RESULTS: MicroCT revealed a lack of bridging bone healing in negative controls. There was bridging bone formation across all 3DBC treatment groups. As a function of bone growth within the scaffold interstices, 1,000μm-DIPY scaffolds regenerated 28.03 ± 7.38% bone, 10,000μm-DIPY scaffolds regenerated 36.18 ± 6.83% bone (p=0.104 1,000μm vs. 10,000μm DIPY), and rhBMP-2 coated scaffolds regenerated 37.17 ± 16.69% bone (p=0.124 vs. 1,000μm-DIPY and p=0.938 vs. 10,000μm-DIPY). MicroCT also revealed rhBMP-2 to be associated with active bone resorption at the area of the suture and evidence of early suture fusion, which was again not seen in DIPY group or controls. On histology and electron microscopy, no changes in suture biology were evident in DIPY groups, while the rhBMP-2 group demonstrated early signs of suture fusion as well as osteoclastic activity at suture borders suggestive of osteolysis. Healing was intramembranous-like and endochondral-like, with highly cellular and vascularized structure across all groups. Reduced elastic moduli of new bone was significantly less than native bone, irrespective of DIPY or BMP augmentation (p<0.01).

CONCLUSION: Dipyridamole augments bone regeneration similarly to rhBMP-2 at both 1,000μm and 10,000μm concentrations. Dipyridamole generates new bone without osteolysis and early suture fusion associated with rhBMP-2. 3DBC scaffolds are effective at local osteogenic agent delivery.

RECONSTRUCTIVE SESSION 2

Retrorectus Mesh Fixation Using Fibrin Glue: Early Outcomes of an Evolving Technique

Presenter: Irfan A. Rhemtulla, MD, MS

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PURPOSE: The retrorectus approach to abdominal wall hernia repair has led to superior post-operative outcomes. However, this technique has been associated with long hospital lengths of stay (LOS), long operative times, long time to drain removal, and more frequent 30-day post-operative visits (POV). Additionally, there is substantial effect on patient well-being with high pain scores and low activity levels. The aim of our study was to determine the effect of fibrin glue fixation (FGF) of mesh when compared to suture fixation (SF) on early post-operative outcomes after retrorectus hernia repair.

METHODS: Patients undergoing retrorectus abdominal wall hernia repairs (n=87) by the senior author between June 1, 2015 and December 31, 2017 were retrospectively assessed. 28 patients (32.2%) received FGF, whereas 59 (67.8%) received SF. Demographic factors, intraoperative details, and early post-operative outcomes were identified through the electronic medical record. The two cohorts were then matched based on the type of mesh, number of prior repairs, average defect size, age, BMI, and wound class. Statistical analyses were performed using chi-square tests for categorical variables and Students T-tests for continuous variables.

RESULTS: After matching the two cohorts based on the 6 variables listed above, 21 patients remained in the FGF group and 21 remained in the SF group. All patients had retrorectus repairs with biosynthetic mesh. No statistically significant differences were identified in percentage of females (43% FGF vs. 48% SF, p=0.757), mean age (57 FGF vs. 56 SF, p=0.890), mean BMI (34 kg/m² FGF vs. 35 kg/m² SF, p=0.575), and average number of prior hernia repairs (0.81 FGF vs 0.76 SF, p=0.883). Intraoperative factors were similar as well with average wound class (1.33 FGF vs 1.38 SF, p=0.848), mean defect size (326 cm² FGF vs. 334 cm² SF), use of epidural and patient-controlled analgesics (p=1), concomitant procedures (p=0.756) including specifically panniculectomies (p=0.758), use of anterior component separation (p=0.4690), and use of transversus abdominis release (p=1). Surgical site occurrences between the two groups were not statistically significant except for a trend towards higher rates of seromas in the SF cohort (3 vs. 0 in FGF, p=0.072). Statistical significance was observed for LOS (3.7 days FGF vs. 7.1 days SF, p=0.032), time to drain removal (17 days FGF vs. 27 days SF, p=0.020), 30 day POV (2 visits FGF vs 3 visits SF, p=0.007), 24-hour pain scores (3 FGF vs 5 SF, p=0.021) and Braden activity scores (walking at 24 hours for FGF compared to sitting in a chair at 24 hours for SF, p=0.004). There was a trend towards decreased operative time (193 minutes FGF vs 217 minutes SF, p=0.352) and decreased narcotics being re-prescribed post-operatively (3 patients FGF vs 7 patients SF, p=0.272).

CONCLUSION: Compared to SF, FGF can improve pain and activity scores while reducing LOS, time to drain removal, and 30 day POV. This study shows that FGF is a safe and useful alternative to SF in the immediate
post-operative period and lays the foundation for future studies to assess long-term outcomes related to hernia recurrence.

**Gauging the Tension: A Simple and Reliable Method to Quantify the Forces Generated on Fascial Closures in Hernia Repair and Component Separation**

**Presenter: Karel-Bart Celie, BA**

**Co-Authors: Adam S. Levy, MD; Jaime L. Bernstein, BS; Jason A. Spector, MD, FACS**

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**INTRODUCTION:** Ventral hernias are a common complication after open abdominal surgery. Excessive tension on the fascial line of closure is an established and major cause of recurrence. Although hernias in the literature are most commonly characterized by area, almost no clinical literature exists that describes the actual tension experienced by the fascia at closure. Thus, small hernias surrounded by less compliant tissue may actually be at higher risk for recurrence than larger hernias with more elastic tissues. Here we aim to develop an accurate and simple technique for intra-operatively measuring the tension of the fascia on closure during hernia repair.

**METHODS:** A simple device (tensiometer) was created using a spring with a known recoil constant ($k$) hooked to a Kocher clamp, which was attached to a fascial defect and pulled until the fascia reached midline. By measuring the change in length of the spring, the resulting tension on the fascia could be calculated by Hooke’s Law (Force=$kx$; $k$=spring constant, $x$=spring displacement). This method was applied first to a synthetic skin secured on one end to test validity over a range of forces by two independent observers. Next, the model was tested on the anterior abdominal fascia of 4 fresh cadavers (8 hemi-abdomens) over a range of simulated hernia defects from 0 to 18cm wide. When the fascia could no longer be approximated to midline, a components separation(CS) was performed and measures repeated. Measurements were taken in triplicate for each defect size by 2 observers for each hemi-abdomen at the midpoint and 1/3 from the inferior and superior most points. All measurements were plotted as force versus defect size, allowing calculations of tissue stiffness. Given our novel methodology, Pearson’s correlation was calculated to validate the reliability of our technique. P-values less than 0.05 were considered significant.

**RESULTS:** When the synthetic skin edge was pulled to 3, 5, and 8 cm, the spring length was increased to 8.6, 9.3, and 10.4 cm, respectively, resulting in a force of 10.44, 14.12, and 19.90 N (SD 0.1). In cadavers, defects ranged from 1 to 18 cm in diameter with average midline force prior to release 36.1 N (range 17–48) and 8.2 N (range 5–11) after CS, a mean 436% decrease (range 327 to 677). Mean $R^2$ values between defect size and tension for the synthetic and cadaver models were 0.99 ($p<0.01$) and 0.91 ($p=0.01$; all values significant), demonstrating the precision of this methodology in quantifying fascial tension. Inter-rater Pearson’s correlation between observers consistently found $R^2$ values >0.95 ($p<0.01$) for each hemi-abdomen, showing this model to be highly reproducible.

**CONCLUSION:** We have developed a low cost, simple, and precise method of assessing fascial tension on the hernia suture line. This technique may be rapidly translated into the operating room, requiring only a Kocher and a spring made of medical grade stainless steel that can easily be sterilized using an autoclave. Quantifying the fascial tension at the time of hernia repair would provide significant objective data to surgeons critical for intraoperative decision-making, leading to improved outcomes and reduced incidence of recurrent hernia.

**Bovine Acellular Dermal Matrix for Complex Abdominal Wall Reconstruction: A Cost Analysis and Outcomes Study**

**Presenter: Johanna D’Agostino, MD**

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**BACKGROUND:** Complex abdominal wall reconstruction with components separation and the use of acellular