good documentation is more likely to result in no payment being made when there is a claim.

**TRACK: HAND AND UPPER EXTREMIT Y**

**Cost Efficiency of Leech Therapy Duration for Revascularized and Replanted Digits with Venous Congestion**

**Presenter: Samantha King**

**Co-Authors: Sergey Toshinskiy, MD, Christopher Hillard, MD**

**Affiliation: University of Minnesota Medical School, Minneapolis, MN**

**PURPOSE:** Venous congestion is a common complication following digital revascularization and replantation which threatens immediate survival of the digit. Leech therapy is an accepted therapeutic option to relieve venous congestion. The duration and efficacy of leech therapy varies and may prolong hospital length of stay requiring significant hospital resources. Previous studies evaluated the difference in Quality Adjusted Life Years (QALY) of salvaging a dysvascular digit and immediate revision amputation.\(^1\) The purpose of this study was to evaluate the cost efficiency of leech therapy duration for treatment of venous congestion.

**METHOD:** Retrospective review was performed to identify patients who underwent revascularization or replantation procedures for incomplete or complete digital amputations at a level 1 academic trauma center from January 2005 to December 2020. Only patients requiring leech therapy for venous congestion were included in the study. Leech therapy was started immediately after any signs of venous congestion appeared and was continued until either the congestion resolved or the digit lost viability. Leech therapy duration, digit survival, length of hospitalization, and hospitalization costs were obtained. Cumulative Incremental Cost Effectiveness Ratios (ICER) for each additional day of leech therapy were calculated using hospitalization cost, incremental leech success rate, and incremental QALY assumptions per published literature for one digit, a thumb, and multiple digits.\(^1\) Cost efficiency was analyzed by comparing calculated cumulative ICER of daily leech therapy to commonly accepted $/QALY cost efficiency thresholds of $50,000, $100,000, and $150,000.\(^1\)

**RESULTS:** Of the 213 digits that underwent revascularization (n = 135) or replantation (n = 78), venous congestion requiring leech therapy developed in 53 total digits. Leech therapy failed in 15 digits (56%) and 17 digits (65%) for the revascularization and replantation groups, respectively. Leech therapy duration ranged from 1 to 15 days (median of 5 days in both groups). Success rate diminished over time such that leeching for 1 to 3, 4 to 7, >7 days had success rates of 69%, 42% and 8% respectively. Hospitalization costs ranged from $12,622 to $123,563, and the average cost of an additional day of leech therapy was $2,951. Overall cost efficiency of leech therapy diminished with longer therapy duration, lower $/QALY threshold and lower relative importance of the leeched digit. Using the standard cost-efficiency $/QALY cutoff value of $100,000, leech therapy becomes cost inefficient after three days, five days, and seven days for one digit, a thumb, and multiple digits, respectively.

**CONCLUSION:** The cost efficiency of leech therapy for treatment of venous congestion of replanted and revascularized digits diminishes with time, ranging from 0 to 7 days depending on incremental QALY assumptions and cost efficiency thresholds. These data can help aid in determining the utilization of leech therapy and appropriate timing of treatment cessation based on cost efficiency for venous congestion in replanted and revascularized digits.

**REFERENCES:**
1. Elmaraghi S, Israel JS, Gander B. Systematic Review of Replant Salvage and Cost Utility Analysis of Inpatient Monitoring After Digit Replantation. J Hand Surg Am. 2022;47(1):32-42.e1. doi:10.1016/j.jhsa.2021.07.024

**TRACK: RESEARCH/TECHNOLOGY PAPER**

**A History of Mechanical Tension Depletes Lgr6+ Epidermal Stem Cells**

**Presenter: Ainsley Taylor**

**Co-Authors: Yingchao Xue, Luis Garza, Sashank K. Reddy, MD, PhD**

**Affiliation: Johns Hopkins Medicine, Baltimore, MD**

**PURPOSE:** Recent research found the epidermal Lgr6 stem cell population to be progressively depleted under mechanical tension, with a paralleled increase in the Lgr6 descendant population.\(^1\) This study aims to determine if
there is a reversal of tension-induced skin growth characteristics, specifically if the Lgr6 stem cell population recovers after tension is removed. Our results will guide future research in therapeutic interventions for optimal skin recovery following tension, such as seen with bariatric surgery and the resulting excess skin from rapid weight loss.

METHOD: Genetic Lgr6-EGFP-Cre-ERT2;tdTomato mice (EGFP=Lgr6, tdT=Lgr6 descendants) underwent controlled expansion (E) of the back skin. A tissue expander was surgically placed under the back skin on day zero, rested for 7 days, expanded over 10 days with a total of 24mL saline, rested for 14 days, then deflated of saline at post-injection day 14 (PI-14) or deflation day zero (DF-0). Skin over the expander was resected, embedded in paraffin, and sectioned at 4µm. Cell populations were defined using immunofluorescence and quantified by relative expression and cell counting (ImageJ). Control mice underwent expander surgery but did not undergo saline expansion (non-expanded, NE). NE and E mice (n=3 each) were compared for PI-14, DF-14, and DF-56. We used two-tailed t-test with alpha set at 0.05.

RESULTS: Relative expression of EGFP decreased from NE to both DF-14 (p=0.0474) and DF-56 (p=0.0477), while relative expression of tdT increased from NE to DF-56 (p=0.0125). EGFP+ cells decreased from NE to PI-14, DF-14, and DF-56 (p=0.0114 for all), while tdT+ cells increased from NE to PI-14, DF-14, and DF-56 (p=0.0086, p=0.0133, p=0.0002). Proliferating cells (Ki67+) increased from NE to PI-14, DF-14, and DF-56 (p=0.00007, p=0.00001, p=0.0417), but decreased from DF-14 to DF-56 (p=0.0278). Of the proliferating cell population, the [Ki67+tdT+] population increased from NE to DF-56 (p=0.0002). Cytokeratin 5 (K5) relative expression increased from NE to PI-14, DF-14, and DF-56 (p=0.0109, p<0.00001, p<0.00001). The number of epidermal keratinocyte layers increased from NE to PI-14, DF-14, and DF-56 (p<0.00001, p<0.00001, p=0.0043), with a decrease from DF-14 to DF-56 (p=0.0020).

CONCLUSION: The epidermal Lgr6 stem cell population remained severely depleted following discontinuation of mechanical tension. Conversely, both the Lgr6 descendant population and K5 stem cell expression continued to increase while under tension and following release of tension. A prolonged history of discontinued tension revealed that the majority of the proliferating cell population was from Lgr6 progeny. Together, these observations suggest that in skin with a history of tension: (1) the Lgr6 population is permanently depleted, (2) the majority of the epidermis will be from Lgr6 progeny, and (3) Lgr6 progeny and K5 stem cells will be preferentially and progressively activated over Lgr6 stem cells to maintain the epidermis. Overall, these results imply that specific stimuli will prioritize responses from specific stem cell populations, and possibly to the detriment of an existing stem cell population.

REFERENCES:
1. Xue Y, Lyu C, Taylor A. Mechanical Tension Mobilizes Lgr6+ Epidermal Stem Cells to Drive Skin Growth. [provisionally accepted ahead of print February 23, 2022]. Sci Adv.

**TRACK: BREAST**

Post Mastectomy Tissue Expander Placement followed by Radiation Therapy: A Cost-effectiveness Analysis of Staged Autologous vs. Implant-based Reconstruction

**Presenter:** Joshua Alex Bloom, MD

**Co-Authors:** Shivani Ashish Shah, Emily Long, MD, Abhishek Chatterjee, MD, MBA, Bernard T. Lee, MD, MBA, MPH

**Affiliation:** Tufts Medical Center, Department of Surgery, Boston, MA

PURPOSE: There is no clearly preferred approach to breast reconstruction in patients with locally advanced breast cancer who require post-mastectomy radiation therapy (PMRT). Staged implant and deep inferior epigastric perforator (DIEP) flap reconstruction each have unique risks and benefits. No previous study compares the cost-effectiveness of these approaches with validated utility scores.

METHOD: A literature review looking at prospective trials determined the probabilities and outcomes for mastectomy and staged implant reconstruction or staged DIEP flap reconstruction. Utility scores were used to calculate the quality adjusted life years (QALYs) associated with a successful procedure and post-operative complications. Medicare current procedure terminology and diagnosis-related group codes were used to assess the costs for a successful surgery and associated complications. A decision analysis tree was constructed with rollback analysis to highlight the more cost-effective strategy. An incremental cost-effectiveness ratio (ICER) analysis was performed with a willingness