first month following STSG.

Long Term Outcomes

Outcome	Treatment		Control		p-value	Odds Ratio	Odds CI
Death	63	14.13%	58	13.00%	0.6249	1.1	(0.75,1.615)
Graft Failure	16	3.59%	16	3.59%	1	1	(0.494,2.025)
Re-grafting	29	6.50%	31	6.95%	0.7892	0.931	(0.551,1.573)
Amp - MTP	18	4.04%	18	4.04%	1	1	(0.513,1.948)
Amp - Boyd/Symes	91	20.40%	95	21.30%	0.7416	0.947	(0.686,1.308)
Amp - Below Knee	19	4.26%	12	2.69%	0.2007	1.609	(0.772,3.356)
Amp - Above Knee	20	4.48%	15	3.36%	0.3886	1.349	(0.682,2.67)
Pooled Amputations	125	28.03%	125	28.03%	1	1	(0.747,1.339)
STSG - Foot	14	3.14%	14	3.14%	1	1	(0.471,2.123)
STSG - Leg	17	3.81%	19	4.26%	0.7337	0.891	(0.457,1.737)
Angiography	19	4.26%	14	3.14%	0.3751	1.373	(0.68,2.774)
Balloon Angioplasty	12	2.69%	10	2.24%	0.6659	1.206	(0.515,2.82)

Table 3) Long-Term Outcomes: Long-term was defined as being between 1 month and 5 years after STSG. Amp = amputation; MTP = metatarsophalangeal joint; IP = interphalangeal joint

RESULTS

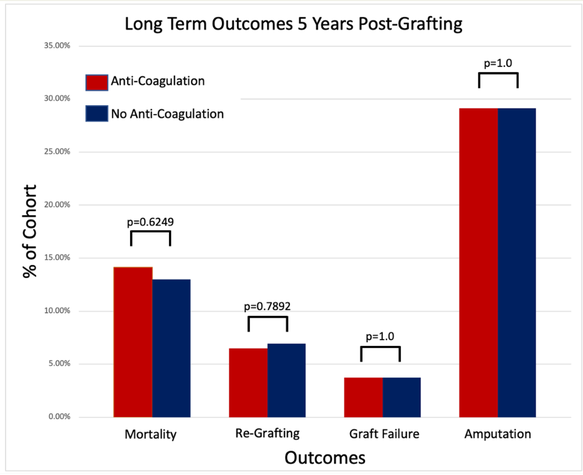

Figure 2) Primary Long-Term Outcomes Following STSG: Long-term was defined as being between 1 month and 5 years after STSG. There was no significant difference in mortality, re-grafting rates, graft failure, or pooled amputations between the two cohorts.

DISCUSSION/CONCLUSIONS

- We found no significant increase in graft failure or regrafting at 1 month or at 5 years between the two groups.
- Overall, patients on chronic anticoagulation therapy do not experience increased complications after STSG, either in the long term or short term.
- Patients with DFU who are on anticoagulants should continue to receive standard of care treatment, including STSG when appropriate.

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