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Examining Costs and Readmissions in Patients Treated with surgiGRAFT™ Versus Another Allograft Product and Standard of Care

WHITE PAPER

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EXECUTIVE SUMMARY

Background

The use of homologous allografts – tissue from another human which performs a similar function to that which it is replacing – is increasing in the field of medicine and orthopedics.[1] Allografts eliminate the need for additional surgical sites, which reduce patient morbidity, post-operative pain, and recovery time,[2] and are a reasonable alternative to autografts and standard of care (SOC).[3-6] surgiGRAFT™ (Synergy Biologics) is a dehydrated single layer amnion allograft that acts as a shielding barrier that promotes the progression of healing while providing improved handling properties for surgical applications. It can be utilized in a range of specialties (e.g., neurosurgery, orthopedics, urology) and procedure types (e.g., surgical wounds, burns, amputations). Amniofix/Epifix™ (MiMedx) is another well-established amnion allograft product used for similar applications. Premier, Inc. assessed cost and healthcare resource utilization (HCRU) among patients receiving surgiGRAFT™, Amniofix/Epifix™, and SOC, leveraging a large, all-payer, US hospital administrative database (the Premier Healthcare Database, PHD).

Cost and Readmission

Patients receiving surgiGRAFT™ had **lower allograft-related costs when compared to patients receiving Amniofix/Epifix™** ($599 and $2,241 on average, respectively; $p < 0.001$). When considering all hospital costs (fixed and variable expenses) in the encounter in which the procedure occurred, patients receiving surgiGRAFT™ and Amniofix/Epifix™ had similar total hospital costs ($9,253 and $10,399 on average, respectively; $p = 0.536$). Patients receiving surgiGRAFT™ were **less likely to have all-cause readmissions and revisits** in the 30 days following the procedure when compared to patients receiving Amniofix/Epifix™ (37.2% vs. 53.6%; $p < 0.001$). In addition, there was no difference in surgical site infection (SSI) in the 30 days following discharge between patients receiving surgiGRAFT™ and Amniofix/Epifix™ (0.7% and 1.2%, respectively; $p = 0.736$). No adjustment was made for patient, hospital, or procedure characteristics.

Conclusion

Patients receiving surgiGRAFT™ experienced similar clinical outcomes to Aminofix/Epifix™. This was expected because these homologous allografts fall under the same regulations (21CRF1271) which indicates processing (while "proprietary" in nature) must have "minimal manipulation" which cannot alter its original structural and biological characteristics.

Additionally, **patients receiving surgiGRAFT™ incurred lower allograft-related costs, and had fewer 30-day all-cause readmissions when compared to Amniofix/Epifix™.**

The study findings indicate that surgiGRAFT™ may reduce costs and improve utilization efficiency in the US hospital setting compared to other allograft products.

HIGHLIGHTS

When compared to patients receiving Amniofix/Epifix™:

- Patients receiving surgiGRAFT™ incurred **lower allograft-related cost** and **similar total cost**
- Patients receiving surgiGRAFT™ experienced **fewer 30-day all-cause readmissions/revisits**
- Patients receiving surgiGRAFT™ had **similar prevalence rates of surgical site infection**

Patients receiving surgiGRAFT™ experienced similar clinical outcomes and reduced resource utilization when compared to their counterparts receiving Amniofix/Epifix™.

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Introduction

The use of allografts is increasing in the field of medicine and orthopedics.[1] Allografts eliminate the need for additional surgical sites, which reduce patient morbidity, post-operative pain, and recovery time,[2] and are a reasonable alternative to autografts and standard of care (SOC).[3-6]

surgiGRAFT™ (Synergy Biologics) is a dehydrated single layer amnion allograft that acts as a shielding barrier that promotes the progression of healing while providing improved handling properties for surgical applications. It can be utilized in a range of specialties (e.g., neurosurgery, orthopedics, urology) and procedure types (e.g., surgical wounds, burns, amputations).

Under Title 21 of the Code of Federal Regulations (CFR) Part 1271 (21CFR1271.10), human cells, tissues, and cellular and tissue-based products (HCT/P), such as these allografts, need to meet criteria of "homologous use" and "minimal manipulation".[7] Under the criterion of homologous use, the tissue needs to be from another human being and perform a similar function to the tissue being replaced. Under the criterion of minimal manipulation, while the preparatory process of the allograft may be "proprietary," the tissue cannot be altered from its original structural and biological characteristics. Thus, the clinical outcomes for allografts are expected to be similar and the key differentiator between these products is cost and resource utilization.

Being able to choose between different allograft products may help surgeons to define the best treatment plan for patients while optimizing cost and utilization efficiency. Anecdotal evidence suggests that surgiGRAFT™ may be associated with lower costs yet similar effectiveness when compared to well-established amnion allograft products, such as Amniofix and Epifix™ (MiMedx).

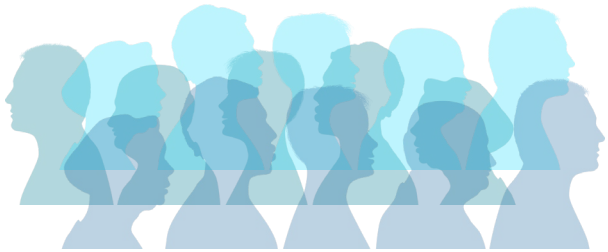
This study aimed to assess cost and healthcare resource utilization (HCRU) among patients receiving surgiGRAFT™, Amniofix/Epifix™, and SOC, leveraging a large, all-payer, US hospital administrative database (the Premier Healthcare Database, PHD).

Methods

Premier, Inc. researchers conducted a preliminary retrospective observational cohort analysis. Synergy Biologics sponsored the project but was not involved in the planning or conduct of the analysis.

Study Population

The study included patients with a hospital encounter (inpatient or outpatient) with evidence of surgiGRAFT™, Amniofix/Epifix™, or SOC between 01/01/2022 and 05/31/2024. Patients were assigned to one of three groups:



01 Patients receiving surgiGRAFT™

02 Patients receiving Amniofix/Epifix™

03 Patients receiving SOC only (without surgiGRAFT™ or Amniofix/Epifix™)

Patients were excluded if they received both surgiGRAFT™ and Amniofix/Epifix™ within 30 days of each other, or if their index procedure was not among the procedures received by patients in the surgiGRAFT™ cohort.

Patients were followed for 30 days after receiving the product.

This study leveraged the Premier Healthcare Database (PHD), a large, all-payer, US hospital administrative database. For more details about the PHD, click here: PHD.

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Results

Attrition and Utilization

The study population included 223,519 patients treated in 665 unique member hospitals. Figure 1 displays the patient selection criteria results for the study population and cohort assignment.

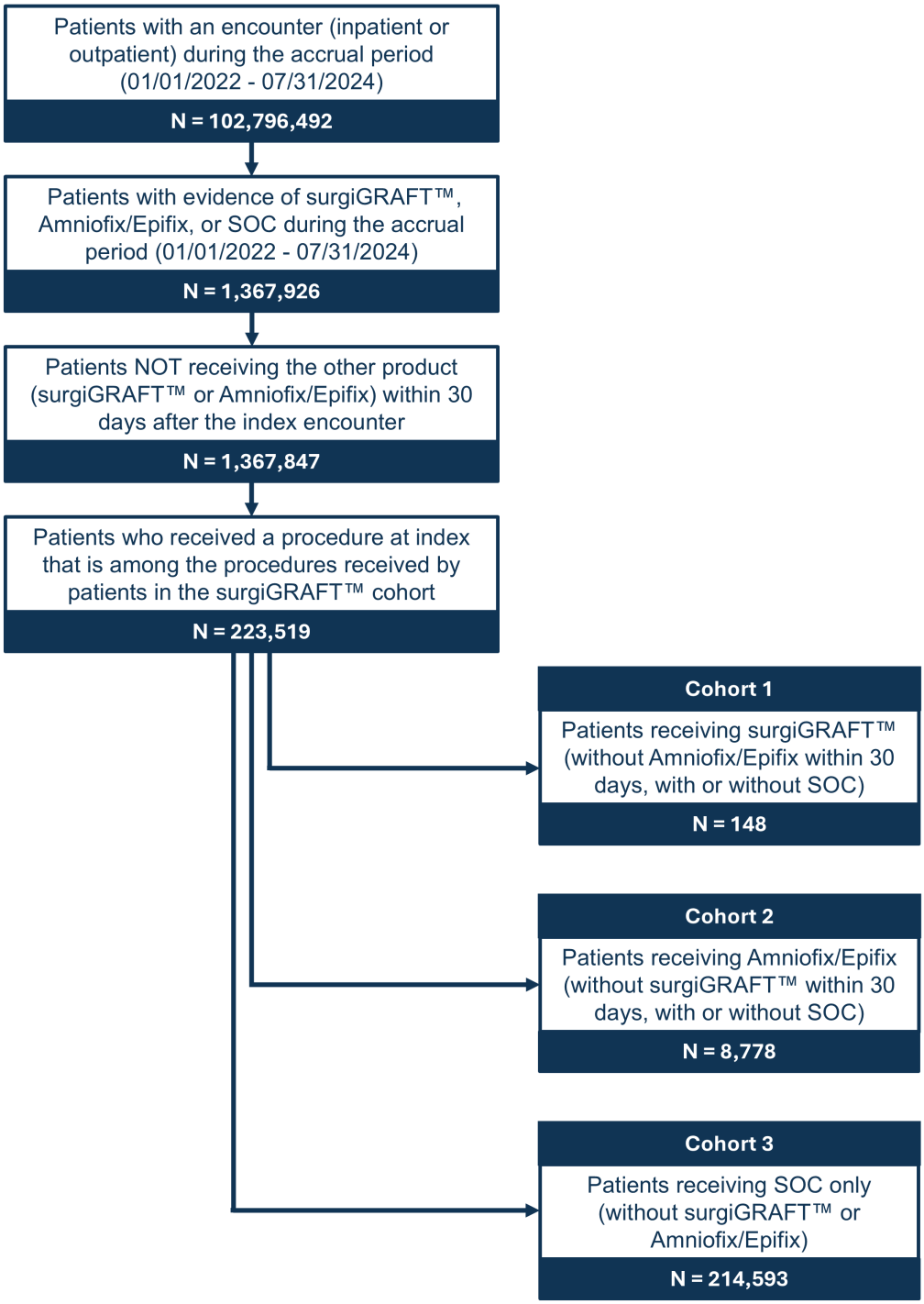

Figure 1. *Patient selection criteria for study population and cohort assignment*

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Patient, Hospital, and Procedure Characteristics

Patients receiving surgiGRAFT™ and Amniofix/Epifix™ were of similar age (59 - 61 years old, on average), mostly female (64% and 53%, respectively), white (80% and 76%, respectively), and covered by Medicare (51% in both cohorts) and commercial insurance (37% and 35%, respectively). Patients receiving surgiGRAFT™ were most frequently treated in hospitals in the South (64%). Most patients received surgiGRAFT™ in elective and outpatient visits (91%), and similar results were found for patients receiving Amniofix/Epifix™ and SOC. Patient, hospital, and procedure characteristics are summarized in Appendix A.

Cost Outcomes

Patients receiving surgiGRAFT™ had **lower allograft-related costs** when compared to patients receiving Amniofix/Epifix™ ($599 and $2,241 on average, respectively; $p < 0.001$; Figure 2a).

When considering all hospital costs (fixed and variable expenses) in the encounter in which the procedure occurred, patients receiving surgiGRAFT™ and Amniofix/Epifix™ had **similar total hospital cost** ($9,253 and $10,399 on average, respectively; $p = 0.536$) and significantly **lower total hospital cost** than patients receiving SOC ($15,306, $p < 0.001$; Figure 2b).

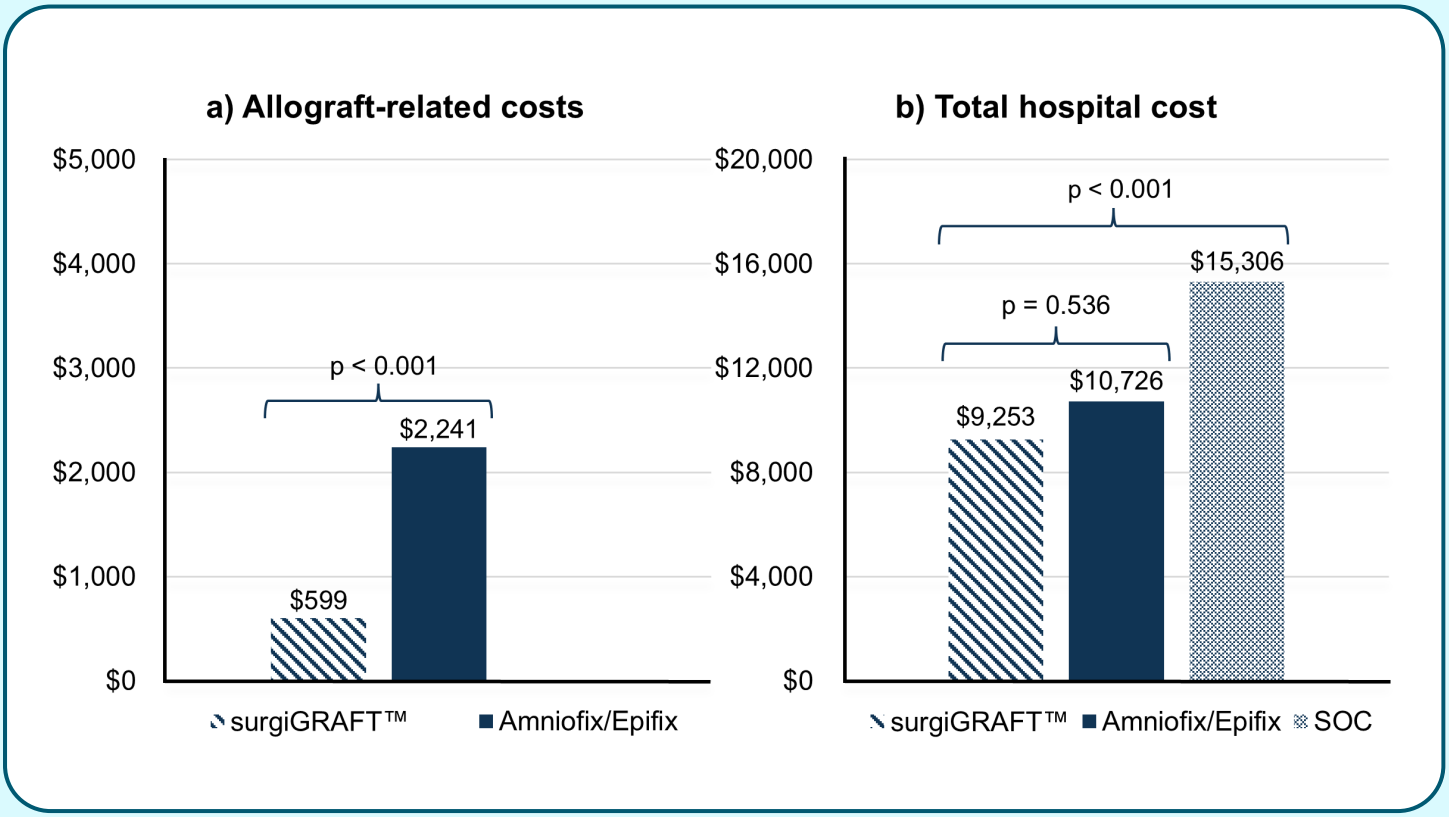

Figure 2. Cost outcomes

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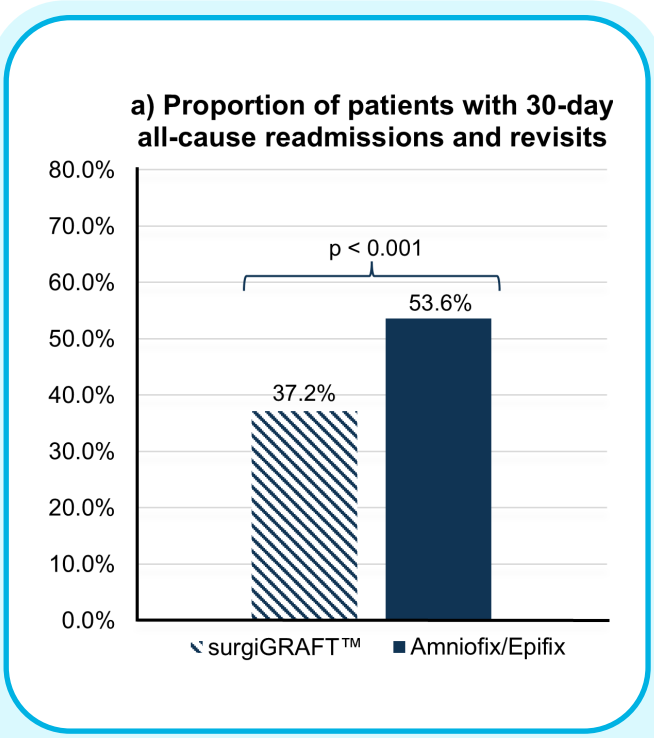

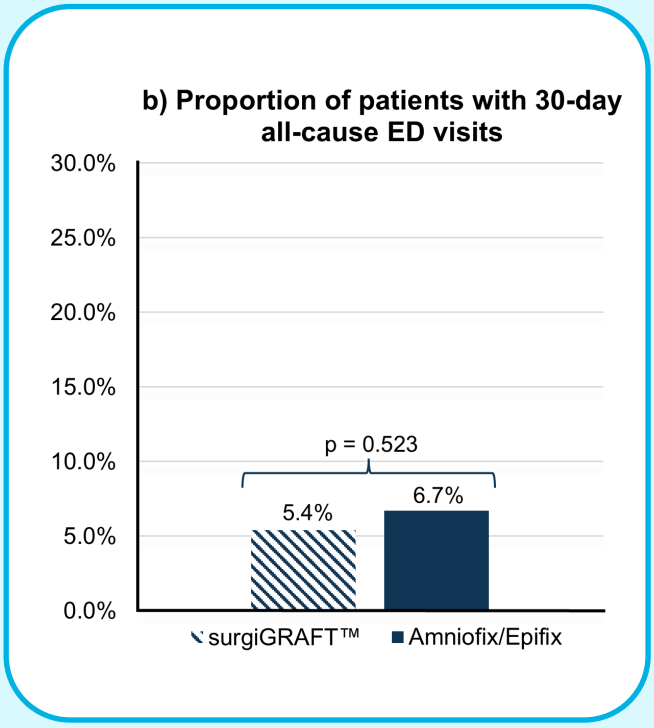

Figure 3. Readmission outcomes

Resource Utilization Outcomes

There was **no difference in surgical site infection (SSI)** in the 30 days following discharge between patients receiving surgiGRAFT™ and Amniofix/Epifix™ (0.7% and 1.2%, respectively; p = 0.736).

Patients receiving surgiGRAFT™ were **less likely to have all-cause readmissions and revisits** in the 30 days following the procedure when compared to patients receiving Amniofix/Epifix™ (37.2% vs. 53.6%; p < 0.001; Figure 3a).

In addition, there was **no difference in all-cause visits to the Emergency Department (ED)** in the 30 days following discharge between patients receiving surgiGRAFT™ and Amniofix/Epifix™ (5.4% and 6.7%, respectively; p = 0.523; Figure 3b).

Comorbidities and Procedures

Patients in the surgiGRAFT™ cohort were slightly healthier than patients in the Amniofix/Epifix™ cohort (57.4% vs. 40.3% had zero comorbidities, respectively, based on the Charlson Comorbidity Index, p < 0.001).

Expectedly, the most common outpatient procedures in patients receiving surgiGRAFT™ were in the CPT category “Surgical Procedures on the Integumentary System” (e.g., skin substitute graft to the trunk, arms, or legs, and skin substitute graft to the face, neck, hands, or feet).

In addition, patients receiving surgiGRAFT™ frequently received outpatient procedures in the CPT category “Surgical Procedures on the Cardiovascular System” (e.g., routine venipuncture, withdrawal or arterial blood) followed by “Surgical Procedures on the Musculoskeletal System” (e.g., partial removal of foot bone, repair of lower leg ligament) and “Surgical Procedures on the Male Genital System” (e.g., laparoscopic surgical procedure for retropubic radical prostatectomy).

Figure 4 provides the number of outpatient procedures by CPT category.

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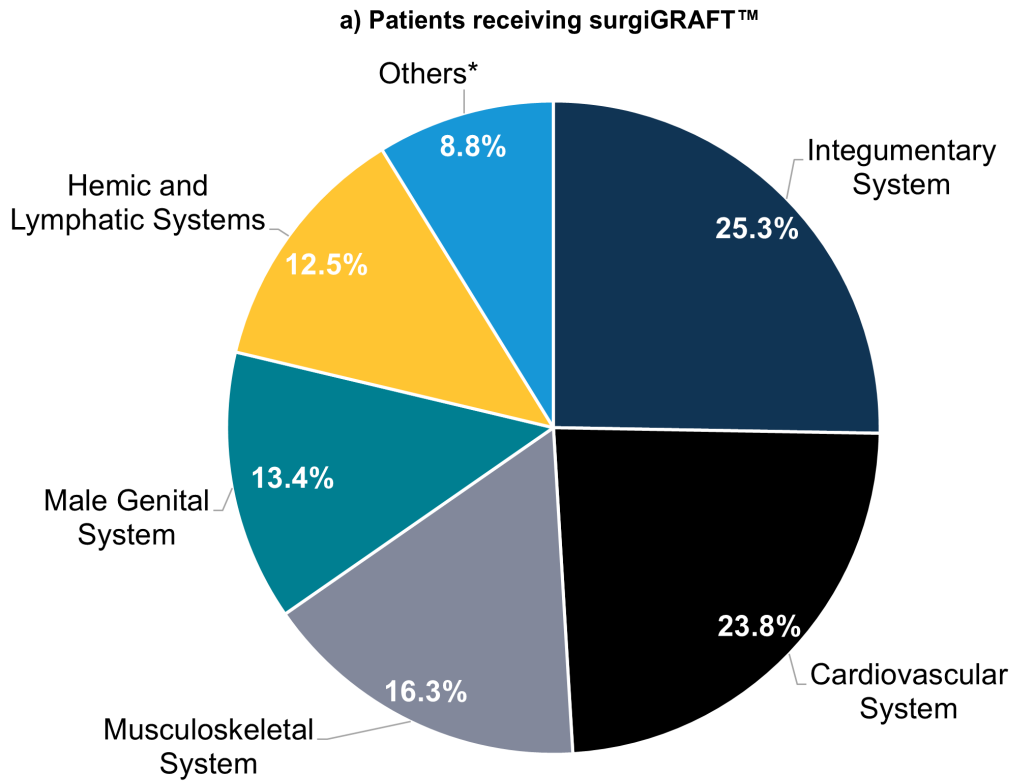
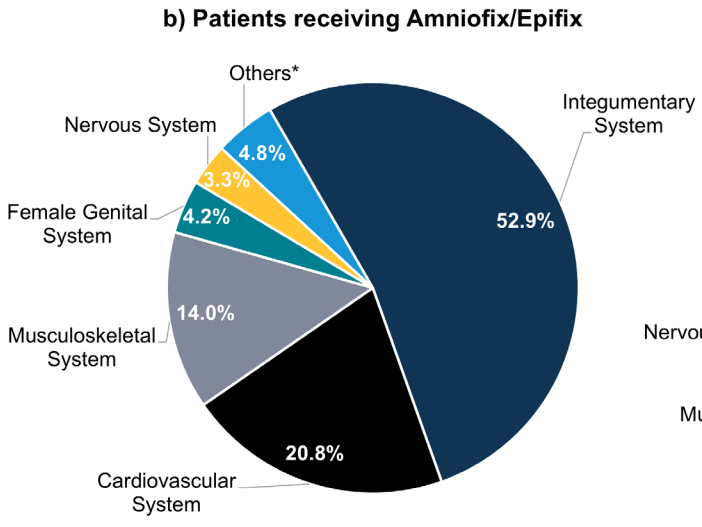
Surgical Procedures in the Outpatient Setting





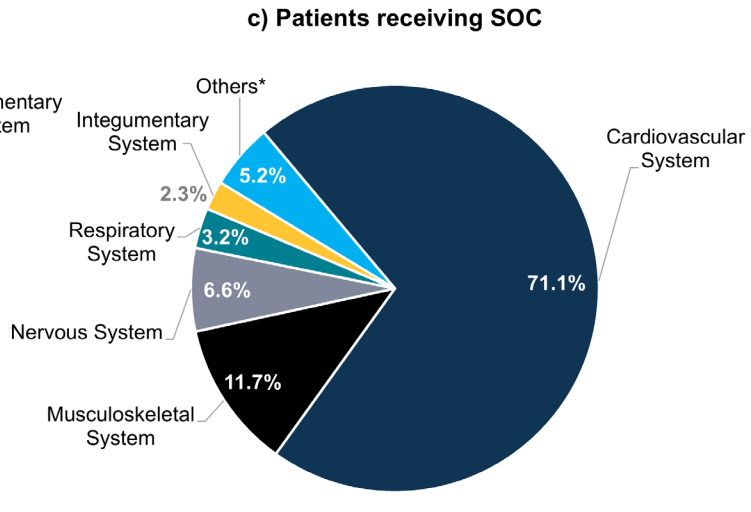


Figure 4. *Outpatient procedures among patients receiving surgiGRAFT™*

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Limitations

This analysis has limitations that are common to retrospective studies utilizing administrative databases. Data accuracy depends on hospitals' reporting codes and billing descriptions fully and correctly. In addition, there could be potential selection bias due to the possibility that patients with varying health status and severity level could receive different products.

This study addresses the potential differences by including patients receiving the two products for the same procedures. However, there could be remaining differences in patients' clinical characteristics and complexity of procedures.

Further research utilizing adjusted analysis is warranted to better understand the clinical and economic outcomes for patients treated by different products.

Conclusions

The results of this study highlight the real-world clinical outcomes and resource utilization of patients receiving surgiGRAFT™, a dehydrated single layer amnion allograft that offers a versatile, biocompatible solution for tissue reconstruction and repair.

When compared to patients receiving Amniofix/Epifix™, patients receiving surgiGRAFT™ had:

- Lower allograft-related cost
- Similar total hospital cost
- Similar proportions of surgical site infection
- Fewer 30-day all-cause readmissions and revisits
- Similar 30-day all-cause ED visits

In summary, patients receiving surgiGRAFT™ experienced similar clinical outcomes and incurred lower cost and healthcare resource utilization when compared to their Amniofix/Epifix™ counterparts.

Overall, the study findings provide a good rationale for the use of surgiGRAFT™ as an alternative to other allograft products to reduce cost and improve utilization efficiency in the US hospital setting.

Notes about FDA regulation 21 CFR 1271.10

The criteria for human cells, tissues, and cellular and tissue-based products (HCT/P) is denoted under 21CFR1271.10, which was further defined via guidance and first introduced by FDA in 2017 and updated in July 2020.[7]

Four criteria must be met to fall into the low-risk category for tissues: (1) the tissue is minimally manipulated, (2) homologous use, (3) no combination with other cells or tissues, (4) no systemic effect or the systemic effect is directly dependent on the primary function of the tissue (for specific functions). If these criteria are not met, then the HCT/P is regulated as a device, drug, or biological product and must undergo the relevant nonclinical and clinical testing to demonstrate safety and effectiveness for market authorization based on the product type.

However, **for HCT/P which meet these specific criteria like allograft tissues, the product may be processed using "proprietary" methods, but the procedures cannot introduce other products and must be minimalistic**. For this reason, as was seen in this analysis, **the clinical outcomes of different allografts are expected to be similar, and the key differentiator between these products is cost and resource utilization.**

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Appendix A

Patient, hospital, and procedure characteristics

	surgiGRAFT™	Amniofix/Epifix™	SOC
Unique Patients	148	8,778	214,593
Age at index date, years			
Mean (SD)	59.7 (16.1)	61.1 (15.7)	53.3 (20.6)
Median (Q1 - Q3)	62 (52 - 70)	63 (51 - 72)	57 (37 - 69)
Min - Max	11 - 89	0 - 89	0 - 89
Sex at index, N (%)			
Male	53 (35.8)	4,118 (46.9)	126,894 (59.1)
Female	95 (64.2)	4,659 (53.1)	87,679 (40.9)
Race at index, N (%)			
White	118 (79.7)	6,640 (75.6)	157,592 (73.4)
Black	26 (17.6)	1,205 (13.7)	31,716 (14.8)
Asian	0 (0)	144 (1.6)	3,543 (1.7)
Other/Unknown	4 (2.7)	789 (9)	21,742 (10.1)
Primary Payer at index, N (%)			
Medicare	76 (51.4)	4,445 (50.6)	81,085 (37.8)
Medicaid	13 (8.8)	837 (9.5)	39,565 (18.4)
Commercial insurance	55 (37.2)	3,032 (34.5)	80,167 (37.4)
Uninsured	0 (0)	81 (0.9)	5,704 (2.7)
Other/Unknown	4 (2.7)	383 (4.4)	8,072 (3.8)
Provider Region at index, N (%)			
Northeast	7 (4.7)	443 (5)	15,344 (7.2)
Midwest	47 (31.8)	2,681 (30.5)	54,381 (25.3)
South	94 (63.5)	4,804 (54.7)	127,585 (59.5)
West	0 (0)	850 (9.7)	17,283 (8.1)
Admission Type at index, N (%)			
Emergency	8 (5.4)	434 (4.9)	53,391 (24.9)
Urgent	2 (1.4)	194 (2.2)	14,296 (6.7)
Elective	135 (91.2)	6,722 (76.6)	132,598 (61.8)
Other/Unknown	3 (2)	1,428 (16.3)	14,308 (6.7)
Index encounter setting, N (%)			
Inpatient	14 (9.5)	1,310 (14.9)	88,429 (41.2)
Outpatient	134 (90.5)	7,468 (85.1)	126,164 (58.8)

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About the Authors

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Dr. Lopes has several years of experience in retrospective cohort studies, applied epidemiology, and advanced biostatistics with over 40+ publications in peer-reviewed journals. He has led multiple studies on healthcare resource utilization, pharmacogenomics (PGx), burden of illness, and treatment journey in the areas of oncology, cardiovascular disease, obesity, and infectious diseases, among others. He is also experienced in validating natural language processing (NLP) queries in electronic health records (EHR) for complex health data analysis. At the Mayo Clinic, Dr. Lopes was a co-investigator on multiple NIH-funded studies and earned national research honors. He co-led international cancer clinical trials across 15+ countries and served as Principal Investigator on a project examining opioid pharmacogenomics using integrated EHR and PGx datasets. During the COVID-19 pandemic, he provided critical weekly reports to Minnesota's local and state health partners. He has presented at global conferences and published extensively in high-impact journals.

Zhun Cao, MA, PhD

Dr. Cao has over two decades of experience in healthcare services and outcomes research, with expertise in observational cross-sectional, case-control, and cohort studies, as well as retrospective and prospective research designs. She co-leads a multidisciplinary team at Premier Applied Sciences and has guided studies across infectious diseases, maternal health, oncology, cardiovascular disease, pain management, surgery, and mental health. Her portfolio includes comparative effectiveness research, healthcare resource utilization, cost analyses, market assessments, and burden of illness studies. Dr. Cao has advised pharmaceutical and medical device firms and worked with government agencies. Her previous roles include Associate Director for Methodological Affairs at the Center for Multicultural Mental Health Research and Instructor at Harvard Medical School. She has presented globally and published widely in peer-reviewed journals in health economics, clinical medicine, and policy.

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Dr. Ikpe brings over 20 years of experience in medicine and health informatics, with work spanning private sector roles, government consulting, and international development organizations. He has supported U.S. CDC-sponsored initiatives across sub-Saharan Africa, serving as a health informatics expert on public health programs. Currently focused on computational epidemiology, Dr. Ikpe combines skills in epidemiologic methods, biostatistics, machine learning, and software engineering. He is a published author in numerous peer-reviewed journals.

Mary Beth Ritchey, MSPH, PhD, FISPE

Dr. Ritchey is a recognized leader in medical product safety and real-world evidence, with a career spanning government, industry, and academia. She is currently Chief Scientific Officer for CERobs Consulting where she leads a team providing innovative strategy and conducting rigorous evidence generation studies and is part-time faculty in the Center for Pharmacoepidemiology and Treatment Science at Rutgers University where she teaches and mentors students who will become future leaders in the field. Her early career at the U.S. FDA involved oversight of post marketing surveillance and contributions to foundational programs such as MDEpiNet and Sentinel. In the private sector, she

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advanced tools for data strategy, comparative effectiveness, and signal management. More recently, she served as Chief Epidemiologist at the FDA's Center for Devices and Radiological Health, providing oversight on clinical and real-world evidence policies. As a consultant, she has led regulatory-grade studies supporting labeling expansions and real-world evidence submissions. Dr. Ritchey co-edited *Pragmatic Randomized Clinical Trials* (2021) and serves as President (2024-2025) and Fellow of the International Society for Pharmacoepidemiology (ISPE). She has chaired international conferences and contributed extensively to global training efforts. She holds degrees in Chemistry (Duke), Nursing (UNC-Chapel Hill), and Epidemiology (MSPH, PhD – UNC Gillings School of Global Public Health).

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