Micro/Nanobubbles: A Novel Oxygenation Technology for Cellular and Organ Transplantation

Presenter: Lohrasb Sayadi, MD

Co-Authors: Derek A. Banyard, MD, MBA; Gregory R. D. Evans, MD, FACS; Alan D. Widgerow, MBCh, MMed, FCS, FACS

Affiliation: University of California Irvine, Orange, CA

PURPOSE: The survival and preservation of transplanted tissue (kidney, heart, fat grafts) are directly tied to and limited by ischemia time. A new innovation, micro/nanobubbles (MNBs), are miniature gaseous voids that allow for oxygenation of a tissue bathed in them for varying periods of time. Given their high oxygen carrying capacity, MNBs offer an inexpensive technology for oxygenating transplantable tissue and improving cell survival and viability. A priority in the field of islet cell transplantation for Type 1 Diabetes is to preserve every single islet count due to the shortage of donors and consistent low recovery of islets with current isolation procedures. The purpose of this study was to demonstrate that islet cell survival and viability can be improved when immersed in MNBs and to generalize our findings to other autologous and allogenic transplants.

MATERIALS AND METHODS: Rat pancreatic islet cells were harvested and split into 3 groups starting with 500 cells in each group – these were cultured in JPI media overnight. On day 0, media was changed to either control media (pO2: 210 mmHg); control media with dissolved air (pO2: 210 mmHg) or micro/nanobubbled solution (pO2: 223 mmHg). Media was replenished under the same conditions at 24 hours. On day 2 the number of living islet cells were counted using dithizone staining and their viability was assessed using the calceinAM/propidium assay. All experiments were replicated 5 times to achieve statistical significance.

DATA: Islet cells preserved in air filled micro/nanobubbled solutions had both a significantly improved cell survival and viability (Islet count: 223, viability: 96 ± 1%) when compared to either islet cells treated with control media (Islet count: 104, viability: 87 ± 1%) or control media with dissolved air (Islet count: 92, viability: 87 ± 1%).

SUMMARY OF RESULTS: Harvested Islet cells preserved in MNB solution had a significant improvement in cell survival and viability when compared to the controls. MNBs improve Islet survival by 114% (223 cells vs. 104 cells) and viability by 10% (96% vs. 87%).

CONCLUSION: MNBs added to standard media significantly improve oxygenation and survival of harvested pancreatic islet cells prior to transplantation compared to control media. These findings are very encouraging in the field of islet cell transplantation for Type 1 diabetes given the demonstrated increase in preservation of robust cells. Given these findings, we hypothesize that MNBs may also improve oxygenation and survival of a variety of other tissues including fat grafts from liposapirate, chronic wounds and large organs.

REFERENCES:
1. Sayadi LR BD, Ziegler ME, et al. Topical Oxygen Therapy & micro/nanobubbles: a new modality for tissue oxygen delivery. International wound journal. 2017:1–13
2. Barshes NR, Wyllie S, Goss JA. Inflammation-mediated dysfunction and apoptosis in pancreatic islet transplantation: implications for intrahepatic grafts. J Leukoc Biol. 2005;77(5):587–597.
3. Ricordi C, Strom TB. Clinical islet transplantation: advances and immunological challenges. Nat Rev Immunol. 2004;4(4):259–268.

Diversity in Plastic Surgery Trainees: Trends in Minority Representation Among Applicants and Residents

Presenter: Nisha Parmeshwar, BS

Co-Authors: Emelia R. Stuart, BS; Christopher M. Reid, MD; Parisa Oviedo, BS; Amanda A. Gosman, MD

Affiliation: University of California, San Diego, San Diego, CA

INTRODUCTION: While the American population grows increasingly diverse each year, the physician workforce fails to reflect a similar change. Prior studies have shown plastic surgery residents demonstrate a lower representation of racial, ethnic, and gender minorities than other surgical fields. With its inherently diverse patient population,
plastic surgery stands to benefit from increased diversity in surgeons, which begins by recruiting interested applicants to training from various backgrounds. We sought to evaluate trends in minority representation among applicants to plastic surgery compared with other specialties, and subsequently how these correlate with minority proportions of practicing residents.

METHODS: AAMC Electronic Residency Application Service (ERAS) data was used to assess applicants to integrated and independent plastic surgery, internal medicine, family medicine, obstetrics and gynecology, and general surgery from 2010–2016. Corresponding resident data was attained from JAMA Graduate Medical Education annual reports, and medical student data from AAMC graduate student questionnaires. Groups analyzed included self-identified Black, Hispanic, and females. Binomial distribution analysis was used to assess differences in minority proportions of applicants and residents each year. Best-fit trend lines were compared amongst groups and across specialties.

RESULTS: In integrated and independent plastic surgery, females have seen an increase in resident representation (+2.23% and +0.7% per year, respectively) over the last 7 years, despite a relative decrease in applicants (-0.23% and -0.8% per year, respectively). The proportion of female applicants and residents correlated yearly for all specialties (p>0.05). Black representation among both sets of applicants is increasing, however integrated residents fail to reflect this trend, with a -0.42% decrease in representation per year. Similarly, for all years and most specialties, the black proportion of applicants was significantly higher than the same year’s resident representation (p<0.05). Hispanic applicant and resident representation has seen a minimal change, <1% for both independent and integrated plastics.

CONCLUSION: Overall, female representation in plastic surgery residents has increased greatly with near constant applicant representation in the integrated track, indicating better match success. There appears to be waning interest among females in applying the independent pathway. Despite increased Black representation in graduating medical school classes and accordingly applicants to plastic surgery, there has been a decline in Black representation of integrated plastics residents. No significant changes were seen among Hispanics. The data highlights a discrepancy between the population of applicants and those that continue on as residents, consistent across many specialties and deserving of our attention. Barriers to minority recruitment, including an absence of mentors and lack of resources, may exist starting from medical school and must be addressed in order to increase minority representation in plastic surgery.

REFERENCES:
1. Association of American Medical Colleges. Diversity in the Physician Workforce: Facts & Figures 2014. Available at <http://aamediversityfactsandfigures.org/>.
2. Silvestre J, Serletti JM, Chang B. Racial and Ethnic Diversity of U.S. Plastic Surgery Trainees. J Surg Educ 2017;74:117–123
3. Silva AK, Preminger A, Slezak S, et al. Melting the Plastic Ceiling: Overcoming Obstacles to Foster Leadership in Women Plastic Surgeons. Plast Reconstr Surg 2016;138:721–729

The American Council of Academic Plastic Surgeons Plastic Surgery Boot Camp Program: Evaluation of the University of Pittsburgh’s Three Year Experience

Presenter: Francesco M. Egro, MBChB, MSc, MRCS

Co-Authors: Edward Davidson, MD; Jeffrey E. Janis, MD, FACS; Vu T. Nguyen, MD

Affiliation: University of Pittsburgh, Pittsburgh, PA

BACKGROUND: The American Council of Academic Plastic Surgeons (ACAPS) Plastic Surgery Boot Camp program was introduced in July 2015 in Pittsburgh and was expanded to four regional sites thanks to standardized presentations, increased practical sessions, and streamlined evaluations. The aim of this study was to evaluate our ACAPS Plastic Surgery Boot Camp experience over the past three years and the impact it had on participant performance.

METHODS: Over the past three years a total of 119 residents (99 Integrated / 20 Independent) attended the Boot Camp in Pittsburgh. Lecture topics and practical sessions covered the full spectrum of plastic surgery. All participants completed pre- and post- evaluation surveys with mean scores being reported as percentages and analyzed using ANOVA.