for planning and guide creation in the wide variety of craniofacial surgeries performed. The average deviation of post-operative anatomy from pre-operative plan was also not statistically significant when Black Bone MRI versus CT scans were utilized in the surgeries. These results then enabled the translational application of this technology clinically, and we demonstrate a clinical reconstructive craniofacial case planned utilizing Black Bone MRI. DISCUSSION/SIGNIFICANCE OF IMPACT: This study demonstrates that virtual surgical planning and 3d surgical guide creation can be performed using Black Bone MRI with comparable accuracy to CT scans in a wide variety of craniofacial procedures. This could dramatically reduce radiation exposure for patients. The successful segmentation, virtual planning, and 3d printing of accurate guides from Black Bone MRI demonstrate potential to change the pre-operative planning standard of care. This project, overall, also demonstrates the development of new solutions to advance clinical care, thus serving as an example of moving translational science from a concept to the operating room.

**4023**

## Catecholamines and Opioid Therapy Requirements for the Management of Acute Post-Procedural Pain: The clinical Trend to Identify Remarkable Elements in Opioid Drug Dependency

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OBJECTIVES/GOALS: To compare the opioid drug requirements amongst those individuals with high levels of catecholamines in blood and acute post-procedural pain, by ICD9/10 codes (experimental) to those with normal levels of catecholamines and acute post-procedural pain (AP-PP) only (controls) METHODS/STUDY POPULATION: In collaboration with both the Informatics and the Biostatistics Departments at CTSI and under the auspices of the IRB at the University of Rochester, we completed the collection of ~8,000 electronic health records(EHRs) of adults 18 years and older with surgical appointments at Strong Memorial Hospital (SMH), who met inclusion criteria, from January 2006 to September 2019 and received Fentanyl therapy for AP-PP management. Subjects were categorized in a two-arm-matched case-control fashion. A ratio of 1(Experimental):1(Control) was utilized. Analytic comparisons were completed using normal distribution statistical methods with $p > 0.1$ for significance. RESULTS/ANTICIPATED RESULTS: After removal of duplicates and exclusion of EHRs, a total of 17 subjects met inclusion criteria for the experimental group. We matched controls ($n = 17$) with experimental subjects for age, gender and surgical procedure for accurately compare opioid requirements in the postoperative recovery. Mean age of subjects was 69(+/-10.1235) years old. Most of subjects were females (70%). Mean Fentanyl requirement was significantly different in the experimental group 466.17(625.621)mcg compared to 215.58(353.323)mcg in the controls (p value 0.07832) DISCUSSION/SIGNIFICANCE OF IMPACT: It is suggested that healthy individuals with genetic variations in pain pathways including; the COMT and MAOA rendered individuals with higher levels of catecholamines in the body driving abnormal responses to pain sensitivity. We emulated this genetic variation for clinical purposes using ICD10/9 codes of those with conditions related to higher catecholamine levels in the body. Based on our preliminary results, we suggest that COMT and MAOA genetic variations could impact opioid drug use and the current opioid dependency and epidemics in the U.S. This study will address remarkable questions and identify strategies about this topic.

**4089**

## Clinical Implementation of Monte Carlo Dose Calculation for Patient-Specific Radiotherapy Quality Assurance

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OBJECTIVES/GOALS: The Monte Carlo dose calculation method is often considered the "gold standard" for patient dose calculations and can be as radiation dose measurements. Our study aims to develop a true Monte Carlo model that can be implemented in our clinic as part of our routine patient-specific quality assurance. METHODS/STUDY POPULATION: We have configured and validated a model of one of our linear accelerators used for radiation therapy treatments using the EGSnrc Monte Carlo simulation software. Measured dosimetric data was obtained from the linear accelerator and was used as the standard to compare the doses calculated with our model in EGSnrc. We will compare dose calculations between commercial treatment planning systems, the EGSnrc Monte Carlo model, and patient-specific measurements. We will implement the Monte Carlo model in our clinic for routine second-checks of patient plans, and to recalculate plans delivered to patients using machine log files. RESULTS/ANTICIPATED RESULTS: Our Monte Carlo model is within 1% agreement with our measured dosimetric data, and is an accurate representation of our linear accelerators used for patient treatments. With this high level of accuracy, we have begun simulating more complex patient treatment geometries, and expect the level of accuracy to be within 1% of measured data. We believe the Monte Carlo calculation based on machine log files will correlate with patient-specific QA analysis and results. The Monte Carlo model will be a useful tool in improving our patient-specific quality assurance protocol and can be utilized in further research. DISCUSSION/SIGNIFICANCE OF IMPACT: This work can be implemented directly in clinical practice to ensure patient doses are calculated as accurately as possible. These methods can be used by clinics who do not have access to more advanced dose calculation software, ensuring accuracy for all patients undergoing radiotherapy treatments.

**4061**

## Clinical utility of precision medicine approaches to guide anti-platelet selection for adult patients with acute coronary syndromes (ACS), following percutaneous coronary intervention (PCI)

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OBJECTIVES/GOALS: Our goal is to determine if a precision medicine approach to guide anti-platelet therapy for patients with ACS, post PCI, is feasible for a diverse urban population. Also, we will evaluate if guided therapy reduces major adverse cardiovascular

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events (MACE) while remaining economically sustainable. METHODS/STUDY POPULATION: This prospective, pragmatic study will enroll two-hundred patients with ACS undergoing PCI, receiving DAPT. Patients will receive point-of-care *CYP2C19* genotyping. Patients with at least one loss-of-function (LoF) allele will be recommended prasugrel. Those without LoF alleles, will be recommended to take prasugrel for 7 days then clopidogrel for 7 days, followed with platelet reactivity phenotyping. Patients with HPR >208 $P2Y_{12}$ reaction units will take prasugrel; the remainder will take clopidogrel. We will review electronic health records and contact patients at baseline, then at 1, 3, 6, and 12 months to collect data for cardiovascular and health-related quality of life (HRQoL) outcomes. RESULTS/ANTICIPATED RESULTS: Feasibility and clinical utility will be measured by the proportion of patients with a genotype or phenotype leading to a clinical recommendation of alternative therapy and whether or not recommendations were accepted by clinicians. Effectiveness will be measured by combined MACE (composite of cardiovascular death, non-fatal myocardial infarction, and non-fatal stroke), stent thrombosis, and major and minor bleeding over the study period. Cost of testing, 30-day hospital readmission, and HRQoL questionnaires will be included for pharmacoeconomic analysis from an institutional perspective. DISCUSSION/SIGNIFICANCE OF IMPACT: There are no studies investigating the clinical utility of implementing guided anti-platelet selection, combining *CYP2C19* genotyping and HPR phenotyping. We anticipate incorporating this precision medicine approach to guide $P2Y_{12}$ inhibitor selection will be feasible while improving patient outcomes.

**4058**

## Enhanced efficiency of large-scale clinical proteomic studies: when less is more

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OBJECTIVES/GOALS: Large-scale clinical proteomic studies of cancer tissues often entail complex workflows and are resource-intensive. In this study we analyzed ovarian tumors using an emerging, high-throughput proteomic technology termed SWATH. We compared SWATH with the more widely used iTRAQ workflow based on robustness, complexity, ability to detect differential protein expression, and the elucidated biological information. METHODS/STUDY POPULATION: Proteomic measurements of 103 clinically-annotated high-grade serous ovarian cancer (HGSOC) tumors previously genomically characterized by The Cancer Genome Atlas were conducted using two orthogonal mass spectrometry-based proteomic methods: iTRAQ and SWATH. The analytical differences between the two methods were compared with respect to relative protein abundances. To assess the ability to classify the tumors into subtypes based on proteomic signatures, an unbiased molecular taxonomy of HGSOC was established using protein abundance data. The 1,599 proteins quantified in both datasets were classified based on z-score-transformed protein abundances, and the emergent protein modules were characterized using weighted gene-correlation network analysis and Reactome pathway enrichment. RESULTS/ANTICIPATED RESULTS: Despite the greater than two-fold difference in the analytical depth of each proteomic method, common differentially expressed proteins in enriched pathways associated with the HGSOC Mesenchymal subtype were identified by both methods. The stability of tumor subtype classification was sensitive to the number of analyzed samples, and the statistically stable subgroups were identified by the data from both methods. Additionally, the homologous recombination deficiency-associated enriched DNA repair and chromosome organization pathways were conserved in both data sets. DISCUSSION/SIGNIFICANCE OF IMPACT: SWATH is a robust proteomic method that can be used to elucidate cancer biology. The lower number of proteins detected by SWATH compared to iTRAQ is mitigated by its streamlined workflow, increased sample throughput, and reduced sample requirement. SWATH therefore presents novel opportunities to enhance the efficiency of clinical proteomic studies.

**4440**

## Enhanced radiation therapy using chlorin-e6 conjugated gold nanoparticles

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OBJECTIVES/GOALS:

- Development of gold nanoparticles covalently linked to a photosensitizer for use to enhance radiation therapy. The particles will be thoroughly characterized structurally and mechanistically. The gold particles should enhance radiation activity by closer proximity to the photosensitizer and by increasing particle accumulation in the tumor.

METHODS/STUDY POPULATION:

- Gold nanoparticles were synthesized and coated with amine-terminated poly(ethylene) glycol, then covalently conjugated to chlorin e6, a known FDA-approved photosensitizer. The system was characterized using UV-Vis spectroscopy, transmission electron microscopy, and nanoparticle tracking analysis. The generation of reactive oxygen species was measured after X-irradiation. Enhanced cell killing was evaluated clonogenically in addition to assessment of *in vivo* efficacy and tumor pathology.

RESULTS/ANTICIPATED RESULTS:

- Conjugation of the particle to the photosensitizer was achieved, and the molecule was detected by UV-Vis spectroscopy. TEM and NTA showed no aggregation of the particles, and an increase in reactive oxygen species generation was observed. The conjugates increased cell killing during radiation treatment, whereas neither the particle alone nor the photosensitizer significantly affected clonogenic survival at the same concentrations. Breast tumors grown in immunocompetent mice showed increased necrotic tissue after a single 20 gy treatment in the presence of the conjugate.

DISCUSSION/SIGNIFICANCE OF IMPACT: Radiation therapy is widely used clinically, but dosage is limited largely to prevent injury to adjacent normal tissue. By increasing the local effect of radiation therapy, our gold conjugate has the potential to augment the effective radiation dose in the tumor, thereby reducing damage to healthy tissue and providing a more effective therapy.

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