

**THE UNIVERSITY OF VIRGINIA
DEPARTMENT OF OTOLARYNGOLOGY – HEAD & NECK SURGERY
PRESENTS**

THE 44th ANNUAL FITZ-HUGH SYMPOSIUM

RESIDENT RESEARCH PRESENTATIONS

Friday June 19, 2020 at 8:35 am

Riggs Auditorium

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RESIDENT RESEARCH ABSTRACTS

Development of a laryngeal microporous annealed particle hydrogel spheroid assay

Ian Churnin MD; Lauren Pruett BS; Michael Dougherty MD; Donald Griffin PhD; James Daniero MD

Objective. To develop an in-vitro spheroid model to assess cellular integration into gel matrices with goal of optimizing a microporous annealed particle (MAP) hydrogel for use in treatment of laryngeal pathology such as glottic insufficiency and posterior glottic stenosis. We hypothesize that heparin-MAP hydrogel will increase cell proliferation and migration compared to plain-MAP hydrogel.

Design: In Vitro Assay

Methods: 3T3 murine fibroblast cell line was used to prepare spheroids containing 1.25×10^5 cells/mL. Fibroblast containing spheroids were pipetted onto heparin-MAP (n = 5) and plain-MAP hydrogel (n = 4) that had been plated and annealed into 48-well plates. After 24-hours, cell media was added to each well. The wells were imaged at 24, 72, and 120 hours using a Micro Confocal High Content Analysis Microscope. Area of cell growth was calculated using imageJ software and area fold-change at 72 and 120 hours was compared between treatment groups using t-tests.

Results: 3T3 murine fibroblasts grown on heparin-MAP and plain-MAP hydrogel demonstrated no significant difference in cell proliferation and migration at 72 hours (4.15 vs. 3.33 area-fold change, $p = 0.39$) or 120 hours (15.1 vs. 9.61 area-fold change, $p = 0.12$).

Conclusions: A spheroid plating technique was successfully utilized to assess and compare fibroblast proliferation and migration amongst various MAP hydrogel formulations. While no significant difference in fibroblast proliferation and migration was demonstrated between heparin-MAP and plain-MAP hydrogel in this study, there was a notable trend over time suggestive of a possible growth-augmenting effect observed in the heparin-MAP group warranting further evaluation.

Correlation of the UVA bony facial trauma score with tracheostomy and mortality

Harrison Bartels MD; Garrett Casale MD; Sebastian Dobrow BS; Andrew Strumpf MPH; J Jared Christophel MD MPH

Background: In 2016 the University of Virginia developed the Bony Facial Trauma Score (BFTS), a validated scale to quantify bony trauma of the face. Scores were collected on all trauma patients over two years and used to assess the predictive value of the score.

Study Objective: To use a validated score to standardize quantification of bony facial trauma and assess the score's correlation with relevant patient outcomes.

Design Type: Retrospective review

Method: A retrospective analysis was performed on patients who sustained bony facial trauma between 1/1/2017 to 11/30/2019. The primary outcome measures were admission status, need for operative management, tracheostomy placement, and mortality. Logistic regression modeling was used to measure the association of the BFTS and the above outcome measures.

Results: A total of 308 patients were included in the study. On average, patient BFTS was 6.3 (SD, 7.26) while age was 45.1 years (SD, 22.3). Controlling for age, BFTS was found to have a statistically significant ($p < 0.05$) correlation with each outcome measure: admission (OR 1.06, 95% CI 1.01 – 1.12), mortality (OR 1.05, 95% CI 1.00 – 1.09), tracheostomy placement (OR 1.11, 95% CI 1.07 – 1.17), and need for operative management (OR 1.16, 95% CI 1.11 – 1.22).

Conclusion: The findings of significant correlation between the BFTS and our clinical outcome measures validate its use as a helpful clinical tool. Additionally, the correlation with need for tracheostomy placement is particularly compelling in that early intervention in these patients could prevent known complications associated with prolonged intubation.

Post-neck dissection chyle leaks: clinical management and associated costs

Annesha Basu MD; Lydia Weykamp MS4; Katherine Fedder MD; David Shonka MD; Mark Jameson MD PhD

Objective: To identify the rate of post-neck dissection (ND) chyle leaks (CLs) and to evaluate effectiveness and costs of their clinical management.

Design/Setting: Retrospective chart review.

Setting: Academic tertiary care hospital.

Patients: 558 patients who underwent ND between January 2017 and March 2020 were retrospectively studied to identify cases complicated by CL, evaluate management, and quantify associated costs.

Main Outcome Measure: Incidence of post-ND CL. Relative effectiveness and cost of medical versus operative management.

Results: Fifteen patients (2.7%) experienced an intra-operative CL without subsequent post-op CL. Eighteen patients (3.1%) experienced postoperative CL with five of those patients with documented intra-operative leaks. The average time to detection of postoperative CL was 2.2 days; average time to resolution was 11.2 days. 18 patients underwent medical management (low-fat diet, pressure dressing and/or octreotide) for an average of 5.6 days; 12 of these (66.7%) resolved with medical treatment alone. The average cost of medical therapy was \$11,651.63. Six patients underwent cervical exploration after an average of 6.5 days of conservative treatment. Surgical success rate was 50% and average cost was \$38,699.67. Transthoracic or interventional radiology procedures were performed in two patients each, with 50% success rate for transthoracic procedures and 50% for interventional radiology procedures. Average cost of transthoracic procedures was \$68,421.00 and for interventional radiology procedures was \$25,559.00.

Conclusions: The rate of post-neck dissection CL in our patient population is very low and is usually successfully managed with conservative medical therapy. Our data seems to show that patients are treated in an algorithmic pattern, starting with medical management and escalating as necessary starting with cervical exploration, with the main difference occurring in when various operative interventions occur. As cervical exploration and interventional radiology success rates were equal at 50%, perhaps IR procedures should be considered prior to the operating room.

Analysis of eustachian tube dysfunction pre and post mandibular distraction osteogenesis in children

Rachel Jonas MD; Jonathan Black MD; Bradley Kesser MD

Objectives: To determine if mandibular retrognathia predisposes children to eustachian tube dysfunction (ETD) and if correction of retrognathia via mandibular distraction osteogenesis (MDO) will mitigate the risk.

Study Design: Retrospective chart review

Methods: We identified all patients who underwent mandibular distraction osteogenesis at UVA over the past 10 years. Patients' charts were reviewed for evidence of ETD including documentation in the chart, type B or C tympanogram, need for pressure equalization tube and CT opacification of the middle ear or mastoid. Other patient characteristics such as presence of cleft palate, apnea-hypopnea index (AHI), maxillary-mandibular discrepancy, distraction length and smoke exposure were collected. As a control, we identified patients with the diagnosis of Pierre Robin Sequence without cleft palate who did not undergo MDO.

Results: Nine patients who underwent MDO were identified. One patient demonstrated ETD prior to MDO and two developed ETD after undergoing MDO. There was no statistically significant difference between ETD pre-MDO and post-MDO, even when stratifying by known ETD risk factors. When comparing patients with retrognathia who did not require MDO to those who did, there was no statistically significant difference in rates of ETD.

Conclusion: We cannot conclude that retrognathia alone is an underlying condition that predisposes children to eustachian tube dysfunction. Furthermore, we cannot answer the question that MDO improved ETD, given only one patient had ETD prior to MDO.

Mucosal wound healing and mechanical trauma in laryngotracheal stenosis

Delaney Carpenter MD; James Daniero MD; Patrick Cottler PhD

Objectives:

1. To establish representative laryngeal fibroblast cell lines from patients with laryngotracheal stenosis (LTS).
2. To assess the response of iatrogenic subglottic stenosis (SGS) to balloon dilation versus cold scar excision in a leporine model

Design: In vitro cell culture and in vivo animal study

Methods: In the in vitro portion of the study, 5 patients with LTS underwent airway scar tissue biopsy in the operating room. The tissue was processed and digested for fibroblast isolation and cultured in a fibroblast oriented media. In the in vivo portion of the study, 6 rabbits underwent direct laryngoscopy and subglottic cautery to produce a model of iatrogenic SGS. Once the presence of SGS was confirmed, the rabbits underwent treatment via cold scar excision or incision and balloon dilation, as randomly assigned. Direct laryngoscopy was repeated two weeks after treatment to assess for recurrent stenosis. Rabbits were sacrificed at this time and their larynges were harvested for histopathologic analysis.

Results: Robust fibroblast cultures were established from 4/5 tissue biopsies. The rabbit tracheal injury protocol produced inconsistent results, with 0-70% airway stenosis noted two weeks after injury. Sample size was too small for formal statistical analysis.

Conclusions: This project yielded a successful protocol for isolating laryngeal fibroblasts from tissue biopsies and preliminary data for the use of a leporine model of subglottic stenosis. In the future, these models will be used to study the differential expression of fibroinflammatory markers based on the mechanism of intervention, to better classify airway stenosis and to tailor treatments to underlying phenotype.

Reconstructing a mandibular defect with nanoparticle hydrogel

Caitlin Iorio MD, Logan McColl BS (MS4), Xizhao Chen BS (MS3), Ryan Cha, Blaise Pfaff BS, Abhijit S. Dighe PhD, Donald R. Griffin PhD, Jared Christophel MD MPH, Quanjun Cui MD

Introduction: The contemporary mainstays for repair of craniofacial (CF) bony defects after trauma, osteonecrosis, and oncologic surgery are fixation, bone grafting and free tissue transfer. Developing an osteogenic biosynthetic implant for CF reconstruction could alter standards of care. We have shown that delivery of BMP-6, VEGF, and smoothed agonist (SAG) through a polysaccharide scaffold (PS^{BVS}) significantly enhances bone healing (66.19% bone regeneration) in a rat mandibular critical-sized defect (CSD) model. A recent study showed bony defect closure of 99.38% with Matrigel[®]-BVS; proving that changing from a hard polysaccharide scaffold to a softer gel is beneficial. The goal of this work is to evaluate the use of a novel hydrogel, or Microporous Annealed Particle (MAP) gel, in reconstructing CSDs.

Methods: Bilateral CSDs were created at the angle of the mandible in nine, 8-week female Sprague-Dawley rats. The CSDs were left untreated or filled with MAP gel or MAP gel-BVS. Rats were euthanized at 8 weeks postoperatively and mandibular bone regeneration was evaluated with radiographic imaging. Analysis of variance testing was used to compare bony regeneration between treatment groups.

Results: Control and MAP-only cohorts showed minimal osteogenesis upon radiographic analysis, yielding results between 33-36% defect closure (p= 0.6712). However, when combined with growth factors, MAP-BVS significantly outperformed both the control and MAP groups, p=0.0352 and p=0.0121 respectively.

Conclusion: The MAP gel alone did not enhance bone growth and the gel alone may inhibit bone growth due to its lack of reabsorption.

Long term cosmetic outcome after parotidectomy

Justin Hyde MD; BJ Ferreeb Ghamandi; Jasmine Malhi MS2; Andrew Strumpf MPH; Katherine Fedder MD; David Shonka MD; Mark Jameson MD PhD

Objective: To determine patient satisfaction with their cosmetic outcome after parotidectomy and to evaluate their perception of the benefit of additional reconstructive surgery. To associate poor outcomes with presenting tumor and/or patient characteristics.

Design: Slicer Dicer™ was utilized to identify 41 patients who underwent parotidectomy without primary reconstruction for benign pathology at UVA over 24 months. 27 patients completed a quality of life questionnaire assessing their comfort and satisfaction with their final aesthetic result; this survey was based on previously validated questions to assess breast reconstruction outcomes. Bivariate regression analysis was used to identify predictive factors of patients who in hindsight would have preferred primary reconstruction during surgery.

Results: 21 of 27 patients (77.8%) indicated no negative cosmetic impact following surgery and complete satisfaction with their cosmetic result. No statistically significant discriminators such as tumor type or volume, BMI, gender, or time from surgery were significant that could identify those that might benefit from reconstruction at the time of surgery. Patients who did not recall pre-operative counseling regarding reconstruction were 7.5 times more likely to be not completely satisfied with their result which was significant. 4 patients (14.9%) would have requested reconstruction at the time of surgery however no patient or tumor characteristics were statistically associated with this group.

Conclusions: A majority of patients undergoing superficial parotidectomy for benign disease were completely satisfied with their cosmetic result, and even more would not want concurrent reconstruction. Counseling all patients pre-operatively may improve perception of their cosmetic result.

25 year review of pediatric cutaneous malignancies of the head and neck, a single institution

Heather Koehn MD, William Swift MS4, Mark Russell MD, Stephen Park MD

Objectives: This review aims to describe our institution's experience over the past 25 years in regards to patient risk factors, diagnosis, treatment and outcomes.

Methods: We conducted a search of the medical record from 1994 to present for diagnosis codes of pediatric cutaneous malignancies and CPT codes related to excision and reconstruction to capture all patients diagnosed and treated at our center for a pediatric cutaneous malignancy. Our search produced 143 medical records which were reviewed for pathology and subtypes, family and personal history of cutaneous malignancies, medical comorbidities, treatment, including number of stages of Mohs surgery where relevant, as well as any reconstruction if performed.

Results: Of the 143 patients reviewed, 38 of which were located on the Head and Neck. 21 of which were non-melanoma, the most common non-melanoma pathology was basal cell carcinoma of which 31% percent were co-morbid with Gorlin syndrome, or Nevoid Basal Cell Carcinoma Syndrome (NBCCS). The percentage of non-melanoma prior to 2011 was 33% while after 2011 was 7%. Treatments included wide excision, Mohs surgery, photodynamic therapy, cryotherapy and topical chemotherapeutic agents.

Conclusions: Pediatric cutaneous malignancies remain a rare entity, and, given our results, there has been a shift in the prevalence of Melanoma in recent years. This warrants further exploration.

Practice patterns in endotracheal tube use: provider awareness of laryngeal complications

Margeaux Corby MD; Stephen Chau BS; Steve Schoeff MD; Sunil Verma MD; Seth Dailey MD; James Daniero MD

Objectives: Posterior glottic stenosis (PGS) occurs when the glottis is critically narrowed due to interarytenoid scar and/or cricoarytenoid joint fixation. It is caused most commonly by intubation injury. This research is aimed to assess provider decision-making regarding endotracheal tube (ETT) size.

Study Design: Multicenter survey study

Methods: Survey of licensed independent practitioners who perform or supervise others performing intubation in an intensive care unit setting. The survey consists of questions assessing standard endotracheal tube size selection and provider knowledge regarding airway stenosis and associated risk factors. Descriptive statistics concentrating on measures of frequency were calculated.

Results: The survey was completed by 185 advanced practice providers. When performing intubations, 39.4% of respondents used a 7.5 ETT or larger 51-100% of the time. In comparison to a standard adult patient, only 4.3% of providers used a small diameter tube if the patient had diabetes. When bronchoscopy was anticipated, 88.6% of respondents used a larger diameter ETT.

Conclusions: Current practice patterns indicate that for a standard male patient, a 7.5 ETT is most commonly used, and for a standard female patient, a 7.0 ETT. Providers are more likely to increase the diameter of the ETT if bronchoscopy is anticipated. Patient co-morbidities, such as diabetes, do not play appear to play a substantial role in ETT size selection. While there is great variability in the familiarity amongst providers regarding airway stenosis, the majority indicated they would be willing to use a smaller ETT if there is a correlation between airway stenosis and large ETT diameter.

Thyroid involvement and hypothyroidism after total laryngectomy for squamous cell carcinoma

Neil Saez MD; William Swift MS4; Ariel Finberg MS4; Katherine Fedder MD; David Shonka MD; Mark Jameson MD PhD

Objectives: To determine factors that influence thyroid gland involvement by squamous cell carcinoma (SCCA) and the development of hypothyroidism after total laryngectomy (TL).

Study Design: Retrospective chart review

Methods: A chart review was performed of all patients who underwent TL for primary or recurrent SCCA from January 2011 through February 2020 at UVA. Outcomes included thyroid gland involvement and post-operative thyroid hormone replacement.

Results: 136 patients met inclusion criteria. 92 patients (68%) underwent hemithyroidectomy and 17 (13%) underwent total thyroidectomy at the time of TL. 14 patients (10%) had pathologic thyroid involvement and 82(60%) developed post-TL hypothyroidism. Binomial logistic regression was performed and out of 12 independent variables only thyroid/cricoid cartilage invasion ($p=0.01$), pre-operative radiation therapy (RT; $p=0.04$), the largest dimension of tumor ($p=0.02$), and the interaction between anterior commissure involvement and LVI ($p = 0.01$) were correlated with thyroid invasion. Location of the primary tumor was not correlated, and preoperative chemotherapy was a protective factor that trended towards significance. When total thyroidectomy is not performed post-TL hypothyroidism is only correlated with pre-op RT ($p=0.004$, OR 6.8) and post-op RT ($p=0.004$, OR 7.08).

Conclusion: This study identifies several factors that may help predict thyroid involvement at the time of TL which may allow for reduction in associated thyroidectomy and preservation of thyroid function.

Evaluating outcomes of bony facial trauma: ICU needs and c-spine trauma

Garrett Casale MD; Harrison Bartels MD; Sebastian Dobrow MS4; J Jared Christophel MD MPH

Objective: To investigate possible correlations between the UVA Bony Facial Trauma Score (BFTS) and the need for ICU admission and co-incident C-spine injury

Design: Retrospective chart review

Methods: Data was collected on all patients evaluated in consultation by the UVA Department of Otolaryngology between 01/2017 and 11/2019 with a diagnosis of bony facial trauma. We collected the BFTS data for each patient. We then reviewed data on (1) the need for ICU admission, (2) ICU length of stay (LOS), and (3) C-spine injury for each patient.

Results: A total of 312 patients were included in this study. Average BFTS was 6.2 (SD 7.26) and average age was 48 years (SD 22.4). A binary logistic regression was performed and when controlling for age and gender, total BFTS values were noted to be correlated with need for ICU admission (OR 1.069, 95% CI 1.027-1.112, $p=0.001$). A multivariate regression was performed and when controlling for age and gender, mandible BFTS values were noted to be correlated with increasing ICU LOS ($p<0.001$) and total BFTS values were noted to be correlated with worsening C-spine injury ($p=0.003$)

Conclusion: This study demonstrates a correlation between the BFTS and valuable clinical outcome measures. A high score on the BFTS should raise our clinical suspicion for a co-incident C-spine injury. Mandibular injuries are correlated with prolonged ICU stay. This data further supports the use of the BFTS in describing and communicating facial trauma severity.
