TRANSFORMING ORTHOPAEDIC TRAUMA CARE: FORECASTING OPERATING ROOM DEMAND BY HARNESSING MACHINE LEARNING

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Purpose: Efficient allocation of operating room (OR) time is crucial, especially in trauma centers where unpredictable orthopedic trauma cases strain resources. Forecasting trauma volume is difficult due to factors like seasonality, weather, and traffic. Without standardized methods, resource misallocation may impact patient outcomes. This study develops machine learning models to predict daily orthopedic trauma volumes at a Canadian Level I trauma center to improve OR scheduling.

Methods: Orthopedic trauma cases from January 2012 to March 2020 were analyzed. Daily trauma volume in minutes was calculated, triaging cases by urgency. Exploratory data analysis (EDA) identified trends and engineered features. Data sources included hospital records, Statistics Canada, and Environment and Climate Change Canada. Machine learning models, including XGBoost, Linear Regression, and Ridge Regression, were trained using 5-fold cross-validation. Model performance was evaluated using mean absolute error (MAE).

Results: A total of 9,506 surgeries were aggregated into 2,883 daily entries. EDA revealed that 7-day and 30-day lagged volumes significantly predicted future volumes. Seasonal trends showed winter and summer fluctuations compared to October. The XGBoost model achieved the lowest test MAE of 241.4 minutes, though all models performed similarly around 245 minutes.

Conclusions: Machine learning models provide a foundation for predicting orthopedic trauma volumes at a Canadian Level I trauma center. While features used were relevant, more granular data and advanced models like SARIMA may improve accuracy. A larger dataset could enhance forecasting reliability, aiding surgical planning and patient care.

INTERHOSPITAL TRANSFER IN CHILDREN WITH SUSPECTED APPENDICITIS – A REFERRAL CENTER EXPERIENCE

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Purpose/Hypothesis: Interhospital transfers (IHT) to the Hospital for Sick Children (HSC) frequently occur for pediatric patients with suspected appendicitis. However, some of these transfers may be avoidable with improved diagnostics, improved communication with referring hospitals, or through community-based surgical care. In this study, we quantify the number of children transferred to HSC's Emergency Department (ED) with a presumed diagnosis of appendicitis and determine treatment requirements and patient outcomes post-transfer. **Methods:** This retrospective analysis of children transferred to HSC ED from another hospital between 2018 and 2024 includes patients that had an ICD10 diagnoses code pertaining to appendicitis or ED notes indicating suspected appendicitis. Patient data were extracted through SickKids Enterprise-wide Data in Azure Repository. **Results:** 255 cases of presumed appendicitis cases were transferred to HSC during the study period. 114 (44.7%) patients were female and 141 (55.3%) were male, with an average age of 9.7 years (range: 1.6-17.9). Imaging performed at HSC included 31 CT (16.1%) scans, 11 (5.7%) MRIs, 53 (27.5%) X-rays, and 169 (87.6%) Ultrasounds. 86 patients (33.7%) did not undergo surgery or IGT procedure and 62 (24.3%) cases did not receive surgical consultation. 86 (33.7%) patients had a length of stay of one day or less. **Conclusions:** We quantified the number of patients transferred to HSC for management of presumed appendicitis. Nearly one quarter of transfers did not require surgical consultation and nearly a third were not treated with surgical procedures. Given these findings, it is likely that some of these transfers were potentially avoidable. Additional analyses of these data are planned to further characterize patient outcomes and determine risk factors for these transfers. Our study highlights opportunities to improve transfer appropriateness, optimize resources, and improve patient-centered care.

KCNQ1 MEDIATES FAM46C-INDUCED TUMOUR SUPPRESSION IN GASTRIC ADENOCARCINOMA

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Purpose and Hypothesis: A significant proportion of patients with curable gastric adenocarcinoma (GCa) undergo neo/adjuvant treatment that does not benefit them, while exposing them to dangerous side effects. We seek a deeper understanding of the drivers of GCa recurrence following curative resection, to facilitate a precision oncology approach. Previously, our lab identified the Plk4 inhibitor FAM46C as a novel tumour suppressor in GCa. Our hypothesis is that the ion channel KCNQ1, which is enriched in normal gastric mucosa, mediates the suppressive effect of FAM46C. **Methods:** FAM46C and KCNQ1 were individually depleted in the GCa cell line AGS, each using two distinct lentiviral constructs (shFAM46C-1,2; shKCNQ1-B,E). shGFP knockdown lines served as controls. mRNA expression was estimated via real time RT-PCR (ΔΔCt method) or RNA sequencing. **Results:** In a series of 70 consecutive curative-intent gastrectomies performed at Mount Sinai Hospital, FAM46C and KCNQ1 were each found to be depleted in tumour vs. normal tissue, with a strong correlation between the two ($p<0.001$). Furthermore, genome-wide RNASeq analysis revealed that KCNQ1 was preferentially depleted in low FAM46C-expressing tumours. Knockdown of FAM46C to <50% of control in AGS cells caused a 60-70% reduction in KCNQ1 expression. Viability and proliferation of AGS cells were not affected by either FAM46C or KCNQ1 depletion. However, FAM46C depletion conferred a survival advantage on AGS cells exposed to high [KCl] medium challenge, an effect that was mimicked by KCNQ1 depletion, suggesting that KCNQ1 could mediate the effect of FAM46C on pro-apoptotic or other death-related pathways in GCa cells. **Conclusions:** These results indicate that resistance to the hostile intra-tumoural microenvironment inherent to locally advanced GCa can be conferred by loss of FAM46C expression, mediated by KCNQ1-dependent signalling. Activation of KCNQ1 may represent a therapeutic strategy to diminish GCa cell survival and combat resistance to cytotoxic therapy.

EXPLORING BARRIERS AND FACILITATORS TO UNDERGRADUATE MEDICAL EDUCATION IN HIGH INCOME COUNTRIES VERSUS LOW- AND MIDDLE-INCOME COUNTRIES: A SURVEY BASED STUDY

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Purpose and Hypothesis: Medical students in low-and middle-income countries (LMICs) and high-income countries (HICs) encounter factors that influence their academic success, professional development, and well-being. Given the global shortage of physicians and need for equitable education strategies, it is critical to investigate the barriers and facilitators faced. This study hypothesizes that distinct differences exist in the challenges and supports in different regions. **Methods:** An anonymous cross-sectional survey was disseminated to medical students enrolled in various HICs and LMICs, which included questions related to demographics, curriculum, and school conditions. Inductive thematic analysis was employed to analyze the data. **Results:** 332 medical students from 20 countries in Europe, North America, Africa, and Asia were surveyed. Preliminary thematic analyses identified four key barriers to medical education: lack of early clinical exposure, lack of research opportunities, assessment and curriculum policies, and finances. Facilitators included flexible schedules, mentorship programs, and supportive faculty. Notably, students in LMICs reported reduced access to technological advancements, inadequate infrastructure, outdated teaching, and weak basic science foundation compared to HICs. Conversely, students in HICs highlighted increased burnout and bureaucracy. **Conclusions:** This study reveals shared challenges faced by medical students across socioeconomic contexts, despite differences in specific barriers and facilitators. Findings underscore the need for targeted improvements in medical education globally, particularly in addressing resource disparities in LMICs while also recognizing the unique pressures experienced by students in HICs. Insights may inform policies aimed at enhancing equity in medical education and ultimately improving physician retention worldwide.

HEMIEPIPHYSIODESIS WITH PERCUTANEOUS TRANSPHYSEAL SCREWS VERSUS TENSION BAND PLATES FOR CORRECTION OF KNEE CORONAL PLANE DEFORMITIES: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Purpose and Hypothesis: Hemiepiphysiodesis is the primary treatment modality for the correction of knee coronal plane deformities in skeletally immature patients. The purpose of the current study is to compare the outcomes of the two most prevalent techniques for hemiepiphysiodesis namely percutaneous transphyseal screw (TS) and tension band plating (TBP). We hypothesized that TS would result in a more rapid correction and fewer complications. **Methods**: Electronic databases were searched for clinical studies comparing TS and TBP for correction of genu varum or valgum in skeletally immature patients. Primary outcomes of interest were correction rates of mechanical axis deviation (MAD), mechanical lateral distal femoral angle (mLDFA), and medial proximal tibial angle (MPTA). Secondary outcomes included time to removal and complication rates. The methodological quality was evaluated using the modified Newcastle-Ottawa scale. **Results**: Six retrospective studies were included. The total number of physes was 549 (322 TS, 227 TBP) in 281 patients. The mean difference (MD) and 95% confidence interval (CI) for the MAD correction rate was 1.09 (0.19 to 1.99) demonstrating a faster rate in favor of TS (P = .02). However, the MDs and 95% CIs for mLDFA and MPTA correction rates were 0.20 (0.00 to 0.41), and 0.18 (-0.04 to 0.39), respectively without a statistically significant difference. The TS had a significantly shorter time to removal with an MD and 95% CI of -4.81 (-8.09 to -1.52) (P = .004). Regarding complications, the TS had a higher overcorrection rate (14% vs 1%, P = .005), while the TBP had higher rates of rebound (63% vs 19%, P = .001) and incisional complications (12% vs 1%, P = .040). No statistically significant difference was observed as regards implant failure. **Conclusions**: TS could be considered a superior technique for hemiepiphysiodesis near skeletal maturity. Nevertheless, careful attention is needed when determining the implant type in growing children considering the physeal behavior following removal.

PERIOPERATIVE PREDICTORS OF ONGOING OPIOID USE IN PATIENTS WITH PRIOR OPIOID EXPOSURE UNDERGOING HIP AND KNEE ARTHROPLASTY AT ONE YEAR

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Purpose and Hypothesis: Opioid use after total hip arthroplasty (THA) and total knee arthroplasty (TKA) remains a concern, especially in patients with prior opioid exposure. This study examined the proportion of previously opioid-exposed patients continuing opioid use at one year postoperatively and identified perioperative predictors. We hypothesized that prior opioid exposure, elevated BMI, and psychological factors would significantly predict prolonged use.

Methods: A retrospective analysis of 278 opioid-exposed patients undergoing primary THA or TKA at a single academic institution was conducted using a prospectively collected database. Demographic variables, BMI, pain scores, and functional outcomes were assessed at baseline, 6 weeks, 3 months, 6 months, and 1 year. Multivariable logistic regression identified predictors of persistent opioid use.

Results: At one year, 42.4% (118/278) of opioid-exposed patients continued use. Significant predictors included prior opioid exposure (OR: 9.67, $p < 0.001$), knee arthroplasty (OR: 1.80, $p = 0.031$), multi-joint pain (OR: 1.90, $p = 0.020$), and elevated BMI (OR: 1.03, $p < 0.05$). Higher PainDETECT scores showed a trend toward significance (OR: 1.04, $p = 0.058$), while HADS depression scores were higher in persistent users (6.76 vs. 5.51, $p = 0.008$). Continued opioid users reported higher postoperative pain and more adverse events.

Conclusions: Prior opioid exposure is the strongest predictor of persistent opioid use at one year. Additional risk factors include knee arthroplasty, multi-joint pain, and elevated BMI. These findings underscore the need for comprehensive preoperative risk assessment and tailored perioperative pain management to reduce long-term opioid use. Future research should focus on targeted interventions to mitigate opioid reliance in high-risk populations.

THE EXTENDED FLEXOR CARPI RADIALIS APPROACH FOR DISTAL RADIUS FRACTURE FIXATION - A PROSPECTIVE STUDY

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Purpose and Hypothesis: The extended flexor carpi radialis (EFCR) approach for unstable distal radius fractures (DRF) and malunions was first described in 2001 by Orbay et al. It ensures optimal exposure and simplifies reduction by releasing primary deforming forces while providing access to the critical volar ulnar corner. We hypothesize the EFCR approach is safe and effective technique for routine use in surgical management of acute/subacute DRFs without increased complication rates. **Methods:** 100 patients who underwent open reduction and internal fixation (ORIF) using an EFCR approach and volar locking plate between 2018 and 2023 were included. A retrospective review of prospectively collected data was conducted including wrist range of motion, grip strength, Disabilities of Arm Shoulder and Hand (DASH) scores and complications. Radiographic measurements were determined postoperatively, and descriptive statistics for each were calculated. **Results:** The average follow-up period was 14 months with a 6.8 mean DASH score at the final visit. The mean wrist range of motion was 72±11° flexion, 60±11° extension, 78°±8° supination, 77±6° pronation. The mean grip strength was 27±10kg. Postoperatively, the mean volar tilt was 7±6°, radial inclination 24±4°, and ulnar variance 0±1.6mm. Overall, the complication rate was 9%. A revision fixation occurred for a periprosthetic fracture proximal to the existing construct. Hardware removal was performed for symptomatic plate-tendon irritation in 3%, and for patient preference in 2%. All other complications (3%) were minor and treated nonsurgically. **Conclusions:** Our study supports the safety and effectiveness of the routine use of EFCR approach for all acute/subacute operative DRFs. It demonstrates excellent clinical, radiographic, and patient-reported outcomes. Our study further supports its value in providing advantageous exposure and more efficient fracture reduction without increasing morbidity rates.

TRENDS AND OUTCOMES OF MECHANICAL CIRCULATORY SUPPORT IN CARDIOGENIC SHOCK AND CORONARY ARTERY BYPASS GRAFTING: AN STS DATABASE ANALYSIS

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

THE USE OF MENTAL SKILLS TRAINING AND EMOTIONAL REGULATION IN POST-GRADUATE SURGICAL TRAINING PROGRAMS: A SCOPING REVIEW

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Purpose: Stress and burnout is highly prevalent amongst surgical trainees and has been shown to have a negative impact on memory, decision-making, and risk tolerance. Stress and burnout has also been associated with deleterious mental and physical health outcomes, including substance abuse and suicide. Mental skills training (MST) has been shown to decrease stress and improve performance in other high functioning groups such as athletes, police, and military personnel. More recently, data has shown that mental skill training may also have a positive effect amongst surgeons. The objective of this scoping review aimed to collate data regarding the use and outcomes of MST in surgical training program.

Methods: A systematic search was conducted on MEDLINE, Embase, and APA PsychInfo databases to identify studies investigating the role of mental skills training and emotional regulation (ER) in surgical training programs.

Results: A total of 21 articles were reviewed. Nine studies evaluated task performance; of those, 6 (66%) demonstrated an improvement in surgical performance following a short duration MST intervention. Thirteen studies evaluated stress reduction and found that 9 of those studies (69%) demonstrated decreased stress level following MST. Qualitative analysis revealed that longitudinal mental skills training was associated with improved patient satisfaction, and physician well-being

Conclusion: MST and ER are effective in managing stress and improving performance amongst surgical trainees. Future studies should examine the sustainability and feasibility of MST/ER amongst postgraduate surgical programs.

AIRWAY CONTROL IN TRAUMA: MISSED OPPORTUNITIES BEFORE THE MOVE

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Purpose and Hypothesis: Limited exposure to injured patients at referring centers increases the risk of omitting life-saving interventions prior to transfer. The purpose of this study is to identify patient and injury characteristics that increase the risk of these "missed opportunities" (MOs), with a focus on airway control. We sought to explore their frequency, hypothesizing that certain patient and injury characteristics contribute to the risk of MO. **Methods:** Using a retrospective cohort design and data derived from the Trauma Quality Improvement Program (TQIP), we identified adult patients transferred to level I/II trauma centers over 2022-23. Patients intubated within 60 minutes of arrival were considered to have a MO for airway control and were compared to patients intubated prior to transfer. **Results:** Of 36, 784 transferred patients who underwent intubation; 20,882 were intubated prior to transfer and 2,127 (5.8%) were intubated early after arrival to definitive care (mean: 12.7 minutes), representing the population with a MO. Patients with a MO were older, more likely to be injured due to a fall and had lower injury severity. They were more comorbid, less likely to be transported by air and no more likely to receive preliminary care in rural environments than patients without a MO. **Conclusion:** MOs for airway control occur in frail patients with limited physiologic reserve. This data highlights an at-risk group for missed pre-transfer airway control who may benefit from proactive intubation.

Variable	MO	No MO
Age ≥65 yrs§	38.0	28.7
Fall§	48.7	39.8
Rural †	9.9	10.1
Motor GCS ≤4§	63.7	87.0
Shock (sBP <90mmHg)§	8.7	10.3
Air transport§	2.1	4.5
Mean ISS§	18.5	21.6
≥3 comorbidities§	31.0	23.8

*Data shows % of patients, except mean ISS
†Based on zip code of residence
§p<0.05

GCS (Glasgow Coma Scale)
sBP (Systolic Blood Pressure)
ISS (Injury Severity Score)

UNDERSTANDING THE BURDEN OF LOWER EXTREMITY AMPUTATIONS IN INDIA: PRELIMINARY ANALYSIS

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

SURVIVAL OUTCOMES OF LOBAR VS. SUBLOBAR RESECTION FOR NON-SMALL CELL LUNG CANCER: A 10-YEAR SINGLE-CENTRE COMPARATIVE ANALYSIS

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Background: There is a debate about whether lobectomy or sublobar resections are an appropriate standard of care for non-small cell lung cancer (NSCLC). This study retrospectively compares overall survival (OS) and disease-free survival (DFS) in patients undergoing lobectomy, segmentectomy, or wedge resection over a 10-year period at a community teaching hospital. **Methods**: Electronic medical records were reviewed from 2012 to 2022. Detailed patient demographics and tumor characteristics were compared using multivariable models. OS and DFS were assessed via Kaplan-Meier curves and Cox proportional hazards. **Results**: Of 898 patients, 614 underwent lobectomy, 181 wedge resection, and 103 segmentectomy. Lobectomies had significantly higher tumour size of 30.3 ± 17.7 mm ($p<0.01$), segmentectomies had significantly lower DLCO of 74.3 ± 19.2 ($p<0.01$), and wedge resections had significantly greater previous history of cancer, with 58.3% ($p<0.01$). Pathological staging of stage I for each group was 69.9%, 76.7%, and 59.1%, respectively. Median unadjusted OS for each group was 11.4, 9.4, and 6.4 years, respectively ($p<0.05$). Median adjusted OS for lobectomy and segmentectomy were 11.7 years, and 7.9 years, respectively. Lobectomy and wedge resection demonstrated statistically significant higher OS compared to segmentectomy ($p<0.05$). No significant differences in DFS were observed among resection types ($p=0.4$). Metastatic patterns did not significantly differ between groups. **Conclusion:** Our study shows wedge resection and lobectomy were associated with comparable overall survival, while segmentectomy demonstrated significantly lower overall survival. Disease-free survival did not differ significantly across resection types. Further analyses are ongoing to account for potential confounders. These findings provide additional data to inform the ongoing discussion regarding the optimal extent of pulmonary resection for lung cancer.

ASSOCIATION OF NEIGHBORHOOD SOCIOECONOMIC STATUS AND ETHNIC DIVERSITY WITH FAILURE TO RESCUE IN CURATIVE-INTENT COLORECTAL CANCER SURGERY: A POPULATION-BASED COHORT STUDY

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Purpose and Hypothesis: Failure to rescue (FTR) is an outcome reflecting the ability to detect and treat patients with declining clinical status. Though frequently conceptualized in its relationship to hospital-level characteristics, little is known about the associations between patient social factors and FTR in the oncologic population. We examined the association between a patient's neighbourhood socioeconomic status (SES) and ethnic diversity on FTR after curative-intent colorectal cancer (CRC) resection. We hypothesized that living in lower SES or more ethnically diverse neighborhoods would be associated with increased odds of FTR. **Methods**: We conducted a population-based retrospective cohort study of adults undergoing resection for stage I-III CRC (2007-2020). Exposures were SES and ethnic diversity measured in quintiles. The primary outcome was FTR, measured as *the number of patients with a major complication who died in-hospital*. Logistic regression examined the association between each exposure and outcome while adjusting for confounders. **Results**: Of 60,470 patients included, FTR occurred in 1,158 (1.9%). Among those with FTR, 289 (25.0%) were from the lowest SES neighbourhoods versus 196 (16.9%) in the highest ($p < 0.001$), whereas 214 (18.5%) were from the most ethnically diverse neighbourhoods versus 245 (21.2%) in the least ($p=0.12$). After adjusting for age, sex, surgical approach, comorbidity burden, cancer type, and year, residing in the both the lowest SES (Odds Ratio, OR 1.26; 95% confidence interval, CI 1.05-1.52) and most ethnically diverse neighborhoods (OR 1.53, 95%CI 1.26-1.85) was associated with higher odds of FTR. **Conclusions**: These findings outline inequalities in post-operative outcomes by social characteristics pointing towards potential gaps in structures of care for patients from marginalized populations.

VIRTUAL CONSULTATIONS FOR BREAST CANCER PATIENTS IN ONTARIO AND THE IMPACT ON WAIT TIMES AND REFERRAL PATTERNS: A POPULATION-BASED STUDY

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Introduction: During the COVID-19 pandemic, virtual care was greatly expanded in Ontario. This study aimed to characterize breast cancer (BC) patients seen virtually compared to in-person, measure wait times, and explore referral patterns. **Methods**: We conducted a population-based cohort study using linked health administrative data at ICES. Invasive BC patients ≥18 years diagnosed between March 14, 2020, and December 31, 2022, were included. Patients were assigned to in-person or virtual cohorts based on their initial surgical consultation billing data. Patient, tumour, and healthcare interaction characteristics were compared. **Results**: Of 28,262 BC patients identified, 2,181 (7.7%) had an initial virtual consultation. Median age was 63 years. Virtual patients were less materially deprived (21.6% vs. 25.6%; $p < 0.001$), more likely from Toronto or East Ontario ($p < 0.001$), more often hormone receptor-positive, HER2-negative (42.9% vs. 32.1%; $p < 0.001$), node-negative (45.8% vs. 34.4%; $p < 0.001$), and had smaller tumours (29.8% T1 vs. 21.2%; $p < 0.001$). They more frequently underwent mastectomy with reconstruction (9.3% vs. 7%) and were more likely referred to Plastic Surgery (19.0% vs. 16.4%; $p = 0.002$). Wait times from diagnosis to surgical consultation were significantly shorter for virtual patients (median 7 vs. 12 days; $p < 0.001$), though diagnosis-to-surgery times were similar. **Conclusions**: Most BC patients are not seen virtually, and significant regional variation exists. Virtual consultation was associated with shorter wait times to assessment. Ontario surgeons prioritize seeing less complex, early-stage HR-positive, HER2-negative patients virtually. This may reflect perceived limitations of virtual consultations for complex cases. Virtual consultation may facilitate Plastic Surgery assessment and slightly impact reconstruction rates.

EVALUATION OF PEDICLE SCREW PLACEMENT IN HIGH-FIDELITY 3D ANATOMICAL MODELS: A PILOT STUDY

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Purpose and Hypothesis: The purpose of this pilot study was to (1) evaluate the feasibility of employing 3D modelling technology to construct anatomical high-fidelity models of the lumbosacral spine; (2) simulate pedicle screw insertion through the pedicles of L1-L5 and S1 vertebrae; (3) determine the location and frequency of screws breaching the cortical bone. **Methods:** One lumbosacral spine was digitized using a Faro Laser ScanArm, reconstructed into a high-fidelity 3D model and imported into Blender3D. Simulated screws were inserted by an orthopaedic surgeon through the pedicles of L1-L5 and S1 using an entry point at the junction of the lateral border of the superior articular process and midline of the transverse process, with screw trajectory of 10°. The placement of the 12 screws (6R/6L) were assessed to determine if there was a breach of the cortical wall of the pedicle. Breach frequency was determined and compared between specimens. **Results:** High-fidelity anatomical models of the lumbosacral spine were constructed using laser scanning and 3D-modelling technology. In total, 4/12 of the screws were breached. At L1 level, both right and left pedicle screws were breached, at L2 and L5 levels the right screw was breached, at L3, L4, and S1 levels, there was no breach. **Conclusion:** The 3D models with pedicle screws were ideal for the assessment of bilateral pedicle screw placement in the lumbosacral spine. Thirty-three percent of the pedicle screws were breached. The right pedicle screws were breached at 3/6 vertebral levels whereas the left pedicle screw was less frequently breached (1/6 vertebral levels). The same entry-point angle of 10° was used for all the lumbar vertebrae even though the morphometric characteristics of the vertebrae differ. This could have been a factor in the breach of both the right and left pedicle screws at L1 vertebral level. Further study is needed to determine the optimal entry-point angle specific to each vertebral level to improve the placement of pedicle screws.

HEAD INJURY, WHIPLASH, AND CONCUSSION IN MOTOR VEHICLE COLLISIONS

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Purpose and Hypothesis: Patients frequently present at the Canadian Concussion Centre (CCC) with concussion plus persisting concussion symptoms (C+PCS) resulting from motor vehicle collisions (MVC). Our aim is to enhance protection against concussion by elucidating concussion mechanisms in MVC. We postulate that previous automotive research has failed to address concussion prevention with effective occupant safety systems. **Methods**: The CCC collected data on 136 motor vehicle occupants who sustained C+PCS from MVC to determine injury mechanisms and risk factors. Efforts to protect occupants against concussion were examined using this dataset and through a search of automotive literature, including an ongoing scoping review. **Results**: We found that the high frequency and severity of concussions in MVC occupants was not commensurate with the relatively few onboard concussion prevention strategies. In contrast, significant automotive research has been conducted for prevention of whiplash and head injuries more severe than concussion. For example, anthropomorphic testing has been insufficiently examined for concussion prevention, especially for female occupants in rear-end collisions; 56 out of 136 patients in our C+PCS-MVC cohort were women concussed in a rear-end impact. In these concussions, the head typically moves backwards and strikes the head restraint, followed by a secondary forward motion of the head, known as the “rebound effect”. In automobile racing, this mechanism of head motion has been eliminated in drivers through widespread adoption of the Head and Neck Support (HANS) device. **Conclusions**: We provide evidence indicating that occupant protection against whiplash and concussion – especially for female occupants in rear-end collisions – can be markedly improved by adapting available safety systems, including seatbelts and airbags, to immobilize the head on the trunk.

THE IMPACT OF POSTOPERATIVE NEUROMUSCULAR ELECTRIC STIMULATION (NMES) AFTER ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Introduction: Successful anterior cruciate ligament (ACL) reconstruction surgery is highly dependent on effective postoperative rehabilitation, with quadriceps weakness being one of the most significant challenges. Neuromuscular electrical stimulation (NMES) is a therapeutic modality which is increasingly used as an adjunct to traditional rehabilitation. This study aims to determine the effectiveness of NMES on quadriceps strength and knee function after ACL surgery. ***Methods:*** An search of PubMed, Ovid MEDLINE, and Embase from inception until December 2024 was conducted. Inclusion criteria was defined as randomized controlled trials (RCTs) on adult patients undergoing ACL surgery with NMES as an intervention and standard rehabilitation as a control group. Data was collected on the demographics, treatment parameters, and clinical outcomes including knee extension and flexion strength, thigh circumference, pain, and functional scores. Meta-analysis of outcomes was performed with subgroups including early (≤12 weeks) or late- (>12 weeks) postoperative follow-up. ***Results:*** Twenty RCT studies met our inclusion criteria (n=682). The frequency weighted mean age of included patients across all studies was 26.8 years, and mean follow-up time was 18.6 weeks (4-54). Twelve studies were included in pooled analysis for isometric knee extension strength and demonstrated statistically significant improvements in absolute strength between NMES and control groups (n=109, $p<0.01$) and strength as a percentage of the uninvolved limb (n=264, $p=0.03$) in the early- but not late-postoperative follow-up. Similar statistical significance was noted with improvements in knee flexion ($p=0.01$) and thigh circumference ($p=0.04$) but not Lysholm or IKDC scores. ***Conclusion:*** Compared with standard rehabilitation, the use of NMES as an adjunct in ACLR rehabilitation accelerates early recovery of isometric knee extension and flexion strength. However, NMES may not necessarily lead to superior long-term improvements in knee strength or functional recovery beyond the three-month postoperative mark.

Level of Evidence: Level IV, systematic review.

CONGENITAL DIAPHRAGMATIC HERNIA IN CANADA: THE FIRST NATIONAL STUDY ON PATIENT DEMOGRAPHICS AND CLINICAL OUTCOMES

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Purpose/Hypothesis: Congenital diaphragmatic hernia (CDH) is a devastating birth defect, characterized by herniation of intraabdominal contents into the thorax. Variability in ante- and post-natal care is a critical issue, which affects outcomes. Herein we performed the first national cohort study examining CDH treatment in all Canadian pediatric surgical centers. **Methods:** We conducted a retrospective cohort study by interrogating the Canadian Pediatric Surgery Network database from 2006-2022, which collects data nationally from all 16 pediatric surgical centers. Demographic factors, maternal characteristics, geographic location, management strategies, and clinical outcomes were analyzed. **Results:** Of the 1006 infants with CDH, 59% were male, and 86% had a left-sided defect. Median gestational age was 38 weeks (IQR 2), and mean birth weight was 2961.9 g. Mothers of infants with CDH were a mean age of 30.2 years (±5.5), were overwhelmingly healthy, and 32% resided in rural locations. Most patients received a prenatal diagnosis of CDH (76%). The median length of NICU stay was 20 days (IQR 30). Over the study period, 7% of infants underwent extracorporeal membrane oxygenation (ECMO) for a mean duration of 10.6 days (±7.1), with ECMO-related complications occurring in 63% including organ failure in 38%. Median time to surgery was 4 days (IQR 5) from birth and minimally invasive surgery (MIS) was performed in 13% of patients. The overall mortality rate was 16.5%, not including the 7% of fetuses who were electively terminated. Post-operative morbidities were recorded in 38% of patients. **Conclusions:** In this first multicenter, national cohort study, we observed similar patient characteristics and clinical outcomes compared to other large database studies. Access to fetal procedures remains limited, and only a few patients underwent MIS. Interestingly, a relatively high survival rate was achieved despite a low use of ECMO.

EVALUATING THE IMPACT OF EXTENDED WARM ISCHEMIC TIME USING *EX VIVO* HEART PERFUSION IN JUVENILE PORCINE MODELS OF CIRCULATORY DEATH

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Purpose and Hypothesis: *Ex vivo* heart perfusion (EVHP) can rehabilitate and assess donor hearts procured after circulatory death (DCD) and inform whether the 30min functional warm ischemic time (WIT) threshold can be exceeded in the pediatric population. **Methods**: A flow-targeted pediatric EVHP protocol was applied to DCD hearts of juvenile Yorkshire pigs subjected to WIT of 30 or 45min (n = 6 each). After 2h reperfusion at 10ml/kg/min, hearts were loaded in working mode (WM) up to left atrial pressure of 10 mmHg for functional assessment by pressure-volume catheterization and epicardial echocardiography. Groups were compared using analysis of variance. **Results**: Lactate and myocardial oxygen consumption were similar between WIT groups, but higher cardiac tropoinin I for 45min. During WM, the 30min group had greater median cardiac index (2.26 vs 1.45 mL/min/m^2, p=0.01), with significant variability in the 45min group (IQR 0.96 – 2.29 mL/min/m^2). Left ventricular ejection fraction (LVEF) was reduced from baseline for all groups, with lower LVEF in the 45min group (31.8±4.4 vs 23.0±5.6 %, p=0.02) during WM. Although maximum and minimum dP/dT both improved with reperfusion, higher WM minimum dP/dT (-2246±250 vs -1612±558, p=0.001) demonstrated greater diastolic dysfunction after 45min WIT, compared to 30min. The percentage of heart weight gained as an estimate of myocardial edema was not significantly higher in the 45min group (18.9±15.0 vs 22.2±16.1 %, p=0.35) but did correlate with WM cardiac index (r_s= -0.62, p=0.03). **Conclusions**: 45min WIT hearts have greater diastolic impairment, partly explained by more severe myocardial edema. However, 33% of 45min hearts achieved comparable cardiac function to that of 30min WIT after EVHP.

SCALING ARTIFICIAL INTELLIGENCE FOR SURGICAL PLANNING OF BREAST CANCER: FROM MAGNETIC RESONANCE IMAGING SEGMENTATION TO 3D RECONSTRUCTION AND DIGITAL TWIN SIMULATIONS

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Purpose & Hypothesis: Breast conserving surgery (BCS) is the most common surgical treatment for breast cancer. The oncological and cosmetic success of BCS is highly dependent on pre-operative planning, which remains challenging as clinicians must reconstruct the breast anatomy in 3D, using 2D images. This work aims to assist in pre-operative planning and patient education for BCS through the development of an AI-based model to segment breast MRI data, reconstruct the breast in 3D, generate distance maps and digital twins (biomechanical models) of the breast. **Methods:** U-Mamba, an AI segmentation network, was trained to semi-autonomously segment adipose and fibroglandular tissue from T1-Weighted (T1W) MRI sequences, and tumour tissue from Dynamic Contrast-Enhanced (DCE) MRI sequences. The segmentations were combined to generate patient-specific 3D reconstructions, which were utilized to produce colour maps illustrating the distance between the skin and underlying fibroglandular and tumour tissues. Qualitative assessment of the 3D reconstructions was obtained through interviews with patients and surgical oncologists. **Results:** Mean dice similarity coefficient and normalized surface distance were calculated to be above 0.8 for segmentation of all tissues, suggesting good agreement between model generated segmentations and ground truth. Interviews with 6 patients and 8 surgical oncologists highlighted the potential benefits of integrating 3D breast reconstruction into clinical practice, such as assisting in surgical planning, intraoperative navigation, and patient education. **Conclusions:** This work demonstrates the utility of scaling AI models through a breast segmentation and 3D reconstruction pipeline and the significant impact AI technology can have in improving the provision of care, particularly for surgical breast cancer treatment.

THE USE OF DUAL-ENERGY X-RAY ABSORPTIOMETRY IN EVALUATING RECOVERY FOLLOWING MUSCULOSKELETAL INJURIES IN ATHLETES - A SCOPING REVIEW

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Purpose and Hypothesis: Dual-energy X-ray absorptiometry (DEXA) is a valuable imaging tool in sports medicine, offering precise assessments of bone mineral density (BMD) and body composition. Tracking these parameters provides insights into musculoskeletal injury recovery, an essential aspect of athlete rehabilitation. This scoping review explores the role of DEXA in monitoring changes in BMD and body composition post-injury, guiding rehabilitation strategies. **Methods:** A systematic literature search across multiple databases (2000–2024) identified studies employing DEXA for evaluating athletes' post-injury musculoskeletal adaptations. Eligible studies included those measuring BMD or body composition following various injuries. Two independent reviewers screened studies, resolving discrepancies through discussion. Thematic analysis identified key trends and findings. **Results:** From 1,132 unique records, 12 studies met inclusion criteria, encompassing 319 athletes (34% female) across multiple sports and competition levels. Injuries assessed included anterior cruciate ligament (ACL) tears, lumbar stress fractures, femoroacetabular impingement, and Achilles tendon ruptures. Most studies reported significant BMD reductions in the injured limb, persisting up to two years post-surgery in some cases. Rehabilitation strategies influenced recovery, with approaches like blood flow restriction therapy and combined running/isometric exercises showing better outcomes in preserving lean mass and BMD compared to conventional programs. **Conclusions:** These findings highlight DEXA’s emerging role in orthopaedic sports medicine, enabling detailed evaluation of injury impact and recovery trajectories. By detecting subtle shifts in bone and muscle health, DEXA contributes to rehabilitation planning and return-to-sport decision-making. Future research should focus on integrating DEXA data into sport-specific rehabilitation protocols, establishing validated thresholds for return-to-play assessments.

FINITE ELEMENT MODELING TO SIMULATE GYMNASTICS-TYPE LOADING IN ADOLESCENT WRISTS

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Purpose and Hypothesis: The purpose of this study is to develop a finite element (FE) model of an adolescent gymnast's wrist with Gymnast Wrist (GW) to estimate the magnitude and distribution of loads experienced across the open physes of the distal forearm during a common gymnastics task. It is hypothesized that a high magnitude of wrist stress and strain will occur, particularly at the volar ulnar corner of the distal radial physis. **Methods:** A CT scan of the GW affected wrist was obtained from a single adolescent female gymnast (age = 14 years). The solid 3D geometry of the distal radius and ulna were developed in 3D Slicer. A semi-automatic threshold-based technique was applied to segment each bone and subsequently separate the cortical, trabecular, and physeal bone regions. The forces experienced at the wrist during a handstand, measured from a current in vivo study, are being applied to the model in Abaqus. The principal stresses and strains through the radius and ulna, as well as the contact pressures experienced at both the epiphyseal-physeal and metaphyseal-physeal interfaces, are estimated. **Expected Results:** High magnitudes of wrist stress and strain are expected to occur across the open physes of the distal forearm. As clinical reports for GW often cite damage to the volar ulnar corner of the distal radial physis, the stresses and strains are expected to be concentrated in this region. This will help to explain the pathological findings common in those with GW, as well as the increased risk for patients to develop various sequalae**. Conclusion:** To the researchers' knowledge, this study is the first of its kind to model gymnastics-type wrist loading across the open distal radial physis of the GW affected wrist. As such, this research is foundational as it aids in the identification of risk factors for the development and/or progression of GW. Such efforts will support enhancements to the performance, career longevity, and quality of life of young gymnasts and are imperative considering the growing calls to safeguard this vulnerable population.

TRI-MODAL MOSQUITO BITE NEEDLE ENDOSCOPY (MBNE) FOR BREAST CANCER DIAGNOSTICS

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Purpose and Hypothesis: To lessen patient discomfort and improve breast cancer biopsy efficacy, a smaller, acupuncture sized needle should be used for core needle biopsies. Minimally invasive Mosquito Bite Needle Endoscopy (MBNE) using a 34-gauge needle with tri-modal (WAR) imaging could improve diagnostic accuracy and reduce unnecessary biopsies. **Methods**: An 85-micron multi-core imaging fiber is threaded within the lumen of the 34-gauge needle and the resolution of the image is analyzed using a CCD camera setup. Separately, a confocal microscope uses WAR tri-modal imaging to characterize cancerous and healthy breast tissue and build a database of tissue samples. WAR tri-modal imaging includes: (W) white light reflectance RGB image, (A) autofluorescence contrast imaging, and (R) point Raman spectra collection identify the chemical composition of the tissue spot. **Results**: A 34-gauge needle endoscope with 85-μm multi-core fiber captures images at ~1000-pixel resolution. WAR tri- modal images were successfully captured from 20+ breast tissue specimens, using the confocal microscope. The first iteration of a machine learning algorithm was created to classify tissue regions as cancerous or non-cancerous. **Conclusions**: A 34-gauge needle endoscope with 85-μm multi-core optical fiber was developed to capture high-resolution images of breast tissue. A machine learning algorithm was implemented to classify tissue regions using WAR tri-modal imaging. The accuracy of the algorithm is being refined via comparison to pathologist- marked images. Through accurate tissue classification, this minimally invasive system has the potential to reduce unnecessary 14-18G biopsies and enhance patient comfort. Work is underway to integrate the needle endoscope and WAR imaging microscope for real-time tissue analysis.

24-HOUR EX-VIVO PERFUSION IN THE SWINE TOTAL HINDLIMB MODEL

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Hypothesis and purpose: This study aims to develop an ex vivo perfusion protocol to maintain swine hindlimb viability for 24 hours. We hypothesize that 24-hour perfusion will preserve muscle morphology and ATP levels compared to the 12-hour static cold storage (SCS) viability threshold.

Methods: Five swine hindlimbs were cold-stored for 12 hours, and five consecutive hindlimbs were perfused for 24 hours. The perfusate contained low potassium dextran solution with 2.5 g/dL bovine serum albumin and autologous washed red blood cells (Hematocrit 10-15%). Limb temperature was maintained at 28-32ºC, with in-line pressure at 60-65 mmHg. Proximal and distal muscle samples were taken every 6 hours for histology (Injury Severity Score) and ATP quantification.

Results: In proximal muscles, baseline injury scores were 3.03 (SD: 0.39) in the perfusion group and 2.4 (SD: 0.56) in SCS. At the endpoint, scores were 3.26 (SD: 1.04) and 3.73 (SD: 0.75), with a significant increase in SCS ($p = 0.0079$) but no change in perfusion. For distal muscles, baseline scores were 2.90 (SD: 1.34) in perfusion and 2.56 (SD: 0.69) in SCS. At the endpoint, scores rose to 4.63 (SD: 0.66) and 4 (SD: 1.04), with a significant increase in SCS ($p = 0.0291$) but no change in perfusion.ATP levels dropped significantly in SCS. In proximal muscle, ATP decreased from 0.502 to 0.15 nmol/µL, and in distal muscle, from 0.335 to 0.078 nmol/µL at 12 hours ($p<0.001$). In perfusion, ATP remained stable at 24 hours. Proximal muscle levels were 0.416 at baseline and 0.367 nmol/µL at 24 hours, while distal levels were 0.315 and 0.267 nmol/µL, respectively.

Conclusions: Ex vivo perfusion with red blood cells could extend preservation, showing stable ATP and morphology at 24 hours. Further investigation is needed in a reperfusion setting.

LOGISTIC REGRESSION USING EYE-TRACKING METRICS ACCURATELY DISTINGUISHES THORACIC SURGERY TRAINEES BEFORE AND AFTER HANDS-ON TRAINING ON MINIMALLY INVASIVE RESECTION

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Hypothesis and Purpose: Eye-tracking metrics can quantify trainee learning progression after a single day training intervention on minimally invasive lung surgery. **Methods:** A total of 22 thoracic surgery trainees (post-graduate year (PGY) range 6-7) and 8 staff (PGY 11-28), attending a training course between 2022-2024, participated in the study. Participants viewed recordings of 4 surgeries performed by a board-certified thoracic surgeon, while gaze metrics were collected using a commercial eye tracker. Trainees were randomly assigned to watch 2 videos pre- and post- training intervention. Features related to cognitive load, gaze fixation, and gaze kinematics were derived from the data. Recursive Feature Elimination was used to identify 6 features with the strongest relationship to trainee state (pre- and post- training intervention). Three machine learning approaches (Logistic Regression, Support Vector Classification, and Extreme Gradient Boosting) were compared to classify trainee state. The dataset (n=88) was divided into 80% training and 20% test. Additionally, the 6 features were statistically compared among the trainee and staff cohorts. **Results:** Logistic regression performed best in distinguishing trainee state, achieving 83% accuracy, 88% precision, and 83% recall. Furthermore, significant differences were observed in 3 of the 6 features (gaze fixation, displacement, and acceleration) between the pre-intervention trainees and staff cohorts. However, only 1 feature (gaze acceleration) showed a significant difference between the post-intervention trainees and staff cohorts, suggesting that the intervention helped bridge the gap in experience. **Conclusions:** We showed that eye-tracking metrics can detect changes in trainee gaze behaviour following a single day training intervention. The findings suggest that eye-tracking could be integrated into surgical training programs to provide objective, real-time feedback, enabling more tailored and efficient training interventions.

PLASMA DNA METHYLOME PROFILING PREDICTS RESPONSE TO OLAPARIB AND DURVALUMAB IN RECURRENT IDH-MUTANT GLIOMAS: RESULTS FROM A PHASE II TRIAL

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

PAIN HAS A SIGNIFICANT IMPACT ON POST-OPERATIVE QUALITY OF LIFE OUTCOMES IN PATIENTS REQUIRING SURGICAL INTERVENTION FOR DEGENERATIVE CERVICAL MYELOPATHY

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Purpose and Hypothesis: Degenerative Cervical Myelopathy (DCM) is a progressive condition causing cervical spinal cord injury. Disease severity is commonly assessed using the modified Japanese Orthopedic Association (mJOA) score, yet clinical guidelines do not integrate pain—a key symptom—in evaluations. This meta-analysis examines the relationship between pain scores and quality of life outcomes (QOL) in surgical DCM patients.

Methods: A comprehensive literature search using MEDLINE, Web of Science, and Embase identified 73 studies. Data regarding pain scores (VAS/NRS) and QOL outcomes (SF-12, SF-36) were extracted by 2 independent reviewers. The number of patients analyzed in the studies included was 929.

Results: Meta-regression identified no significant relationship between pain and SF-36 preoperatively but found a significant negative correlation at 3 months ($r = -0.67$, $p<0.05$), 6 months ($r = -0.65$, $p<0.05$), 1 year (-0.63, $p<0.05$), and 2 years ($r = -0.62$, $p<0.05$).

Conclusions: Our results indicate a strong relationship between postoperative pain and QOL among patients with DCM. Surgeons and care teams should prioritize optimal pain management postoperatively for patients with DCM.

MONITORING LUNG HEALTH DURING EX VIVO LUNG PERFUSION USING A RAPID NOVEL TECHNIQUE: METHYLATION-SENSITIVE RESTRICTION ENZYME QUANTITATIVE PCR

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Purpose and Hypothesis: Ex vivo lung perfusion (EVLP) extends donor lung preservation time and enables treatment of previously unsuitable lungs. This study aims to develop and optimize a rapid methylation-sensitive restriction enzyme quantitative PCR (MSRE-qPCR) protocol that estimates cell-type death proportions during the EVLP timeframe (~3-12 hours). This technique will be performed on cell-free DNA (cfDNA) extracted from EVLP perfusate and will inform the lung transplantation (LTx) team about donor lung health, allowing for pre-LTx interventions. **Methods**: Sensitivity of the proposed MSRE-qPCR protocol was tested using mixtures of custom oligonucleotides with known methylation levels (0%, 25%, 50%, 75%, 100%) as a proof-of-concept. The mixtures underwent either a digestion with MSREs or mock digestion without MSREs, then were quantified using qPCR. The difference in cycle threshold values between undigested and digested samples (ΔC_T) indicates the proportion of digested (unmethylated) DNA in each methylation mixture. **Results**: Experimental methylation values were determined using the formula, $2^{(\Delta Ct)} \times 100\%$, and revealed a strong correlation (r=0.99, n=5, p<.001) when compared with the theoretical methylation values. **Conclusions**: The proof-of-concept study demonstrates high sensitivity and ability to detect methylation level differences. MSRE-qPCR will be useful in estimating cell-type death proportions from perfusate cfDNA using primers that target uniquely hypomethylated regions for various cell types. A machine learning model will be developed to predict the lung-quality prior to transplantation based on the MSRE-qPCR results. The proposed MSRE-qPCR protocol can be completed within clinically actionable timeframes and will aid the LTx team in making decisions about the donor lung before transplantation.

WOMEN'S ABDOMINAL AORTIC ANEURYSM - REPAIR EARLY OR AT THRESHOLD

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Purpose and Hypothesis: Abdominal aortic aneurysm (AAA) is a life-threatening condition, with women experiencing higher rupture rates at smaller aneurysm diameters and worse outcomes following repair compared to men. Current guidelines recommend elective repair at an aortic diameter of 5.0 cm for women, based on studies with limited female representation. This study assesses potential benefits of earlier intervention by comparing outcomes for women undergoing repair for small asymptomatic AAAs (4.0-4.9 cm) versus those with AAAs ≥5.0 cm. **Methods**: This retrospective analysis used Vascular Quality Initiative registry data for women ≥50 years who underwent open or endovascular aneurysm repair (EVAR) between August 1, 2010, and December 31, 2023. Patients with iliac aneurysms ≥3.5 cm were excluded. Outcomes assessed included operative mortality, major cardiovascular adverse events (MACE), all-cause mortality, hospital length of stay, and EVAR procedure results. Statistical analyses included Chi-square tests, Mann-Whitney U tests, and Kaplan-Meier survival analyses. **Results**: Among 19,652 women (mean age ~70 years), significantly more with AAAs ≥5.0 cm underwent open repair (22.9% vs. 13.8%, $p<0.001$). Larger AAAs had higher 30-day mortality (5.5% vs. 2.6%, $p<0.001$), across EVAR (3.8% vs. 2.2%, $p<0.001$) and open repair (11.7% vs. 5.4%, $p<0.001$). Myocardial infarction (2.7% vs. 1.4%, $p<0.001$) and heart failure (2.1% vs. 1.4%, $p=0.02$) were also more frequent, while stroke and limb ischemia rates were comparable. Women with smaller AAAs had longer survival (16.4 vs. 15.3 years, $p<0.001$) and shorter EVAR hospital stays (3.2 vs. 4.4 days, $p<0.001$). Endoleaks were more common in larger AAAs (26.8% vs. 21.3%, $p<0.001$), though other complications were similar. **Conclusions**: Women with AAAs ≥5.0 cm faced worse outcomes, including increased mortality, MACE, and longer hospital stays, compared to those with smaller AAAs. Earlier intervention for smaller AAAs may reduce morbidity and mortality in women and warrant reconsideration of sex-specific repair thresholds.

IMPACT OF A DEDICATED ECMO TEAM ON OUTCOMES FOLLOWING VA-ECMO

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Purpose and Hypothesis. Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) provides support to patients with critically reduced cardiopulmonary circulation. With the implementation of a dedicated VA-ECMO team at UHN in 2018, we predicted there would be an associated improvement in outcomes.

Methods. We included consecutive patients supported with VA-ECMO for a primary cardiac indication from January 1st, 2014, to Feb 1st, 2025. De-identified patient-level data were extracted from electronic records and analyzed with R scripts and GraphPad. Exact p-values are provided for personal interpretation of clinical significance.

Results. Patients were divided into historical (2014–2017) and contemporary (2018–2025) cohorts based on cannulation date. Proportionally, demographic characteristics remained consistent across cohorts except for an increase in extracorporeal cardiopulmonary resuscitation in the contemporary cohort, (5.7% to 13%) however the overall trend for indication was non-significant. Days on support differed significantly between cohorts (median 7.0 to 5.0 days, $p = 0.027$). When stratified by age, survival increased significantly in patients older than 60 years in the contemporary cohort (10% to 41%, $p = 0.027$). For patients presenting in cardiogenic shock (CS), survival to decannulation was significantly improved (56% to 74%, $p = 0.033$), and a similar but weaker trend was observed in survival to discharge (47% to 65%, $p = 0.065$).

Conclusions. Since implementation of a dedicated ECMO team, our outcomes have significantly improved in the highest-risk age group and for patients presenting with CS. Additionally, contemporary runs are shorter in duration and use less resources. Future work will investigate patient and decision-making/care factors to define how these outcomes were achieved.

COMBINED NORMOTHERMIC EX VIVO LUNG-KIDNEY PERFUSION SYSTEM IMPROVES ACID-BASE HOMEOSTASIS AND GLUCOSE REGULATION IN A SWINE MODEL

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Purpose and Hypothesis: *Ex vivo* Lung Perfusion (EVLP) is a strategy used to assess and repair donor lungs prior to transplantation. However, the current EVLP technique allows only 12 hours of stable perfusion due to a lack of control over homeostasis. For interventions that require longer perfusion time, an improved system is needed. We hypothesize that adding kidney to EVLP provides better control of homeostasis and safely extends perfusion duration. This study explores the feasibility of a novel *ex vivo* lung-kidney perfusion (EVLKP) technique and investigates potential organ crosstalk between kidneys and lungs in isolated perfusion. **Methods**: Donor lungs and kidneys were procured from Yorkshire pigs (n=4/group) and subjected to minimal cold ischemia. The organs were then placed on a custom designed EVLKP (treatment) or standard EVLP (control) circuit. The perfusate consisted of a low potassium dextran solution with albumin and added red blood cells reaching a final 10-15% hematocrit. Lung functions were evaluated during 12 hours of EVLP. Data were analyzed using two-way ANOVA with Bonferroni multiple comparisons. **Results**: Lungs in both groups demonstrated stable lung functions without edema over the 12 hour perfusion. Interestingly, at the end of perfusion, the perfusate lactate in the EVLKP group was significantly lower compared to control (1.3 vs 4.1 mmol/L, P=0.0001). Additionally, perfusate glucose levels were significantly higher (7.53 vs 6.08 mmol/L, P=0.0107), and pH was significantly closer to physiologic in EVLKP compared to control (7.19 vs 7.06, P=0.0001) at the end of perfusion. **Conclusions**: We demonstrate for the first time feasibility and safety of a combined *ex vivo* system perfuse both lungs and kidney. Interestingly, EVLKP seemed to enhance metabolic and acid-base homeostasis in isolated organ perfusion. Further studies to investigate the ability of EVLKP to extend stable lung perfusion beyond 24 hours are warranted.

BILIARY ATRESIA-THE CONNECTION BETWEEN GENETIC FACTORS, CILIA DYSFUNCTION, AND DISEASE ONSET

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

QUALITY OF LIFE AFTER ONCOLOGIC LIVER SURGERY: AN ANALYSIS DERIVED FROM THE HELIX TRIAL

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Hypothesis and Purpose: Liver resection is the standard treatment for liver malignancies, with survival rates over 50% but high morbidity (15–50%), highlighting the need to prioritize quality of life (QOL). This study assessed QOL changes from preoperative to postoperative days (POD) 30 and 90, hypothesizing a decline at 30 days followed by improvement toward baseline by day 90.

Methods: Data was derived from the HeLiX trial, an RCT randomized controlled trial evaluating tranexamic acid's impact on transfusions in oncologic liver resection. Patients completed the EORTC QLQ-C30 questionnaire. Proportions of patients showing improvement, worsening, or no change were determined using the minimally clinical important difference. Preoperative variables associated with QOL changes by POD30 were identified using multivariable regression.

Results: Clinically meaningful worsening in physical functioning at POD30 was reported in 36% of patients, improving to 17% by POD90. Similar patterns were observed for role functioning. Emotional functioning improved in 20% at both time points. Social functioning worsened in 25% at POD30, improving to 14% by POD90. Global health status worsened in 31% at POD30, improving by half at POD90. Fatigue and pain worsened in 40% and 35% at POD30, improving to 20% and 17% by POD90. Higher preoperative scores strongly predicted better POD30 scores in most domains. Female sex was linked to improved role functioning and global health status. Major resection was associated with reduced physical, role, and social functioning and greater fatigue and pain. Smoking, cardiovascular history, and biliary/vascular anastomosis were also linked to lower scores in several domains.

Conclusion: These findings will support informed-consent discussions by providing surgeons with QOL domain-specific data relevant to oncologic liver surgery patients.

BARRIERS AND FACILITATORS TO ADVANCING GENDER-AFFIRMING SURGERY (GAS) MEDICARE POLICIES IN CANADA: A QUALITATIVE DESCRIPTION STUDY

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Purpose This study explores how gender-affirming surgery (GAS) Medicare policies are developed across Canadian provinces and territories, highlighting factors that facilitate or hinder policy advancement. We aim to pinpoint strategies that address barriers and promote equitable GAS policies. **Methods** We conducted a qualitative description study using semi-structured interviews with 27 individuals (nine government officials, eight healthcare professionals, five community advocates, four judicial experts, and one researcher) who have engaged with, informed, or counselled on GAS-related Medicare policies. A middle-range policy window theory informed our analytical framework. Thematic analysis was then applied to categorize and interpret the data, focusing on how policy changes emerge and progress. **Results** Four interrelated themes surfaced regarding creating or modifying publicly funded GAS policies in Canada: (1) political will and appetite: fostering support and interest is essential to driving policy creation and revision; (2) government relationships and champions: identifying influential allies within government can expedite policy adoption; (3) coalitions and strategic advocacy: collaboration between advocacy groups and intersectoral networks can align efforts, amplify voices, and sustain momentum; (4) consensus-building and best practices: aligning with recognized guidelines (e.g., WPATH) and achieving community consensus strengthen policy legitimacy and facilitate uptake. **Conclusions** Our findings underscore the complex, multifactorial process of advancing GAS Medicare policies in Canada. Despite persistent barriers, notable progress has resulted from strong government relationships, strategic advocacy, and an emphasis on evidence-based best practices. As the sociopolitical climate shifts in Canada, these lessons are especially relevant to safeguarding and expanding trans-inclusive healthcare coverage.

IMPAIRMENT IN VASCULAR REGENERATIVE AND REPARATIVE CELL FLUX IN SOUTH ASIANS: A NOVEL MECHANISM OF ENHANCED ATHEROSCLEROTIC RISK

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Purpose and Hypothesis: Bone marrow-derived vascular regenerative (VR) cell flux influences atherosclerotic cardiovascular disease (ASCVD) susceptibility. Regenerative cell exhaustion (RCE) can lead to impaired vessel repair. We hypothesized that South Asians (SA), compared to White Europeans (WE), may exhibit impaired VR flux as a mechanism of atherosclerosis. **Methods**: Prospective data from 165 individuals (IPE-PREVENTION, ORIGINS-RCE studies) with ASCVD or T2D, who self-reported as SA or WE, was analysed. Flow cytometry assay based on high aldehyde dehydrogenase ($ALDH^{hi}$) activity and cell surface marker phenotyping was performed on venous blood samples. The primary outcome was difference in frequency of circulating $ALDH^{hi}$ progenitor cells, monocytes, and granulocytes between SA and WE.

Results: 75% of the population was male. The SA (vs WE) cohort was younger, had lower BMI, but higher T2DM. SA (vs.WE) exhibited lower $ALDH^{hi}$ progenitor cell content, $ALDH^{hi}SSC^{low}$ progenitor cells with the pro-vascular ($CD133^{+}CD34^{+}$) phenotype, and frequencies of monocyte precursors with vessel regenerative polarization ($ALDH^{hi}SSC^{mid}CD14^{+}CD163^{+}$), but higher frequencies of cells with pro-inflammatory polarization ($ALDH^{hi}SSC^{mid}CD86^{+}CD163^{-}$). These differences persisted in models of multiple linear regression. VR flux in SA (vs WE) was similar in low-risk T2D; however, SA (vs WE) with high risk T2D exhibited greater RCE.

Conclusions: Defects in VR flux, independent of conventional risk factors, are observed SA vs. WE. Our data point towards RCE that affects angiogenic capacity and ischemia-induced collateralization pathways. SA (vs. WE) with high risk T2D exhibit a severe RCE phenotype. These data provide a translational framework for heightened vascular risk in SA populations.

YAP/TAZ REGULATED SENSITIVITY TO OXIDATIVE STRESS UNDER DRUG TOLERANT PERSISTER (DTP) STATE IN XENOGRAFT DERIVED ORGANOID (XDO) MODEL

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Hypothesis and Purpose: EGFR (Epidermal growth factor receptor) mutations are common driver in non-small cell lung cancer (NSCLC) and are targets for EGFR tyrosine kinase inhibitors (TKIs) in patient with EGFR mutant tumour. Despite initial response, majority of patients who are treated with EGFR TKIs eventually develop tumor recurrence due to acquisition of secondary mutation. Drug tolerant persister (DTP) is defined as a minor population of cancer cells which survived treatment by entering a reversible slow proliferation state, during which they may acquire resistant mutations. DTP cells are exposed to oxidative stress during treatment and sensitive to cell death induced by oxidative stress, called ferroptosis. We aim to elucidate the mechanism of oxidative stress response in DTP in relation to YAP/TAZ signaling. Methods: We established organoid model (XDO) from PHLC137 patient derived xenograft of non-small lung cancer (NSCLC). XDO cells were cultured in Matrigel and DTP was induced by Osimertinib, an EGFR TKI. We examined the difference between parental and DTP cells by Western blotting, qPCR, and cell viability. Results: XDO-137 cells entered low proliferative DTP state under Osimertinib treatment and showed reversible proliferation after removal of Osimertinib. Compared to the parental cells, YAP expression and its downstream target genes were increased in DTP cells, suggesting that YAP/TAZ signaling was activated in DTP. DTP cells showed sensitivity to cell death by ferroptosis inducer. We examined GPX4 (Glutathione peroxidase 4), a key molecule of ferroptosis in protecting cells from oxidative damage. We found GPX4 was decreased, while YAP was increased following the transition to DTP. Moreover, GPX4 was increased by inhibiting of YAP/TAZ transcription, indicating that YAP/TAZ signaling suppressed GPX4. Conclusions: In XDO-137 organoid model, DTP state enhanced YAP/TAZ signaling and was associated with altered expression of GPX4 in XDO. Targeting oxidative stress during DTP state may contribute to better outcome of TKI treatment for NSCLC patients.

RADIOTHERAPY VS PHOTODYNAMIC THERAPY - COMPARISON OF ANTITUMOR EFFECTS IN A MOUSE XENOGRAFT MODEL; AND PULMONARY TOXICITY IN A RAT INTERSTITIAL LUNG DISEASE MODEL

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Purpose and Hypothesis: Current treatment options for lung cancer combined with Interstitial lung disease (ILD) are limited because of the risk of ILD exacerbation associated with cancer treatment. We aim to conduct a proof-of-concept study for antitumor effects and pulmonary toxicity to ILD of photodynamic therapy (PDT) in comparison with radiotherapy (RTx) in animal models. **Methods**: 1) Mouse xenograft model: NCr-Foxn1^{nu} athymic mice were subcutaneously inoculated with human A549 lung adenocarcinoma cells to unilateral thigh and were monitored until tumors were grown to 8-12 mm in diameter. We divided mice into three groups; Control (n=8), RTx (n=10), and PDT (n=12). RTx group received a single 20 Gy local irradiation. PDT group received an intravenous porphyrin lipoprotein (PLP: 4 mg/kg) 24 hours before treatment, followed by laser ablation (671 nm) at 100 J/cm^2. Autopsy done after 7 days follow-up. 2) Rat ILD model: Sprague Dawley rats were given intratracheal bleomycin (BLM: 2 mg/kg) or control, and followed up for 3 weeks. We divided rats into four groups; Control (n=8), BLM only (n=9), BLM+RTx (n=7), BLM+PDT (n=6). RTx group received a single 20 Gy irradiation to the unilateral lung base. PDT group had PLP administration (4 mg/kg) 24 hours before intratracheal PDT at 100 J/cm^2. Autopsy done after 3 months follow-up. **Results**: In the mouse xenograft model, a significant reduction in the tumor size was observed in the PDT group in comparison with the RTx- or control group. In the rat ILD model, BLM+PDT rats showed attenuated Ashcroft lung fibrosis score in pathology and decreased macrophage and neutrophil counts in bronchoalveolar lavage over BLM+RTx rats. **Conclusions**: PDT demonstrated comparable antitumor efficacy to RTx in mouse xenograft model and a safer pulmonary toxicity profile than RTx in rat ILD model. PDT may be a promising modality to treat lung cancer combined with ILD.

THE FIRST CANADIAN ACADEMIC ENDOBARIATRIC PROGRAM: INITIAL SEVEN MONTH EXPERIENCE WITH ENDOSCOPIC TRANSORAL OUTLET REDUCTION FOR MANAGEMENT OF WEIGHT REGAIN FOLLOWING ROUX-EN-Y GASTRIC BYPASS

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

IDENTIFYING EARLY PREDICTORS OF SURVIVAL AFTER LVAD IMPLANTATION: A RETROSPECTIVE ANALYSIS OF INTERMACS 1 AND 2 PATIENTS

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Purpose and Hypothesis: INTERMACS profiles stratify patients by disease severity at the time of left ventricular assist device (LVAD) implantation. However, their utility in guiding LVAD bridging strategies and prognoses remains unclear. This study sought to evaluate whether INTERMACS profile independently predicts short-term survival after LVAD implantation. **Methods**: A single-center retrospective analysis was conducted for all INTERMACS Profile 1 (IP1) and 2 (IP2) patients who received a durable continuous-flow LVAD between 2006 and 2024. Multivariable logistic regression identified predictors of 30-day and 1-year survival, while Kaplan-Meier analysis compared 30-day survival rates between the INTERMACS groups. **Results**: Among 114 patients, 30% were classified as IP1 and 70% as IP2. Females comprised 29% of the cohort and 32% of patients presented with ischemic cardiomyopathy. IP1 patients were significantly younger on average ($p = 0.03$) and more frequently bridged with temporary mechanical circulatory support (tMCS) (38%) compared to IP2 patients (5%, $p < 0.01$). Logistic regression identified IP1 as the strongest predictor of early mortality, with IP2 patients demonstrating 4-fold higher odds of 30-day survival (OR, 4.25; 95% CI, 1.24–15.15; $p = 0.02$). Bridging with tMCS did not influence survival at 30 days (OR, 0.88; 95% CI, 0.21–4.22; $p = 0.87$) or 1 year (OR, 0.80; 95% CI, 0.21–3.28; $p = 0.75$). Instead, age was the only significant predictor of 1-year survival (OR, 0.96; 95% CI, 0.92–0.99; $p = 0.03$). Kaplan-Meier analysis reiterated the survival advantage of IP2 patients at 30 days ($p = 0.04$). **Conclusions**: Despite both groups presenting with cardiogenic shock, the distinction between IP1 (critical cardiogenic shock) and IP2 (deteriorating on inotropes) appears to influence short-term survival. Although tMCS is often used to stabilize IP1 patients pre-implantation, these findings suggest it does not effectively bridge the survival gap between the two groups.

AN ANALYSIS IN LOBULAR BREAST CANCER PATIENTS: SEER POPULATION-BASED STUDY

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

COMPARISON OF RESIDENT SALARY AND LIVING WAGE IN CANADA: A CROSS-SECTIONAL STUDY

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Purpose: Canadian medical graduates accumulate on average $170 000CAD in debt to complete their medical degrees. The cost of living in Canada has also sharply risen since the COVID-19 pandemic. While resident salaries range from CAD$49,258 to CAD$98,567 and exceed the national average, it remains unclear if they adequately offset the burden of high debt and elevated living costs, particularly in urban centers. **Methods:** This cross-sectional study evaluates the affordability of resident salaries across PGY-1 to PGY-5 training programs for 2024-2025 through comparison to living wages as calculated from Living Wage Canada, CCPA, and IRIS. Salary-to-living wage ratios were calculated for single adults, single parents with one child, and dual-income families with two children. **Results:** Residents consistently earn a living wage across the nation and family compositions (PGY-1: 1.45 ± 0.25; PGY-5: 1.97 ± 0.33). However, significant regional disparities exist: single-income residents with no children in Quebec had the lowest ratios (PGY-1: 1.18 ± 0.05; PGY-5: 1.66 ± 0.05), while Ontario had the highest (PGY-1: 1.84 ± 0.10; PGY-5: 2.52 ± 0.10). In the U.S., single-income residents with 1 child do not earn a living wage until PGY-5, and those with more than 1 child never earn a living wage. **Conclusions:** Current resident salaries align with living wage benchmarks across Canada. However, residents continue to face significant financial strain due to factors such as high debt and limited time for cost-saving activities. There is additional variability in salary affordability across Canada, with a significant subgroup of residents uniquely impacted by high living costs and fixed incomes in metropolitan cities. There should be further efforts to adjust residency salaries to reflect a true living wage, with particular attention to regions experiencing steep increases in the cost of living.

STRENGTHS AND GAPS IN ALLIED HEALTH TEAM MEMBER PERFORMANCE DURING SURGICAL PROCEDURES

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Purpose and Hypothesis: It is well-established that surgeons' skills impact patient outcomes, but the exact contribution of other surgical team members is unclear. This study aimed to identify patterns in teamwork performance of nurses and radiation technologists (RTs) during orthopaedic surgery. We hypothesized that the patterns would highlight opportunities for improving performance. **Methods**: Expert nursing (n=5) and RT raters (n=2) assessed performance using intraoperative recordings from OR Black Box® technology (Surgical Safety Technologies, Toronto, Canada). Each assessment tool included a checklist and global rating for five facets of teamwork: communication, cooperation, coordination, leadership, and monitoring. **Results**: There were 17 and 11 cases assessed by nurses and RTs, respectively. For nursing, the highest scores were for the coordination checklist (85±12%) and global rating (3.5±0.6 out of 5). Communication behaviours, including addressing contamination issues, were completed least often (mean checklist score: 59±23%). The lowest mean global rating was for monitoring (3.0±0.5 out of 5), which included being aware of surgical procedure steps and performing sterile technique. For RTs, monitoring also included knowing the procedure steps, and had the highest mean checklist score (84±23%) but the lowest mean global rating score (3.6±1.0 out of 5). The lowest mean checklist score was for leadership (43±26%).

Conclusions: Our data identified opportunities for improving the quality of monitoring behaviour and greater awareness of surgical procedure steps for both nurses and RTs during orthopaedic surgery. We will use these findings to develop targeted training interventions to improve performance, helping us to improve patient care.

DOCTOR, WILL MY HAND NUMBNESS IMPROVE AFTER SURGERY?

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Purpose and Hypotheses: This study aims to characterize sensory recovery following surgery for degenerative cervical myelopathy (DCM), examine its association with postoperative health-related quality of life (HRQoL), and identify predictors of sensory improvement. We hypothesize that patients will experience significant sensory recovery, correlated with HRQoL improvements, and that baseline characteristics will predict postoperative recovery. **Methods:** An observational cohort study was conducted using prospectively collected data from the Canadian Spine Outcomes Research Network (CSORN) registry (2015–2024). Adults with DCM undergoing surgery with baseline and follow-up sensory assessments were included. Sensory function was assessed using the modified Japanese Orthopedic Association (mJOA) sensory subdomain. HRQoL was evaluated using SF-12 physical (PCS) and mental (MCS) component scores. Multivariable regression identified factors associated with sensory improvement. R**esults:** Among 787 patients, 43% improved, 47% remained stable, and 10% worsened. The proportion of patients with severe sensory impairment decreased from 25.3% preoperatively to 6.0% at 12 months, while those with normal sensory function increased from 14.1% to 32.7%. Sensory improvement was associated with significant PCS (31.4 to 40.5, $p < 0.001$) and MCS (42.7 to 48.0, $p < 0.001$) gains. Higher baseline sensory scores predicted greater improvement ($\beta = 0.175$, 95% CI 0.101, 0.249, $p < 0.001$) **Conclusions:** Sensory function improves significantly within three months postoperatively and correlates with HRQoL gains in 43% of patients undergoing surgery. Higher baseline sensory scores predict greater recovery, emphasizing the need for early diagnosis and intervention in DCM. These findings provide valuable insights for patient counseling and expectation management in the surgical treatment of DCM.

ENABLING SURGICAL COACHING THROUGH ARTIFICIAL INTELLIGENCE: ENHANCING MASTERY WITH TOOL-TISSUE INTERACTION FEEDBACK

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Purpose and Hypothesis: Surgeons often receive limited objective feedback on their operative performance, particularly after entering independent practice. Surgical coaching offers a solution, but traditional methods face challenges such as time constraints and limited access to expert mentors. To bridge this gap, we developed an Artificial Intelligence (AI) model that detects Tool-Tissue Interactions (TTI) and provides automated, real-time feedback to enhance surgical performance. **Methods**: A dataset of approximately 2,400 five-second laparoscopic cholecystectomy video clips was annotated for TTIs, defined as instances where an instrument interacts with the tissue. Interactions were classified by instrument type and interaction type, with segmentation for precise localization. This approach enables precise identification of surgical maneuvers, allowing for objective assessment of technique in a way that mimics expert feedback. Non-interaction frames were also labeled for contextual reference. **Results**: The AI model achieved a mean Average Precision of 0.560 at an IoU threshold of 0.5. The model correctly identified 62% of TTIs, with a false negative rate of 38%. Qualitative analysis indicates that the model successfully identifies TTIs in most cases, though small positional errors affect numerical performance. **Conclusions**: AI-driven surgical coaching holds significant potential for enhancing intraoperative performance through scalable, automated feedback. By refining surgical technique and optimizing patient outcomes, this model represents a critical step toward the integration of AI in surgical education and practice. Future work will focus on improving accuracy and expanding applications, with the ultimate goal of establishing AI as an indispensable tool in modern surgical training and performance assessment.

A53T ALPHA-SYNUCLEIN OVEREXPRESSION RAT MODEL OF PARKINSON'S DISEASE: BEHAVIOUR AND ELECTROPHYSIOLOGY PHENOTYPING

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Purpose and Hypothesis: Parkinson's disease (PD) is a neurodegenerative movement disorder characterized by the loss of midbrain dopaminergic neurons and the formation of alpha-synuclein (a-Syn) aggregates. Patients diagnosed with PD exhibit a wide array of pathologies, such as motor impairment, depression, anxiety, anosmia, and altered neuronal activity in basal ganglia. The accumulation of a-Syn is central to PD pathology, but its precise role in pathogenesis remains unclear. Here, we investigated the emergence of motor and non-motor behavioural deficits and electrophysiological signatures of circuit dysfunction in rats overexpressing a mutant form of a-Syn linked to early-onset PD. **Methods**: Adult female Sprague-Dawley rats were unilaterally or bilaterally injected into the substantia nigra (SN) with adeno-associated virus (AAV) expressing either human mutant A53T a-Syn or empty vector (EV). Electrophysiological recordings including single unit and local field potentials were performed under isoflurane anesthesia at 3 and 6 weeks post-unilateral injection. Behavioral experiments were conducted on a separate cohort of animals at 3 and 6 weeks post bilateral AAV injection. Post-morten immunofluorescence staining for tyrosine hydroxylase and a-Syn was performed to confirm neurodegeneration. **Results**: The unilateral loss of dopaminergic neurons in the SN of A53T a-Syn expressing animals coincided with the gradual emergence of pathological brain activity. Rats with bilateral expression of A53T a-Syn exhibited progressive deterioration of motor function, accompanied by a diminished responsiveness to palatable stimulation observed 6 weeks post-injection. **Conclusions**: These findings suggest that mutant a-Syn overexpression in the SN is sufficient to cause STN dysfunction, aberrant circuit oscillations within the basal ganglia and motor impairments and depression-like phenotype.

MINIMAL CLINICALLY IMPORTANT DIFFERENCE AND PATIENT ACCEPTABLE SYMPTOM STATE FOR PATIENT-REPORTED OUTCOMES FOLLOWING COMMON ARTHROSCOPIC SHOULDER SPORTS SURGERIES: A SYSTEMATIC REVIEW

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Purpose and Hypothesis: Patient-reported outcome measures (PROMs) are increasingly utilized for evaluating patient experiences following shoulder arthroscopy. To aid the clinical interpretability of PROMs, the minimal clinically important difference (MCID) and patient acceptable symptom state (PASS) are used. The purpose of this systematic review was to comprehensively summarize available literature on MCID and PASS thresholds across PROMs following primary arthroscopic shoulder sports surgeries. It was hypothesized that thresholds would vary due to unique study populations and use of different calculation methods. **Methods:** A systematic electronic search of MEDLINE, Embase, and Cochrane databases was performed from inception to January 30, 2025 for identification of studies calculating MCID or PASS thresholds of PROMs following primary arthroscopic shoulder sports surgeries. Study characteristics, thresholds, and calculation methods were extracted. MCID and PASS thresholds were aggregated by treatment, PROM, and calculation method, and then summarized using a range. **Results:** Forty-five studies were identified. Forty-three studies calculated MCID thresholds and 21 studies calculated PASS thresholds. The most commonly used PROM was the American Shoulder and Elbow Surgeons (ASES) score and the most frequently studied procedure was rotator cuff repair (RCR). The range of MCID thresholds for the ASES following RCR was 8.2–14.5 using distribution-based methods and 6.1–27.1 using anchor-based methods, while PASS thresholds ranged from 65.9–93.5. **Conclusion:** Results demonstrate variability in MCID and PASS thresholds across study populations, treatments, and calculation methods. Standardization of calculation methods using anchor-based approaches will further improve the clinical interpretation of PROMs following arthroscopic shoulder sports surgeries.

RETROSPECTIVE, POPULATION-BASED COHORT STUDY ON THE ASSOCIATIONS BETWEEN TUMOUR SIZE, RECEPTOR STATUS, & REGIONAL NODAL POSITIVITY RATES FOR EARLY-STAGE BREAST CANCER: IMPLICATIONS FOR DECISION BETWEEN UPFRONT SURGERY VS NEOADJUVANT SYSTEMIC THERAPY

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Purpose and Hypothesis: For clinically node-negative T1-T2 breast cancers, ASCO/Ontario Health guidelines discourage staging axillary ultrasound (AxUS). At the same time, neoadjuvant systemic therapy (NST) is recommended for HER2+ and triple negative (TN) breast cancers >2 cm, with controversy whether cT1cN0 HER2+ and TN tumors should receive NST or upfront surgery. This study evaluated the regional lymph node positivity rates across T1a - T2 tumor sizes for HR-HER2+, HR+HER2+, HR+HER2-, and TN breast cancers. **Methods:** We performed a population-based, retrospective cohort study using administrative health databases at ICES Ontario. Data from the Ontario Cancer Registry was extracted for all female patients with invasive breast cancer between 2000 – 2019 in Ontario, Canada. The proportion of patients with positive lymph nodes (N1-3) was calculated for each receptor subtype. **Results:** There were 36,168 T1a – T2 breast cancers. Increasing tumor size was associated with increasing rates of regional nodal positivity across all receptor subtypes ($P < .001$ for all). Among HR-HER2+ tumors, T1a lesions had a nodal positivity rate of 11%, T1b 23%, T1c 34%, and T2 39%. Among HR+HER2+ tumors, T1a lesions had a rate of 11%, T1b 14%, T1c 26%, and T2 44%. Among TN tumors, T1a lesions had a rate of 8%, T1b 12%, T1c 20%, and T2 32%. Among HR+HER2- tumors, T1a had a rate of 5%, T1b 9%, T1c 23%, and T2 44%. **Conclusion:** At the population-level, pathologic regional nodal positivity rates are not insignificant for T1-T2 tumors, especially TN and HER2+ tumors. For cT1c tumors, regional nodal positivity rates reached 34%, 26%, and 20% for HR-HER2+, HR+HER2+, and TN, respectively. These data need to be shared with patients with cT1c tumors when deciding between NST or upfront surgery. Finally, we advocate considering staging AxUS for all HER2+ and TN T1-T2 tumors, irrespective of tumor size.

ANTICOAGULATION AFTER LOWER EXTREMITY BYPASS SURGERY FOR PERIPHERAL ARTERY DISEASE – A SYSTEMATIC REVIEW AND META-ANALYSIS

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

AUTOMATING SYSTEMATIC REVIEW SCREENING WITH LARGE LANGUAGE MODELS – EFFICIENCY GAINS AND COST BENEFITS IN EVIDENCE SYNTHESIS

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

MODELING THE TONE OF THE OPERATING ROOM: A PREDICTIVE MODEL OF INTRAOPERATIVE TEAM INTERACTION

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Purpose and Hypothesis: The tone of the operating room is a construct that describes the affective environment (e.g. tense, relaxed, focused). It can shape the safety, coordination and efficiency of teams. The tone is a 'team emergent construct', changing throughout the case in response to events of the operation, team interaction, and interpersonal and contextual factors. The aim of this study was to develop a computational model of tone to identify events and factors associated with tone change in real operating room cases. **Methods**: Twenty-one operations were recorded and processed to produce clean transcript and audio. Features were extracted for each speaker segment: sentiment, sentence type, communication context, behaviour annotation, and professional role. A time series transformer model was trained to predict tone. Predictions of the model were plotted to demonstrate shifts in tone over time. Qualitative analysis was used to identify events surrounding tone change. **Results**: The model trained and evaluated (f1 0.69, accuracy 0.73, recall 0.73, and precision 0.73). Logits were used to identify moments of tone change. Events surrounding change in tone included uncertainty, equipment delay, and focused work. **Conclusions**: We developed a model for predicting tone – an interpersonal construct – over time. To our knowledge, this is the first predictive machine learning model developed for an emergent team state in this environment. In future, a more granular study may provide detailed insights into the interactions affecting the tone and, therefore, team performance in the operating room. These insights can be used to create systems level change to promote effective teamwork.

THE ASSOCIATION BETWEEN 30-DAY POST-DISCHARGE PRIMARY CARE FOLLOW-UP AND 3-YEAR MORTALITY IN BURN SURVIVORS

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Purpose and Hypothesis: Several studies have demonstrated that timely follow-up with a primary care provider (PCP) after hospital discharge is associated with improved patient outcomes, however its impact on long-term outcomes in major burn injury survivors remains unclear. This study aimed to determine the association between early primary care follow-up and long-term mortality in burn survivors. **Methods:** Using health administrative data, we identified adults (≥18 years old) in Ontario who were discharged alive after a major burn injury between 2010 and 2022 and were attached to a PCP. Attachment was defined as rostering with a PCP or virtual rostering with the highest-billing PCP for primary care encounters (with a usual provider index ≥0.5) in the two years prior to injury. The exposure of interest was a visit with the patient's own PCP within 30 days of discharge. The primary outcome was three-year all-cause mortality, with follow-up until death or 2023. Cumulative mortality estimates were derived using Kaplan-Meier curves. A Cox proportional hazards model was used to estimate the association between 30-day follow-up and mortality, adjusting for age, sex, burn size, comorbidities, and socioeconomic characteristics. **Results:** Among burn survivors, 86% (n = 1,690) were attached to a PCP (71% male, mean age 48 ± 18 years). Of these, 40% (n = 677) had a PCP follow-up visit within 30 days of discharge. Three-year mortality was 6.9% among those with early PCP follow-up, compared to 8.4% among those without. After adjusting for patient and injury characteristics, PCP follow-up within 30 days was significantly associated with a 48% reduction in the hazard of death over three years (HR 0.52, 95% CI 0.36–0.76, $p < 0.001$). **Conclusion:** Among PCP-attached burn survivors, early post-discharge follow-up is associated with reduced long-term mortality. Burn centers should prioritize timely PCP follow-up post-discharge through standardized discharge planning and explore strategies to connect patients without an established PCP to appropriate care.

A PILOT THREE-DIMENSIONAL ANATOMICAL STUDY OF THE FIBULA FREE FLAP CUTANEOUS PERFORATORS

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Purpose and Hypothesis: The purpose of this fibula free flap (FFF) cutaneous perforator study is to: (1) determine perforator origin and course; (2) quantify perforator diameter at origin; (3) quantify pedicle length for each cutaneous perforator; (4) compare perforator course and parameters between specimens. It is hypothesized that the parameters and course of the FFF cutaneous perforators vary between specimens. **Methods**: Four embalmed specimens were used for this pilot study. The perforators were exposed, digitized and modelled in 3D as in situ (Autodesk® Maya® with plugins developed in the laboratory). The course and parameters of the perforators were quantified in 3D and compared between specimens. **Results**: The course of the perforators was visualized in 3D and found to originate from the popliteal (1–4 perforators), anterior tibial (1–4), posterior tibial (1–3), and peroneal (2–4) arteries. The popliteal perforators coursed through the lateral head of gastrocnemius and peroneal artery perforators through the soleus and flexor hallucis longus. The peroneal artery perforator diameter at origin ranged from 1.5–3.4cm. Pedicle length varied from 0.46–24.31cm for each cutaneous perforator. **Conclusion**: Cutaneous perforators of the FFF arise from the popliteal, anterior tibial, posterior tibial, and peroneal arteries. The pedicle length varied depending on the site of origin of the peroneal perforator. The most distal perforators of the peroneal artery had adequate pedicle length for FFF viability. Dissection, digitization and 3D modelling enabled visualization and quantification of the cutaneous perforators and their parameters as in situ. A comprehensive understanding of the cutaneous perforator anatomy as in situ will facilitate an evidence-based approach to optimize FFF skin paddle design with the goal of improving clinical outcomes.

RE-ASSESSING THE MINIMAL CLINICALLY IMPORTANT DIFFERENCES OF PATIENT REPORTED OUTCOMES IN CERVICAL MYELOPATHY: A PATIENT-CENTERED APPROACH FROM THE CANADIAN SPINE OUTCOMES AND RESEARCH NETWORK

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Hypothesis and Purpose: We hypothesized that minimal clinically important differences (MCIDs) for patient-reported outcomes (PROs) in degenerative cervical myelopathy (DCM) vary by baseline severity with more severe cases having higher MCID thresholds. This study aimed to determine MCIDs for the SF-12 Physical Component Summary (PCS), SF-12 Mental Component Summary (MCS), and Neck Disability Index (NDI) in DCM patients, and assess differences by initial severity.

Methods: We retrospectively analyzed data from the Canadian Spine Outcomes and Research Network (CSORN) for DCM patients who underwent surgery between 2015 and 2023. Inclusion required complete baseline modified Japanese Orthopaedic Association (mJOA) scores plus PROs and corresponding related anchor question responses at 3 or 12 months. Patients were stratified into mild (mJOA ≥15), moderate (12 ≤ mJOA ≤14), and severe (mJOA <12) groups. MCIDs were determined using an anchor-based receiver operating characteristic (ROC) approach with bootstrapping to estimate 95% confidence intervals.

Results: Among 290 patients, 77 (26.6%) were mild, 120 (41.4%) moderate, and 93 (32.1%) severe. MCIDs for the overall cohort were 8.89 (95% CI: 7.49–10.90) for SF-12 PCS, 4.32 (95% CI: 2.33–5.58) for SF-12 MCS, and 13.5 (95% CI: 11.5–15.5) for NDI. By severity, SF-12 PCS MCID ranged from 4.77 (mild) to 8.43 (moderate) and 14.8 (severe). NDI MCIDs were 10.5 (mild), 15.0 (moderate), and 17.5 (severe), while SF-12 MCS values remained consistent.

Conclusions: MCIDs for PROs in surgically treated DCM increase with baseline severity, emphasizing the importance of considering disease severity to enhance outcome interpretation and guide individualized treatment goals.

A SCOPING REVIEW ON GOALS OF CARE DISCUSSIONS IN SURGERY: HOW ARE WE DOING AND HOW CAN WE DO BETTER?

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Purpose and Hypothesis: This scoping review aims to characterize the existing literature on the quality of goals of care (GOC) discussions in surgery. We identify gaps in how surgeons conduct GOC discussions with patients and propose strategies for improvement. **Methods**: MEDLINE, MEDLINE In-Process/ePubs, Embase, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Web of Science, Scopus and ClinicalTrials.Gov were searched using terms related to GOC, surgery, and best practices or education. The search strategy was run from inception to July 29, 2022. We included studies that discussed the quality of GOC discussions in surgical settings. **Results**: The search identified 14,254 articles from which 37 were included for review. Most studies originated from North America and focused on eliciting the perspectives of surgeons. Key findings were: (1) the reactive nature of GOC discussions and propensity to initiate conversations in response to acute health changes, (2) ambiguity around the extent of patient autonomy and the surgeon's responsibility to prioritize surgical treatment, (3) surgeons as gatekeepers of information, and (4) tendency of surgeons to provide a list of care options and determine specific care decisions rather than establish understanding of patients' long-term goals. Education for surgeons on how to balance clinical opinion with patient autonomy, elicit patient perspectives on what constitutes a meaningful life, and manage implicit biases around patient readiness for raising difficult topics will improve GOC discussions. **Conclusions**: This review provides an overview of the literature on the current state of GOC discussions in surgery. Findings have important implications for improving GOC discussions in surgical settings and ensuring that these conversations are conducive to patient-centred care.

SENSITIVITY ANALYSIS OF INTRAOPERATIVE PRESSURE-DERIVED INLET BOUNDARY CONDITIONS IN ACUTE TYPE B AORTIC DISSECTION CFD SIMULATIONS

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Purpose and Hypothesis: Acute Type B Aortic Dissections (ATBAD) pose a significant risk of aneurysmal degeneration, influenced by hemodynamic factors such as oscillatory shear index (OSI), relative residence time (RRT), and time-averaged wall shear stress (TAWSS). Computational fluid dynamics (CFD) simulations are commonly used to study these parameters, but reliance on idealized inlet boundary conditions may limit accuracy. This study hypothesizes that inlet boundary condition selection significantly affects hemodynamic metrics, impacting the interpretation of biomechanical risk factors for aneurysmal degeneration. **Methods**: A 55-year-old male with a history of uncomplicated ATBAD who recently underwent a catheter-based intervention was selected for CFD analysis. A contrast-enhanced CT scan was segmented and reconstructed for patient-specific aortic geometry creation. Two inlet boundary conditions were tested: (1) intraoperative pressure measurements recorded at the ascending aorta and (2) an idealized velocity profile from literature scaled to the patient's cardiac output. A constant intraoperative pressure-based outlet condition was applied for both cases. Sensitivity analysis was performed to compare OSI, RRT, and TAWSS across a range of planes derived from the aortic root to the descending thoracic aorta. **Results**: Comparing the intraoperative pressure-based inlet to the ideal velocity profile, the absolute median difference in TAWSS was 19.25% (4.38%–40.61%, $p=0.04$), in RRT was 47.1% (10.7%–140.3%, $p<0.01$), and in OSI was 9.1% (0.78%–36.1%, $p<0.01$). **Conclusions**: These differences highlight the sensitivity of CFD simulations to inlet BC selection, with RRT showing the greatest variability. While differences were observed in all hemodynamic parameters, the idealized velocity inlet scaled to patient cardiac output proved to be a relatively effective approximation of patient-specific inflow conditions. More patient scenarios are needed to determine statistical significance and validate these findings.

ACCESS TO IMMEDIATE BREAST RECONSTRUCTION DURING BREAST CANCER TREATMENT: A POPULATION-BASED STUDY

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Purpose and Hypothesis: The purpose of this study is to explore temporal trends, regional variations, and socioeconomic variables among breast cancer (BC) patients undergoing immediate breast reconstruction (IBR) in Ontario. We hypothesized patients from equity-deserving groups are less likely to receive IBR despite efforts to increase access to IBR over the past decade. **Methods**: Patients who underwent a mastectomy with and without IBR between Jan 2018-Jul 2023 across the six Ontario Health (OH) regions were identified. Multivariable logistic regression was used to determine the odds of receiving IBR based on a patient's residence and over time adjusting for socioeconomic factors. **Results**: 21,933 patients underwent a mastectomy, 26.3% (n=5,758) of which received IBR. There was variability across the six OH regions (10.5% to 36.3%). The odds of having IBR increased by 17% (aOR 1.17, 95% CI 1.14-1.19) with per year. Patients residing in all other areas of the province were significantly less likely to receive IBR compared to patients who resided in OH region 3 – Toronto, with the lowest odds in OH region 5 – North East (aOR 0.22, 95% CI 0.18 – 0.28). The odds of receiving IBR increased with increasing material income quintile (Q1 aOR 2.07, 95% CI 1.85 – 2.31 vs Q4 1.20, 95% CI 1.06- 1.35). Patients who were immigrants also had lower odds of IBR compared to non- immigrants (aOR 0.70, 95% CI 0.65 -0.77). **Conclusions**: There is inequitable access to IBR during BC treatment in Ontario and further work is needed to understand and address the contributing systemic factors.

ROLE OF INFLAMMATION-INDUCED PARACRINE VEGF EFFECTS IN SKIN HEALING

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Purpose and Hypothesis: Efficient skin wound healing relies on keratinocytes, which restore skin integrity by secreting molecules to promote inflammation and migration, leading to re-epithelialization. Dysregulated keratinocyte functions can delay healing or cause excessive scarring. Many inflammatory cytokines, including Tumor Necrosis Factor (TNF)α, enhance keratinocyte migration, but the underlying mechanisms remain unclear. We hypothesized that inflammation augments keratinocyte migration by releasing soluble factors that exert paracrine effects. **Methods**: We analyzed the HaCat keratinocyte secretome via a multiplex Eliza screen, and visualized migration with live cell imaging. Rho regulator guanine nucleotide exchange factors (GEFs) were identified by affinity precipitation using GST-RhoA(G17A) followed by mass spectrometry. RhoA activation was detected using an affinity precipitation assay. Key proteins were silenced using siRNA. The epidermis of an MC903-induced mouse skin inflammation model was analyzed by immunohistochemistry. **Results**: We showed that synthesis and secretion of Vascular Endothelial Growth Factor (VEGF)-A was strongly stimulated by TNFα via SP1, NfκB, and HIF1α. The migration augmenting effect of TNFα required VEGF-A release and VEGF Receptor2 (VEGFR2/KDR) activation. The effect of VEGF was mediated by ERK-dependent activation of the Rho GEF GEF-H1 (ARHGEF2) and by RhoA. GEF-H1 also mediated TNF-induced VEGF release. VEGF-A augmented GEF-H1 S885 phosphorylation both in HaCaT cells and in the epidermis of a mouse inflammatory skin disease model. **Conclusions**: We demonstrated a key role for inflammation-induced paracrine VEGF-A effects in keratinocytes and verified activation of the KDR/GEF-H1/RhoA pathway in a skin inflammation model. This pathway could be a promising target for future therapeutics addressing dermal scar formation, and inflammatory skin diseases e.g. psoriasis and atopic dermatitis.

SELECTIVE TARGETING OF BET FAMILY EPIGENETIC REGULATORS IN PRIMARY AND METASTATIC ALVEOLAR RHABDOMYOSARCOMA

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Hypothesis and Purpose: PAX3/7-FOXO1 positive alveolar rhabdomyosarcoma (ARMS) is highly aggressive, with high risk of metastasis. Standard chemotherapy is toxic and frequently leads to resistance. Bromodomain-containing protein 4 (BRD4) is critical in P3F-driven transcription, making it a potential therapeutic target. Our study evaluated BET inhibitors (BETi) combined with chemotherapy in a metastatic murine model.

Methods: BETi compounds were tested in human ARMS cell lines using ATPlite viability assay. On-target efficacy was confirmed using siRNA-mediated depletion of BRD2/3/4. Synergy with cyclophosphamide (CFA) was analyzed using the Bliss model. RH4 GFP-Luc cells were injected into NSG mice, randomized into four treatment groups (vehicle, BETi, CFA, BET1+CFA). After treatment completion, an amputation surgery was performed on the tumor-bearing limb. Primary tumor volume, metastatic development, and survival were assessed.

Results: BETi reduced ARMS proliferation at low concentrations and knockdown of BRD4 reduced proliferation, further confirming on-target efficacy. CFA showed strong synergy with BETi and, in vivo, BETi+CFA significantly reduced primary tumor growth and improved metastasis-free survival, metastasis-specific survival, and overall survival.

Conclusions: BETi selectively targets the ARMS transcriptional program and demonstrates strong synergy with CFA, improving tumor control and survival in a clinically relevant metastatic model. These findings provide a strong rationale for evaluating BETi+CFA in a clinical trial for high-risk ARMS patients.

CARPAL TUNNEL SYNDROME ATTRIBUTED TO MEDICATION USE: A PHARMACOVIGILANCE STUDY

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Purpose and Hypothesis: This study aims to identify drugs disproportionately associated with Carpal tunnel syndrome (CTS) using Food and Drug Administration Adverse Event Reporting System (FAERS). It was hypothesized that certain drug classes would show a significant association with CTS due to their effects on connective tissue and inflammation. **Methods:** A retrospective pharmacovigilance analysis was conducted using OpenVigil 2.1 to evaluate adverse event (AE) reports of CTS from FAERS (October 2003–September 2024). Only drugs listed as the primary suspect in ≥10 AE reports were included. Disproportionality analysis, including reporting odds ratios (RORs), assessed associations between CTS and specific drugs. Positive signals were validated using Bayesian confidence propagation neural network algorithms, with drugs having ROR ≥10 and significant Bayesian confidence intervals (IC025 > 0) considered strongly associated with CTS. **Results:** Among 12,929,504 AE reports, 6,837 (0.05%) involved CTS. Female patients comprised 69.5% of CTS cases, with a mean age of 57.0 ± 14.9 years. Ten drugs demonstrated significant overreporting of CTS, including idursulfase (ROR=51.2, 95%CI=39.0-67.2), galsulfase (ROR=26.8, 95%CI=17.2-41.7), laronidase (ROR=20.9, 95%CI=14.4-30.3), tesamorelin (ROR=20.7, 95%CI=13.7-31.3), anastrozole (ROR=20.6, 95%CI=17.0-24.9), alendronic acid (ROR=17.1, 95%CI=14.5-20.1), gamma-hydroxybutyric acid (ROR=16.3, 95%CI=9.6-27.6), rofecoxib (ROR=16.1, 95%CI=14.3-18.2), alendronate (ROR=12.9, 95%CI=11.0-15.2), and tafamidis (ROR=12.0, 95%CI=9.2-15.7). **Conclusion:** Several drugs, including enzyme replacement therapies, aromatase inhibitors, and bisphosphonates, showed a strong association with CTS, possibly due to underlying conditions. These findings emphasize the need for clinical vigilance and further studies to confirm associations and mechanisms.

OPTILUME® URETHRAL DILATION FOR URETHRAL STRICTURE DISEASE: A SINGLE-CENTER LONGITUDINAL RETROSPECTIVE COHORT WITH LONG-TERM FOLLOW-UP

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Purpose and Hypothesis: Urethral stricture disease significantly impacts quality of life. While urethroplasty is the gold standard treatment, its invasive nature can be a limiting factor for patients. Optilume® is a paclitaxel-coated balloon designed for endoscopic treatment of urethral strictures. This study aims to evaluate the long-term outcomes of patients treated with drug-coated balloon (DCB) dilation for urethral stricture disease. **Methods**: This single-center retrospective cohort study included male patients who underwent DCB dilation from October 26, 2020-November 7, 2023. Cystoscopy, retrograde urethrography, and voiding cystourethrography were used to diagnose a stricture, determine the location and length. Data on demographics, previous interventions, and postoperative outcomes (uroflow parameters, complications, and patient-reported symptoms) were collected. The primary outcome was treatment failure defined as the need for another intervention such as dilation, direct visual internal urethrotomy (DVIU), or urethroplasty after DCB dilation. **Results**: 56 patients (mean age 48.6 ± 17.7 years) were included. The most common etiology was idiopathic (75%), with strictures predominantly in the bulbar urethra (95%) and a mean length of 2.3 ± 1.2 cm. One patient (1.6%) underwent prior radiation. The median follow-up was 471 (100-1316) days. Before DCB dilation, 91% of patients had undergone at least one intervention, with 32% having undergone two or more. Post-treatment uroflowmetry and residual bladder volume parameters significantly improved (initial: 9.6 mL/s, 98.6 mL vs. post: 18 mL/s, 30.3 mL). At the last follow-up visit, 83% of patients reported improved lower urinary tract symptoms. 21.4% of patients experienced treatment failure with a median time to repeat intervention of 331 (138-731) days. No significant adverse events were reported. **Conclusions**: Optilume® demonstrates clinical improvements in treating urethral stricture disease. Further research is needed to assess long-term outcomes in larger cohorts.

IMPACTS OF SURGICAL RESIDENCY ON EARLY PREGNANCY OUTCOMES: A SYSTEMATIC REVIEW

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Purpose and Hypothesis: Child-bearing surgical residents face a myriad of workplace challenges while balancing family-planning. New COA guidelines provide general recommendations though focus is generally on later pregnancy. This systematic review evaluates the impact of surgical residency on early pregnancy complications, including miscarriage. **Methods:** A systemaatic search was conducted using keywords 'obstetrical complications', 'surgical residents', and 'miscarriage'. Inclusion criteria were studies examining early/mid-term pregnancy outcomes among residents, healthcare workers and the general population. Exclusion criteria were studies without primary data or discussion of early pregnancy complications. The primary outcome was miscarriage. Secondary outcomes were preterm labour, hypertensive disorders, fetal growth restriction. Data were extracted by two independent reviewers, and study quality and risk of bias was reviewed. **Results:** Twenty-eight studies met inclusion criteria. Since the 1990's, rates of pregnancy in female surgical residents have been less than half of the spouses of their male residents. General obstetrics complications were higher among female surgical residents (41.8%) vs. their counterpart (33.7%). Surgical residents have higher miscarriage rate (21%), compared to college-educated childbearing individuals (12%). Female residents initiate prenatal care later (8.6 vs 7.6 weeks) and to compensate for maternity leave, 50% report taking more calls during preterm and 32% upon return. **Conclusion:** Surgical training has shown to negatively impact pregnancy, with challenges persisting through practice. Programs should offer standardized yet adaptable policies and guidelines that help educators to accommodate and support their trainees, ensuring safer pregnancies while meeting their personal and educational objectives.

GENOME-WIDE SEQUENCING ANALYSES REVEAL THE BIOLOGICAL DETERMINANTS OF MARGIN STATUS IN RETROPERITONEAL LIPOSARCOMA

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Purpose and Hypothesis: Liposarcoma (LPS) accounts for the majority (≈70%) of Retroperitoneal (RP) Sarcoma cases. Complete gross resection is the mainstay of treatment, but margins are frequently involved microscopically by tumour (R1≈50%), often attributed to large size (median >25cm) and intimacy with central compartment structures. The link between R1 status and local recurrence of RP LPS is controversial, and could be mediated by adverse tumour biology rather than inadequate surgery. Here we test the hypothesis that R1 status is associated with gene expression patterns that denote high tumour invasiveness into surrounding tissue, and local host immunosuppression. **Methods**: Bulk RNA sequencing was performed on banked samples from 47 resected RP LPS tumours and differentially expressed genes (adjPval<0.05, Log2FC ±2) were identified, comparing tumours resected with positive (R1, n=21) or negative (R0, n=26) microscopic margins. The CIBERSORTx deconvolution algorithm was used to estimate tumour microenvironment cellular composition. **Results**: Transcriptomic analysis revealed upregulation of invasion-associated genes (MMP1, MMP13, PTGS2) and immunosuppressive signaling (TNFSF18, TNFSF11) in R1 tumours, consistent with a locally invasive tumour phenotype. CIBERSORTx analysis demonstrated enrichment of regulatory T cells, tumour-associated macrophages, and endothelial cells in R1 tumours, while R0 tumours showed a greater presence of cytotoxic immune subsets (CD8+ T cells, NK cells). **Conclusions**: These findings implicate the host-tumour interaction, rather than technical factors alone, in determining the microscopic margin status in patients who undergo resection of RP LPS. Validation based on genome-wide analysis of pre-operative biopsy samples would facilitate rational selection of patients for neoadjuvant treatment, predicated on more sophisticated risk stratification.

THE IMPACT OF HYPERTHERMIA AND CHEMOTHERAPY ON THE IMMUNE PROFILE OF A MURINE MODEL OF RHABDOMYOSARCOMA

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Purpose and Hypothesis: Prognosis remains poor in patients with recurrent/relapsed rhabdomyosarcoma (RMS), and treatment-associated toxicity is prevalent. Magnetic resonance-guided high intensity focused ultrasound (MRgHIFU) can produce tumour-localized hyperthermia (HT) to target the release doxorubicin from a thermosensitive liposome (TLD) to the cite of cancer. HT can also modulate the immune response. Purpose: to characterize the immune profile (IP) of a murine model of RMS over time and determine what effect chemotherapy and/or HT has on immune infiltrates. Hypothesis: the IP of this model will be macrophage dominant and HT will promote immune stimulation. **Methods**: Tumours of HT treated mice were heated to ~40°C for 20 minutes. Drugs tested: doxorubicin and TLD. Tumours were collected at 24 and 168 hours post-treatment (hpt) (n=107). Immunohistochemistry for CD11b, CD3, and B220 was quantified using HALO image analysis software. Imaging mass cytometry (IMC) was performed on a subset of tumours and analyzed using Rakaia (n=9). **Results**: The IP is M2-like macrophage dominant with sparse B cells, neutrophils and resident dendritic cells. Doxorubicin treatment increased myeloid immune cells in tumours, while hyperthermia increased B cells in tumours at 168 hpt. IMC analysis is underway and suggests HT+TLD treatment correlates with M2-like macrophage apoptosis and increased cytotoxic T cell infiltrate at 168hpt. **Conclusions**: Characterizing the IP of an RMS mouse model establishes a framework for future IP testing in RMS and will determine potential synergy of immunotherapy with chemotherapy+HT. There is potential for HT-mediated immune stimulation – particularly due to decreased tumour promoting M2-like macrophages, and increased cytotoxic T and B cells.

THERAPEUTIC POTENTIAL OF PROTEOGLYCAN 4-ENGINEERED MESENCHYMAL STROMAL CELLS IN PREVENTION OF OSTEOARTHRITIS

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Purpose and Hypothesis: Osteoarthritis (OA) is a chronic degenerative joint disease characterized by the progressive breakdown of articular cartilage, causing pain, stiffness, and reduced mobility. Current treatments primarily manage symptoms but do not halt disease progression. Lubricin, a superficial zone glycoprotein encoded by the proteoglycan 4 (PRG4) gene, plays a critical role in joint lubrication and cartilage protection. Lubricin deficiency has been linked to increased cartilage wear and OA progression, making it a promising therapeutic target. We predict Lubricin expressing mesenchymal stromal cells (MSCs) will delay the progression of OA. **Methods:** 1) MSC culture: Mouse compact bone-derived MSCs were generated and cultured; 2) PRG4 expression plasmid generation: DNA fragment of PRG4 gene was synthesized by Twist bioscience (South San Francisco, USA), gene was subcloned to PDONR221 plasmid through gateway BP reaction, expression plasmid PB-TetO-PRG4-IRES-GFP-CMV-Puro is generated through gateway LR reaction; 3) Plasmid transfection of MSCs: JetPrime transfection regent is used to transfect PRG4 expression vector into mouse MSCs, transfected cells will be under puromycin-selection for 10 days, then the Dox-induced GFP positive cells will be sorted by FACS and used; 4) PRG4 expression confirmation: PRG4 expression will be confirmed at the mRNA level by qPCR and protein level by Western blot; 5) C57BL6/J mouse destabilization of the medial meniscus (DMM) model will be used as an OA mouse model; 6) PRG4 expressing MSCs will be used for intraarticular injection into DMM mouse knees. **Results:** We anticipate that the tetO-inducible system will enable controlled and sustained expression of Lubricin within transfected MSCs in the knee. These engineered MSCs are expected to secrete functional Lubricin, which could enhance cartilage lubrication and protect against further degradation of OA. **Conclusion:** This approach may provide a foundation for developing cell-based gene therapies to restore joint homeostasis and mitigate OA progression.

FROM CONCEPT TO REALITY: DEVELOPING AN IMMERSIVE VR 3D MODEL FOR COMPLEX LIVER SURGERY EDUCATION

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Purpose and Hypothesis: Mastering liver anatomy and surgical planning requires precise spatial awareness and a deep understanding of complex anatomical structures. Traditional 2D imaging and static 3D models often lack the depth and interactivity needed for comprehensive learning, creating a gap in surgical training. Virtual reality (VR) offers an immersive, interactive alternative, yet its application in liver surgery remains underexplored. This study aims to develop a VR platform that overcomes the limitations of traditional imaging, enhancing trainee education and preoperative planning. **Methods:** In collaboration with biomedical communication specialists, we developed anatomically accurate 3D liver models optimized for VR in a shared, multiuser environment. These models, designed for the Oculus Quest 2 headset, allow users to rotate, scale, and adjust transparency to explore different anatomical layers. Trainees and surgeons participated in iterative feedback sessions to refine both anatomical accuracy and user interface design. **Results:** Preliminary feedback from a diverse group of users was overwhelmingly positive. Participants highlighted the system's intuitive design, ease of navigation, and strong correlation between 2D scans and the interactive 3D model. The multi-user functionality was particularly well received, facilitating collaborative discussions on anatomical structures and surgical planning. **Conclusion:** The development of immersive VR models for liver surgery marks a significant advancement in surgical education. By providing an interactive and anatomically precise simulation, VR enables trainees to explore complex anatomical relationships beyond what is possible with traditional imaging or static models. Future efforts will focus on refining the platform based on user feedback and integrating VR into routine surgical training and preoperative planning.

CLINICAL OUTCOMES AND HEMODYNAMIC PERFORMANCE OF THE SUTURELESS PERCEVAL AORTIC VALVE: LARGEST 10-YEAR SINGLE-CENTER STUDY OF 309 PATIENTS

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Purpose and Hypothesis: Sutureless valve technology can reduce cardiopulmonary bypass and cross-clamp times and facilitate minimally invasive aortic valve replacement (AVR). We aimed to assess the clinical outcomes, safety, and hemodynamic performance of the sutureless Perceval aortic valve prosthesis in patients undergoing surgical AVR. **Methods**: A retrospective, single-centre study was conducted on 309 patients who received the Perceval valve during AVR over a 10-year period (January 2014–June 2024). Preoperative, perioperative, and postoperative outcomes were evaluated using descriptive statistics. **Results**: Of 309 patients, 189 (61.2%) underwent elective surgery and 120 (38.8%) were urgent cases. The mean age was 71.6 ± 8.3 years, and 101 (32.7%) were female. Severe aortic stenosis was present in 209 patients (81.3%), and 56 (26.3%) had bicuspid aortic valves. AVR was combined with coronary artery bypass grafting (CABG) in 169 patients (54.7%), and mitral valve procedures in 69 patients (22.3%). The overall cross-clamp time was 61.7 ± 25.9 minutes, with 42.8 ± 15.4 minutes for isolated AVR and 72.4 ± 22.6 minutes for AVR with CABG. The median ICU stay was 1 day, and hospital stay was 7 days. In-hospital mortality was 4.2%, with 1.5% in the isolated AVR group and 5.9% in the AVR with CABG group. Stroke or transient ischemic attack occurred in 3.9% of patients, and 6.9% required new pacemaker implantation. The mean postoperative aortic valve gradient was 13.4 ± 5.2 mmHg, and the indexed effective orifice area (iEOA) was 0.9 ± 0.3 cm^2/m^2. Patient-prosthesis mismatch (iEOA <0.65 cm^2/m^2) occurred in 19.9% of cases, and the valve was well-seated in 98.7%. Clinically significant paravalvular leak occurred in 1.0%, with trace or mild leaks in 11.7%. **Conclusions**: The Perceval valve is a safe and feasible option for AVR, particularly in reducing cross-clamp times during concomitant procedures such as CABG. The incidence of patient-prosthesis mismatch and clinically significant paravalvular leaks is low.

GLIAL TRANSCRIPTIONAL DIVERSITY AND CELLULAR CROSSTALK FOLLOWING SPINAL CORD INJURY

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Purpose and Hypothesis: Spinal cord injury (SCI) triggers a complex glial response that influences various clinical manifestations, including paralysis, hypoesthesia, and dysautonomia. However, the transcriptional diversity and interactions of glial subpopulations remain unclear. We hypothesize that specific transcriptional programs in glial cells drive the changes after SCI. **Materials and Methods:** We analyzed transcriptional changes in glial cells after SCI using differential gene expression from single nucleus RNA sequencing datasets. We compared log2 fold-change values across injury conditions to identify transcriptional shifts in astrocytes, microglia, oligodendrocytes, and ependymal cells. Hierarchical clustering and functional enrichment showed distinct transcriptional trajectories and key biological processes in glial responses. We modeled ligand-receptor interactions to examine intercellular communication, mapping glial-glial and glial-neuronal crosstalk post-SCI, validated statistically with permutation-based enrichment testing ($p < 0.05$). **Results:** SCI caused major transcriptional shifts in glial populations (Padj < 0.05, log2FC > 1). Astrocytes upregulated Aqp4, Ctnnb1, and Serpina3n, while microglia showed inflammatory (Cxcl10, Trem2) and reparative (Igf1, Arg1) signals, with changing states ($p < 0.05$). Oligodendrocytes expressed remyelination genes (Mog, Plp1, Mbp), focusing on lipid metabolism and axonal support (Padj < 0.05). Ependymal cells activated progenitor genes (Sox2, Nes) and showed vascular-endothelial interactions ($p < 0.05$). Ligand-receptor analysis revealed sex-dependent astrocyte-microglia and neuron-oligodendrocyte interactions ($p < 0.01$). **Conclusion:** This study offers a statistically validated view of the glial response after SCI, revealing distinct subpopulations and signaling pathways. By analyzing differential expression and ligand-receptor interactions, the findings identify specific glial cell targets for therapies to enhance neuroprotection and recovery in SCI patients.

PARP INHIBITORS IN COMBINATION WITH CHEMOTHERAPY TO TARGET HOMOLOGOUS RECOMBINATION DEFICIENCY IN LEIOMYOSARCOMA

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Purpose and Hypothesis: Leiomyosarcoma (LMS) is an aggressive sarcoma with limited treatment options. Recent data identified homologous recombination deficiency (HRD) signatures in 64% of cases, suggesting that synthetic lethality of the DNA damage repair (DDR) pathway may present as a promising therapeutic approach. Our previous work demonstrated a synergistic effect between the PARP inhibitor talazoparib and the standard of care chemotherapy doxorubicin in a panel of LMS cell lines. To further investigate this, we analyzed DNA damage biomarkers and conducted a pilot *in vivo* study, hypothesizing that this combination would lead to increased DNA damage and improve treatment response. **Methods:** Immunofluorescence staining for γH2AX and RAD51 was performed to assess DNA damage and HR repair activity. A panel of LMS cell lines were treated with doxorubicin and talazoparib, using their IC_{50}'s, both individually and in combination. Foci were counted at various time points post-treatment and analysis was conducted using one-way ANOVA followed by Tukey's post-hoc test. Additionally, a pilot *In vivo* study was conducted, where LMS tumour-bearing mice were treated with doxorubicin and talazoparib. **Results:** LMS cell lines (n=4) exhibiting synergy in response to combination treatment showed a significant increase in γH2AX foci ($p<0.05$) and a reduction in RAD51 foci, indicative of persistent DNA damage. Additionally, mice treated with combination therapy demonstrated reduced tumour volume ($p<0.05$) compared to control and monotherapy groups. **Conclusion:** Our findings highlight the vulnerabilities of LMS and provide preclinical evidence supporting the use of doxorubicin and talazoparib as a synergistic treatment strategy to target HRD. The integration of DNA damage biomarker treatment approaches for LMS patients that present with HRD may help refine stratification for clinical trials in the future.

UNSUPERVISED MACHINE LEARNING CLUSTERING OF INJURED OLDER ADULTS TO SUPPORTING PATIENT-CENTERED OUTCOME PROGNOSTICATION AFTER SEVERE INJURY

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

USE OF INTERCOSTAL NERVE CRYOABLATION FOR THE MANAGEMENT OF POSTOPERATIVE PAIN AFTER PECTUS EXCAVATUM SURGERY IN OLDER ADOLESCENTS AND YOUNG ADULTS

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Purpose and Hypothesis: Pectus excavatum is associated with serious cardiopulmonary and psychosocial consequences. Video-assisted thoracoscopic (VATS) Nuss procedure effectively corrects these chest wall anomalies, however, the placement of one or more intrathoracic prostheses is associated with significant postoperative pain. Recently, intercostal nerve cryoablation (INC) has been demonstrated to reduce postoperative pain and length of admission (LOA) in children. This study aims to evaluate this technology in older adolescents/young adults. We hypothesize that INC will significantly reduce LOA and postoperative opioid use in this population. **Methods:** A retrospective cohort study was performed on all patients ages 16-35 who underwent VATS Nuss procedure with or without INC at St. Joseph's Health Centre between May 1, 2018 and September 30, 2024. Primary outcomes were LOA and cumulative postoperative opioid use. All continuous, normally distributed variables, including LOA, will be analyzed by comparison of means via a two-tailed t-test, while categorical data will be compared with the Chi-squared test. **Results:** Fifty-nine patients underwent VATS Nuss procedure, including 44 patients who received INC. No differences in baseline characteristics between control and cryoablation groups were seen. Mean LOA was reduced in the cryoablation group compared to controls (3.07 vs. 4.87 days, p=0.0006). Cumulative postoperative opioid use could not be accurately obtained and was excluded from the analysis. Mean duration of patient-controlled analgesia use was reduced in the cryoablation group, suggesting superior pain control (3.00 vs. 2.37 days, p=0.0204). **Conclusions:** INC is effective in reducing LOA following VATS Nuss procedure in this population, which may result in greater patient satisfaction and potential healthcare system savings. Further research is necessary to clarify its impact on postoperative pain and opioid use.

TUMOR-INFORMED LIQUID BIOPSY FOR ESOPHAGEAL ADENOCARCINOMA FROM MATCHED CANCER ORGANOID CULTURE

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Purpose and Hypothesis: Our project aims to develop a personalized liquid biopsy to monitor treatment response and recurrence in esophageal adenocarcinoma (EAC). Given the lack of recurrent mutations, detecting tumor-specific cfDNA in EAC is challenging. We hypothesize that patient-derived organoids (PDOs) can model ctDNA release, creating a mutational map to improve ctDNA detection in plasma. Since nucleosome positioning influences ctDNA fragmentation, PDO-derived cfDNA can help identify protected tumor-specific regions, enhancing assay sensitivity and specificity. This approach may enable earlier detection of residual disease and recurrence, improving patient prognosis and treatment. **Methods**: PDOs were derived from EAC tumor tissue and expanded in suspension culture. Chromatin was extracted and digested with MNase to isolate mononucleosomes (147 bp), followed by size selection. MNase-sequencing generated a mutation map enriched for nucleosome-protected DNA. Matched whole-genome sequencing of the tumor served as a control. Primers targeting identified mutations were used to amplify patient PDO DNA for sequencing. **Results**: DNA from five PDOs was digested with MNase, generating 147 bp mononucleosomes. MNase-sequencing identified 24 mutations in nucleosome-protected regions across 24 genes, including oncogenes. PCR confirmed the detectability of six genes using PDO or normal cfDNA. We also identified homozygous mutant allele fractions across a dilution series (0.01%-100%) with reference genetic material, demonstrating the ability to detect low-frequency mutations. **Conclusions**: Our findings confirm the isolation and PCR amplification of somatic mutations in PDO-derived nucleosomes, creating a nucleosome SNV map. We detected mutations even at low concentrations mixed with reference genetic material. Ongoing validation in patient blood ctDNA may enable personalized PCR panels for recurrence prediction and drug screening in EAC.

SURVEY OF CANADIAN SURGEONS' ATTITUDES TOWARDS MEDICAL ASSISTANCE IN DYING (MAID)

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Hypothesis and Purpose In 2023, medical assistance in dying (MAID) accounted for 4.7% of all deaths in Canada. Little is known about the role or attitudes of surgeons in this practice. This study aimed to assess surgeon: 1) experience with MAID, 2) knowledge of eligibility criteria, 3) attitudes towards MAID in ethically complex scenarios, and 4) interest in participating in MAID assessment and/or provisions.

Methods Following ethics approval, this cross-sectional study was conducted via an anonymous online survey distributed to 1040 practicing staff surgeons at the University of Toronto (November 21, 2024-February 7, 2025).

Results The response rate was 11.4% (n=119), primarily from General Surgery (31.9%; n=38), Obstetrics and Gynecology (23.5%, n=28), and Orthopedic Surgery (10.1%, n=12). Forty-nine percent (n=58) had been approached by patients requesting MAID, and typically responded with referrals to hospital MAID teams (27.2%, n=33) or other physicians (14.3%, n=17). While 32% (n=38) of surgeons self-reported at least 'good' knowledge of MAID eligibility criteria and 37.8% (n=45) reported that of the assessment process, 74.8% (n=89) answered a multiple-choice question assessing eligibility criteria for Track 1 and Track 2 patients incorrectly. Regarding MAID discussions, 45% (n=53) supported surgeons initiating conversations, while 29.4% (n=35) opposed this. With additional support, 29.4% (n=35) expressed interest in becoming MAID assessors and 25.4% (n=28) in provision.

Conclusion These findings highlight the evolving role of surgeons in MAID. While knowledge gaps exist and comfort levels vary, a notable proportion of surgeons are open to greater MAID involvement, suggesting the need for enhanced education and institutional support.

ADDRESSING ONTARIO'S SURGICAL BACKLOG THROUGH THE TORONTO REGIONAL ARTHROPLASTY COLLABORATIVE (TRAC): A ONE-YEAR REVIEW OF WEEKEND HIP AND KNEE ARTHROPLASTIES

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Purpose and Hypothesis: Hip and knee arthroplasties are among Canada's most common orthopedic procedures. Since the COVID-19 pandemic, Ontario has seen a decline in surgeries performed within recommended timelines. Currently, only 66% of hip and 59% of knee replacements meet these standards, compared to 75% and 70% in 2019. The purpose of this study was to assess a four-hospital arthroplasty collaborative that introduced weekend elective surgeries to expand operating room capacity. This collaborative was hypothesized to reduce wait times, improve outcomes, and enhance access for underserved populations. **Methods:** We conducted a retrospective review of hip and knee arthroplasty procedures performed from April 2023 to March 2024. Data from decision support teams and research were analyzed using descriptive and regression techniques. Key metrics included length of stay (LoS) and wait times (W1 for initial wait, W2 for elective procedures), alongside assessments of patient demographics from underserved neighborhoods. **Results:** A total of 759 procedures were performed (341 hips and 418 knees). Average LoS decreased from 1.4 days pre-intervention to 1.2 days post-intervention—a 14.3% reduction. The program began with two operating rooms (ORs) from April to August 2023, increasing to four ORs by September, which saw a record 103 procedures. Equity outcomes revealed that 20.4% of cases involved patients from high-priority, underserved neighborhoods. Average W1 time dropped from 100.3 to 55.1 days (a 45.1% reduction), while the W2 time decreased from 155.2 to 58.6 days (a 62.2% reduction). **Conclusion:** The weekend arthroplasty collaborative has significantly reduced wait times and enhanced access for underserved populations, while also improving resource utilization and system efficiency. Future directions will focus on setting new equity targets for the institution and delivery of care.

SAFE ACTIVITY PARTICIPATION FOLLOWING ELECTIVE TOTAL HIP REPLACEMENT – SAFET

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Purpose and Hypothesis: Total hip replacement (THR) is one of the most common elective orthopaedic surgeries performed, with increasing demand among younger individuals. Few evidence-based guidelines exist to guide recommendations on safe activity participation following THR, including whether high-intensity sport participation is safe for individuals. The purpose of this study was to identify if increased intensity of physical activity following THR was associated with increased activity-related pain and increased revision rates. **Methods**: Two groups of people undergoing THR were recruited: pre-operative (Cohort 1), and 5-7 years post-surgery (Cohort 2); both followed for five years. Activity was self-reported through validated questionnaires and grouped into categories from “A” (low intensity, e.g.: aquafit) to “F” (high intensity, e.g.: tennis). The primary outcome was the presence of hip pain during activity,, measured by the association between hip pain and intensity of activity (category A to F). Secondary outcomes included activity duration, revision rate, or a change in patient reported outcome measures (PROMs). **Results**: 1098 individuals were included in this study (Cohort 1: n = 588, Cohort 2: n = 510). Regression analysis showed no significant interaction between activity intensity and hip pain across all timepoints. Approximately 20.6% of all activity (11.0% of participants) was in the highest intensity categories (E and F); these subjects showed no decrease in activity duration, worsening PROMs, or increased revision rates compared to lower intensity activity groups. Certain activities (e.g. snowboarding, squash, tennis, and backpacking) were more correlated with hip pain, while others (e.g. snorkelling, swimming, home weights, aquafit, cross-country skiing, sledding) were less likely to have hip pain. **Conclusions**: This study showed that most activities are safe following THR. Surgeons can counsel individuals that certain activities (e.g. snowboarding, squash, tennis, and backpacking) may be associated with pain but not with increased revision rates.

MANAGEMENT OF HIGH BMI AND COMORBIDITIES IN MASCULINIZING CHEST SURGERY AT AN AMBULATORY CENTER: NO IMPACT OF BMI OR ASA ON COMPLICATION RATES

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Purpose and Hypothesis: Masculinizing chest surgery (MCS) is a frequently sought transition-related surgery. There is a paucity of data on outcomes for those with high BMI or ASA, who may be deemed 'too high risk'; our center is well-resourced to provide care to such patients. We aim to assess differences in management and postoperative complications based on BMI and ASA class among patients receiving MCS at our ambulatory center. **Methods**: A retrospective review of MCS performed from August 2021 to October 2024 by one surgeon at an ambulatory center in Toronto, Canada was conducted. Major postoperative complications included cosmetic revision or hematoma/seroma drainage in the operating room or unplanned visit to an emergency room. Minor complications included cosmetic revision or hematoma/seroma drainage under local anesthesia, nipple loss, and infection. Management variables included surgery type/method, airway management, and anesthetic type. Categorical variables were compared with the Chi-squared test and continuous variables with the Kruskal-Wallis test. **Results**: 532 surgeries were performed on people aged 15-66, BMI 16.1-58.7kg/m^2, and ASA class 1-4. Common comorbidities included sleep apnea, hypertension, and diabetes. Only 9 patients stayed overnight for additional monitoring (2), social support concerns (4), or comorbidities (2). There was no difference in total, major, or minor complications based on BMI or ASA class. Full mastectomy was the most common surgery, and double incision mastectomy with nipple grafts the most common method. Compared to those with underweight/normal BMI, periareolar and keyhole surgeries were less common, and breast reduction more common, among those with high BMI and ASA. Endotracheal intubation was more common than laryngeal mask airway among patients with higher BMI. **Conclusions**: We provide insights for management of patients with high BMI and ASA and demonstrate that they can safely receive MCS, as their rate of postoperative complications does not differ.

DEVELOPMENT AND VALIDATION OF AN ARTIFICIAL INTELLIGENCE BASED SCREENING TOOL FOR TRIAGE OF ACUTE TRAUMATIC CERVICAL SPINE INJURY: AUTOMATED SURGICAL INTERVENTION SUPPORT TOOL (ASIST-CSI)

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Purpose and Hypothesis: In this study, we develop and test an artificial intelligence (AI) based screening tool to predict likelihood of surgical intervention for patients with a traumatic injury to the cervical spinal column and/or spinal cord using computed tomography (CT).

Material and Methods: Patients with CST treated at an adult trauma center in Ontario, Canada from 2005 to 2023 were retrospectively included using a local trauma registry. Two channel separated convolutional networks (CSNs), three two-dimensional combination convolutional and recurrent neural networks, and two vision transformer models were trained, internally validated, and tested using cervical spine CT scans. Binary patient-level labels corresponding to whether the patient received surgical intervention to the spine served as the reference standard.

Results: There were 3,068 trauma patients with spine CT scans included in the study. There were 383 patients (12.5%) that underwent surgery for CST. There were 2,254 patients in the training and validation cohort (N=286 underwent surgery, 12.7%), 398 patients in the internal test cohort (N=50 underwent surgery, 12.6%), and 416 patients in the hold-out test cohort (47 underwent surgery, 11.3%). The CSN models were found to have the greatest mean sensitivity (91.5%, 95% CI: 80.1 - 96.6%), specificity (94.0%, 95% CI 91.1 – 96.0%), area under the receiver operating characteristic curve (0.93, 95% CI: 0.89 - 0.97), negative predictive value (98.7%; 95% CI 96.7 – 99.5%), and positive predictive value (61.4%; 95% CI 48.4 – 72.9%).

Conclusion: This study demonstrates, for the first time, that AI-based prediction models can be used to identify patients with CST who are likely to require surgical intervention.

MITOCHONDRIAL TRANSPLANTATION FOR THE RECOVERY OF DONOR LUNGS SUBJECTED TO PROLONGED WARM ISCHEMIA: A NOVEL STRATEGY TO EXPAND THE DONOR POOL FOR TRANSPLANTATION

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

EXCISION *VS* PRESERVATION OF INFRAPATELLAR FAT PAD DURING TOTAL KNEE ARTHROPLASTY: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

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Purpose and Hypothesis: This study aims to systematically review and analyze the existing literature to evaluate whether IPFP resection or preservation leads to superior patient outcomes.

Methods: This systematic review followed PRISMA guidelines. A database search (PubMed, Medline, Embase, Ovid, Cochrane, CBM, CNKI, VIP, Wangfang) was conducted on 10/10/2024. Eligible studies included RCTs and comparative studies on IPFP preservation vs. resection. Outcomes included VAS, PTL, ISR, anterior knee pain, KSS, and ROM. A meta-analysis using a random-effects model assessed homogenous RCTs and prospective studies across all time points with the level of significance set at $p<0.05$.

Results: A total of 728 studies were identified, with 21 included (11 RCTs, 4 prospective, 6 retrospective), and a total of 3,525 patients (4,107 TKAs): 2,298 knees with IPFP preserved and 1,809 resected. Meta-analysis included 961 knees (456 preserved, 505 resected). IPFP preservation significantly reduced pain severity at 12 months (k=3, MD=-0.954, 95% CI [-1.368, -0.540], $p<0.001$, $I^2=0\%$). Rate of anterior knee pain were comparable at 6 months (k=5, OR=0.846, 95% CI [0.406, 1.764], p=0.656, $I^2=11.47\%$) and 12 months (k=6, OR=0.846, 95% CI [0.144, 2.193], p=0.407, $I^2=74.07\%$). PTL was similar at 6 months (k=3, MD=1.585, 95% CI [-1.123, 4.294], p=0.251, $I^2=82.03\%$), but at 12 months, preservation had a significant advantage (k=5, MD=0.816, 95% CI [0.050, 1.583], p=0.037, $I^2=73.77\%$). No significant difference in KSS scores, range of motion, and rate of complications between both groups.

Conclusion: IPFP resection showed greater VAS and patella baja, so we recommend minimal resection of the IPFP necessary for exposure while prioritizing preservation.

ELECTROPHYSIOLOGICAL SIGNATURES AND EFFECTS OF PALLIDAL BURST STIMULATION IN PARKINSON'S DISEASE

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Hypothesis: Parkinson's disease (PD) is a neurodegenerative disorder characterized by dopaminergic neuron loss in the substantia nigra pars compacta (SNc), disrupting basal ganglia circuitry and causing hypokinetic symptoms. Reduced direct pathway activity leads to hyperactive globus pallidus internus (GPi), suppressing movement. Burst high-frequency stimulation of D1-MSNs has shown therapeutic benefits in Parkinsonian rodent models. Our clinical study found that conventional deep brain stimulation (DBS) in PwPD elicited an inhibitory field-evoked potential (fEP) in the GPi. We hypothesize that intraoperatively optimized burst stimulation could enhance fEP in the GPi, improving therapeutic outcomes. **Materials and Methods:** This intraoperative experiment involved inserting two microelectrodes—one for stimulation and one for recording. After detecting a unit, we applied a stimulation paradigm starting with 1 Hz low-frequency stimulation (LFS) for 5 seconds to establish a baseline fEP. This was followed by 150 Hz or 200 Hz burst stimulation for 200 ms with an 800 ms pause, then another 1 Hz LFS to measure post-stimulation fEP. We analyzed relative changes in fEP amplitude and firing rate before and after burst stimulation, along with firing rate dynamics during inter-burst intervals. **Results:** Burst stimulation at 150 Hz and 200 Hz significantly potentiated the fEP ($p < 0.0001$). However, the firing rate dynamics varied across patients, highlighting inter-individual heterogeneity. Additional data is needed to robustly evaluate the effects of different burst stimulation frequencies on firing rate modulation. **Conclusion:** Our study aims to develop a stimulation paradigm based on the GPi's electrophysiological signature to optimize DBS treatment. Higher-frequency burst stimulation suppressed overall unit activity in the GPi, which may help reduce GPi hyperactivity in PwPD. However, some units exhibited heterogeneous activity, possibly reflecting differences in cell types.

UNDERSTANDING THE IMPACT OF COVID-19 PANDEMIC ON DIAGNOSIS AND MANAGEMENT OF LUNG CANCER: A COMMUNITY HOSPITAL EXPERIENCE

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Purpose: Lung cancer remains the leading cause of cancer-related mortality worldwide, with surgical resection serving as the cornerstone of curative treatment. The COVID-19 pandemic significantly impacted cancer care by delaying screening, diagnosis, and treatment for millions of Canadians. This study aims to examine the effects of the pandemic on lung cancer care patterns among patients undergoing surgical resection at our Thoracic Surgery program. **Methods:** We conducted a retrospective cohort study of all patients who underwent lung resection for lung cancer at Michael Garron Hospital between 2018 and 2024. Patients were categorized into three cohorts: pre-COVID (2018–2020), COVID (2020–2022), and post-COVID (2022–2024). We analyzed patient demographics, time to surgery, length of stay, receipt of multimodal treatment, and pathologic stage. **Results:** 1,090 patients were included: 412 pre-COVID, 359 COVID, and 316 in the post-COVID cohort. Demographics were comparable across cohorts: median age of 69 years (IQR: 63–75) and 639 (58%) male patients. The time from consent to surgery was shorter in the COVID cohort compared to the others (26 vs. 29 days, $p<0.05$). Length of hospital stay was also shorter during the COVID and post-COVID periods compared to pre-COVID (median 2 vs. 3 days, $p<0.05$). A higher proportion of patients presented with advanced cancer (Stage III) in the pre-COVID cohort (15% vs. 9%, $p<0.05$). **Conclusions:** This retrospective cohort study found no significant delays in lung cancer surgical care during the COVID-19 pandemic. Time to surgery may have been expedited due to increased resource allocation. Patterns of operable lung cancer cases appear to be shifting, with a higher proportion of early-stage diagnoses in the post-COVID period likely suggestive of more patients seeking medical care or having chest imaging done. Efforts should focus on achieving pre-COVID volumes but revamping screening programs.

THE RELATIONSHIP BETWEEN ELECTROARTHROGRAPHY AND ACUTE SYNOVITIS IN A HORSE MODEL

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Purpose and Hypothesis: Electroarthrography (EAG) is a non-invasive method for assessing cartilage by measuring streaming potentials generated during joint loading that arise from interactions between the extracellular matrix and interstitial fluid. While EAG has been used to evaluate cartilage in human and equine joints and has shown promising results for the potential detection and tracking of cartilage degradation, the effects of inflammation on EAG signals remain unknown. It is hypothesized that EAG signals will be altered by acute synovitis, induced by intra-articular lipopolysaccharide (LPS) injections and will correlate with animal gait pattern (lameness). **Methods**: Six mixed-breed horses underwent two 7-day study periods, receiving LPS injections in the midcarpal joint. Four hours post-injection, joints were treated with either saline (control) or an osteoarthritis therapy. EAG and lameness assessments were conducted at baseline, 4 hours (pre-treatment), 24 hours, and 168 hours post-injection. Lameness was evaluated using the AAEP scale and flexion tests. **Results**: Data from ten joints revealed that in seven cases where the horses became lame due to inflammation, EAG coefficients significantly decreased 4 hours post-injection ($p < 0.049$). In the 3 joints with minimal lameness changes, EAG remained similar to baseline ($p > 0.058$). Most affected joints returned to baseline EAG and lameness within 168 hours, regardless of treatment. EAG was significantly correlated with changes in lameness ($r = -0.545$, $p < 0.001$) and flexion assessments ($r = -0.522$, $p < 0.001$). **Conclusions**: This study confirms that inflammation alters EAG signals, likely due to thickening of the synovium and changes in synovial fluid composition. This work supports the development of EAG as a potential diagnostic tool for tracking joint health and emphasizes the need to account for inflammation when interpreting EAG data for the detection of cartilage damage and diagnosis of osteoarthritis.

A BRAIN NETWORK UNDERLYING RESPONSE TO VAGUS NERVE STIMULATION IN CHILDREN

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Purpose and Hypothesis: Vagus nerve stimulation (VNS) is widely used in children with drug-resistant epilepsy (DRE), yet only half experience meaningful seizure reduction. We hypothesized that presurgical imaging, rather than clinical features, could identify children more likely to respond. The study aimed to define structural and network-based imaging markers predictive of VNS response.

Methods: We analyzed data from 1031 children with DRE undergoing VNS across 11 North American pediatric epilepsy centres, using both retrospective and prospective cohorts. Response was defined as ≥50% seizure reduction. Multivariate models assessed clinical and electroencephalographic predictors. T1-weighted MRI was compared to scans from 2382 typically developing children to identify regions of cortical atrophy. These were mapped to a shared brain network, and network specificity was tested in children treated with temporal lobectomy (n=92) and centromedian thalamic deep brain stimulation (CM-DBS; n=17). Analyses were performed from September 2021 to August 2024.

Results: Presurgical clinical and EEG variables did not predict VNS response (AUC: 0.49, $p > 0.99$). However, atrophy in frontal, temporal, and somatosensory cortices predicted poor outcome (AUC: 0.73, $p = 0.02$). These regions formed a structural network more intact in responders ($t = 2.1$, $p = 0.04$). The network was specific to VNS, as it did not predict outcomes after temporal lobectomy or CM-DBS.

Conclusions: In this large pediatric VNS cohort, clinical variables lacked predictive value. A novel structural brain network involving frontal, insular, and somatosensory regions predicted treatment response and may serve as a presurgical biomarker to improve patient selection.

A MOUSE MODEL FOR PRE-TRANSPLANT ADMINISTRATION OF REGULATORY T CELLS (TREGS) TO DONOR LUNGS FOLLOWED BY LUNG TRANSPLANTATION (LTX)

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Purpose and Hypothesis: Tregs can modulate graft rejection by suppressing T cell activation. In previous studies, we delivered Tregs to rat lungs using Ex Vivo Lung Perfusion (EVLP) prior to LTx, resulting in inhibition of conventional T cell activation at day 3 and increased graft $FOXP3^+$ cells at day 7 post-LTx. This study aims to establish a mouse model for Treg administration to donor lungs, prior to implantation, followed by LTx. Success of a mouse model will allow the use of transgenic mice to test the effects and mechanisms of pre-LTx-administered Tregs on inhibiting lung allograft rejection and fibrosis. **Methods**: Tregs were isolated from C57BL/6 (B6) FOXP3 DTR/GFP/J mice. Lymph node and spleen CD4+ T cells were enriched by magnetic negative selection. $GFP^+CD4^+CD25^+$Tregs were sorted using fluorescence-activated cell sorting and activated with anti-CD3 and anti-CD28 beads with 104 units/mL recombinant human interleukin-2. After 10 days in culture, 9.0×10^6 GFP^+ Tregs were administered to the left lung of C57BL/10J (B10) donor mice via the pulmonary artery after lung flush preservation. Flow cytometry and microscopy were performed on lungs 1.5 hours post-administration to assess Treg presence. In a separate group of B10 donor lungs, 4.1×10^6 Tregs were administered, then lungs were transplanted into B6 recipients, followed by flow cytometry analysis 1-day post-LTx. **Results**: Flow cytometry revealed that 1.5 hours post-administration, 6.4×10^5 cells (7.1% of administered Tregs) in the lung, representing 9.7% of live $CD45^+$ cells. Immunofluorescence showed GFP^+Tregs were localized primarily in the capillaries. In the LTx experiment, 1.0×10^5 cells (2.4% of administered Tregs) persisted in the graft 1 day post-LTx (1.8-2.7% of live $CD45^+$ cells. **Conclusions**: Tregs were successfully administered to donor lungs prior to LTx and persisted at least 1-day post-LTx. We continue to study their long-term persistence and functional role in promoting graft acceptance.

MULTIDISCIPLINARY ONCOLOGY EDUCATION AMONG POSTGRADUATE TRAINEES: A SYSTEMATIC REVIEW

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Hypothesis and Purpose: Understanding the roles and patient management approaches of the entire oncology team is imperative for effective communication and optimal cancer treatment. Currently, there is no standard residency or fellowship curriculum to ensure delivery of fundamental knowledge and skills associated with oncology specialties with which trainees often collaborate. This study is a systematic review to evaluate the multidisciplinary oncology education in post-graduate medical training.

Methods: A systematic literature search was performed using MEDLINE, Embase, Cochrane Database of Systematic Reviews, Cochrane CENTRAL, APA PsycINFO, and ERIC in July 2021. Updates were performed in February 2023 and October 2024. Original studies reporting the effectiveness of multidisciplinary oncology training among residents and fellows were included.

Results: A total of 6,991 articles were screened and 24 were included. Fifteen studies analyzed gaps in existing multidisciplinary training of residents and fellows from numerous fields, including surgical, medical, and radiation oncology, geriatrics, and palliative medicine. Trainees reported limited teaching and knowledge of oncology outside of their respective fields and endorsed the need for further multidisciplinary oncology training. The remaining nine studies assessed the effectiveness of educational interventions, including tumor boards, didactic sessions, clinical rotations, and case-based learning. Trainees reported significant improvements in multidisciplinary oncology knowledge and skills following the interventions.

Conclusions: These data suggest postgraduate medical trainees have limited formal multidisciplinary oncology training. Existing educational interventions show promising results in improving trainees' oncology knowledge and skills. There is a need for further research and the development of multidisciplinary oncology curricula for postgraduate medical training programs.

ESTABLISHING NUTRITIONAL MANAGEMENT GUIDELINES FOR GASTRIC CANCER CARE: A RAND/UCLA MODIFIED-DELPHI CONSENSUS PANEL

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Purpose and Hypothesis: We initiated a RAND/UCLA Modified-Delphi Consensus Panel to establish nutritional management guidelines for patients with gastric cancer (GC). Guidelines addressing specific micro- and macro-nutrient testing and supplementation for the support of patients with GC, may lead to better quality of life and post-gastrectomy outcomes. **Methodology:** A panel of 45 interdisciplinary healthcare providers (HCPs), and 15 GC patients/advocates met virtually after initially evaluating 215 evidence-driven statements on nutritional management in GC. Appropriateness of each statement was evaluated using a 9-point Likert scale (1-3: inappropriate, 4-6: uncertain, 7-9: appropriate). Appropriateness or inappropriateness was deemed if ≥75% of respondents scored 7-9 or 1-3, respectively. **Results:** A total of 303 statements were proposed after 2 rounds of rating and discussion. 143 out of 303 statements were rated as appropriate for management of nutrition in GC. Correction of identified nutrient deficiencies was largely rated as appropriate. Investigations for sarcopenia and bone mineral density were identified as an area with limited evidence. Intervals of nutrition testing were greatly discussed and vary by nutrient. Across the panelists, there is uncertainty surrounding prophylactic supplementation and monitoring of nutrients in GC management. Panel discussion identified the need for a care coordinator to navigate nutrition management. Longer (>5 years) follow-up periods and publicly funded support for nutritional needs were rated as appropriate. The panelists voiced that indefinite follow-up and access to cancer care providers for nutritional management was necessary. **Conclusion:** The large number of uncertain statements reflect the lack of specific evidence and education in GC literature. This work provides a framework for nutritional care in GC while identifying the significant gaps in existing literature. Areas in which there is agreement of appropriateness will form the basis for guidelines for nutritional support for GC patients.

EXPLORING SECOND VICTIM SYNDROME AMONG SURGEONS AT THE UNIVERSITY OF TORONTO AND ASSESSING THE NEED FOR PEER SUPPORT

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Purpose and Hypothesis: Second Victim Syndrome (SVS) is a term that encompasses the emotional and psychological changes experienced by healthcare providers after an adverse event. It is believed to be a nearly universal experience, and peer support programs have emerged as a helpful intervention. This study aimed to understand the experiences of faculty surgeons with SVS at the University of Toronto and determine whether an unmet need for a peer support program exists. We hypothesized that our surgeons would experience SVS with similar frequency to the reported literature, and that interest in a peer support program would be high. We also anticipated higher rates of SVS among female and early-career surgeons based on reports in the literature. **Methods**: A web-based questionnaire was distributed to staff surgeons in the University of Toronto Department of Surgery. The survey included demographics, the validated Second Victim Experience and Support Tool (SVEST), and a gauge of interest for a local peer support program. Descriptive statistics were used to report the SVEST according to the published protocol, and comparative subgroup analysis was performed to determine at-risk demographics for SVS. **Results**: In total, 120 participants were surveyed for a response rate of 21.6%. SVEST scores were highest in the psychological distress, colleague support, and institutional support domains, representing more burden from SVS in these areas. There was no difference in scores between genders. General surgeons had higher scores in the turnover intentions dimension than surgeons in the other divisions. Mid-career surgeons had higher scores in the physical distress, colleague support, and turnover intentions dimensions. More than half of participants were in favor of a local peer support program. **Conclusions**: Our results confirm that surgeons at our institution experience SVS mainly in the form of psychological distress, and that most surgeons are in favor of a peer support program.

ACCESS TO CARDIAC SURGERY IN ONTARIO, CANADA: A GEOSPATIAL ANALYSIS

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Purpose and Hypothesis: This study aims to determine what proportion of the population across Ontario can reach cardiac surgical care within given distances and time frames. We hypothesize that access is high in but poor outside metropolitan areas, resulting in delays to emergency cardiac surgery and geographic barriers to scheduled surgery and follow-up. **Methods**: Ontario GeoHub, CensusMapper, Ontario Ministry of National Resource and Forestry, Canadian Institute for Health Information, and Statistics Canada were sourced to obtain geospatial datasets on the most recent population densities, dissemination areas boundaries, road infrastructure and regulations, and airport locations. Travel times and distances were calculated by road using a least-cost path algorithm for the entire population across Ontario to the nearest cardiac surgical centre using ArcGIS (Esri, Redlands, CA, USA). **Results**: In 2021, 14,223,942 people lived across Ontario, representing 13.2 people per km^2. A total of 11 cardiac surgical centres were identified across Ontario, equaling one centre per 1.29 million people. Based on distance, 74.8% (N=10,642,087), 87.9% (N=12,507,938), and 97.1% (N=13,812,881) of people in Ontario can access a centre within 50km, 100km, or 200km, respectively, with a total range of 0-1,753km. Based on time, 81.9% (N=11,655,837) and 91.8% (N=13,063,517) of people in Ontario can access a centre within one hour or two hours, respectively, with a total range of 0-20.5 hours. Research is ongoing to evaluate how socioeconomic characteristics are geospatially distributed across Ontario, whether regional clustering of disparities exists, and how seasonality affects access.

Conclusions: In Ontario, geospatial access to cardiac surgery is high for populations in or near metropolitan areas but greatly varies for populations in rural and remote regions. Efforts are required to strengthen preventive measures, telemedicine for follow-up and guideline-directed imaging surveillance, and expanded air transfer capacity across the province to leave no one behind.

MINIMUM CLINICALLY IMPORTANT DIFFERENCE AND PATIENT ACCEPTABLE SYMPTOMATIC STATE VALUES IN PRIMARY SPORTS FOOT AND ANKLE INTERVENTIONS: A SYSTEMATIC REVIEW

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Purpose: Minimal clinically important difference (MCID) and patient-acceptable symptom state (PASS) are key metrics for assessing outcomes in orthopedic procedures. Despite the significant impact of foot and ankle injuries on daily life, literature on MCID and PASS for related interventions remains limited. This study evaluates MCID and PASS values for sport-related foot and ankle surgeries to aid clinical decision-making and enhance patient care.

Methods: A systematic search of MEDLINE, Embase, Cochrane, PubMed, and Scopu (inception date: September 10, 2024) identified studies reporting MCID or PASS values for these interventions. PRISMA guidelines followed, and extracted data included study characteristics, outcome measures, treatment types, and MCID/PASS calculation methods.

Results: Six studies (n=1651, 767 females, 894 males; mean age 48.45 years) were included, covering hallux valgus (2), acute Achilles tendon rupture (3), and chronic ankle instability (1). Follow-up averaged 8.2 months. Two studies reported PASS values for Achilles tendon ruptures using anchor-based satisfaction methods. Four studies calculated MCID values using anchor-based methods, with outcome measures including AOFAS (7.9–30.2), MIC for GRoC (-28.5), EQ-5D-5L mobility (13.5), MOXFQ walking (16), and VAS (1.8–5.2)

Conclusion: MCID/PASS values for foot and ankle injuries vary. Standardized reporting criteria are needed to optimize treatment decisions, enhance patient satisfaction, and improve care standards in foot and ankle pathology management.

COVERED STENTS FOR FEMORAL ARTERY PSEUDOANEURYSMS FOLLOWING PERCUTANEOUS TAVI: A CASE SERIES

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Background: Percutaneous transfemoral transcatheter aortic valve implantation (TAVI) is a widely adopted procedure for treating aortic stenosis in high-risk patients. However, vascular complications, including femoral artery pseudoaneurysms (PSAs), remain a concern. This study evaluates the use of covered stents for the treatment of femoral artery PSAs following percutaneous TAVI at Trillium Health Partners.

Methods: A retrospective review was conducted of all patients who underwent percutaneous TAVI and developed femoral artery PSAs treated with covered stents at THP from April 2023 to present. Patient demographics, comorbidities, procedural details, and outcomes were analyzed.

Results: A total of 16 patients were included, with a mean age of 80.69 ± 1.55 years. The cohort was 81.3% male (n=13) and 18.8% female (n=3). Common comorbidities included: coronary artery disease (43.8%), hypertension (75%), dyslipidemia (62.5%), and type 2 diabetes (25%). Medication use at admission included aspirin (37.5%), clopidogrel (6.3%), and DOACs (18.8%). At discharge, medications were adjusted, with 75% on aspirin, 81.3% on clopidogrel, and 2 patients on DOACs. All procedures utilized the MANTA closure device at the end of the procedure. Access site pseudoaneurysms were treated with covered stents achieving a 100% technical success rate. Follow-up ultrasound at 1 month demonstrated 100% stent patency with no recurrent PSAs.

Conclusion: This case series demonstrates that covered stents are a safe and effective treatment for femoral artery pseudoaneurysms following percutaneous TAVI, achieving excellent short-term outcomes. At 1-month follow-up, all stents remained patent with no cases of recurrent PSA. Further studies with larger cohorts and extended follow-up are needed to assess long-term durability and clinical outcomes.

META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS: COMPARING CASTING AND PERCUTANEOUS SCREW FIXATION FOR NON-DISPLACED OR MINIMALLY DISPLACED SCAPHOID WAIST FRACTURES

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Purpose and Hypothesis: The purpose of this study was to compare the efficacy of percutaneous screw fixation versus cast immobilization in managing non-displaced or minimally displaced scaphoid waist fractures. It was hypothesized that percutaneous screw fixation would demonstrate superiority in union rate, time to union, and time to return to work.

Methods: A comprehensive search of MEDLINE, Embase, CINAHL, and Cochrane databases was conducted. Randomized controlled trials evaluating adults with non-displaced or minimally displaced scaphoid waist fractures treated with either percutaneous screw fixation or cast immobilization were included. Six trials with 639 patients (315 surgical, 324 nonsurgical) were analyzed. Outcomes, including union rate, time to union, return to work, grip strength, immobilization duration, and complications, were synthesized using random-effects models.

Results: Percutaneous screw fixation significantly improved union rates in comparison to casting (1.6% nonunion vs. 7.1%; $p = 0.002$), reduced time to union (7.2 weeks vs. 11.6 weeks; $p < 0.001$), and shortened return-to-work duration (4.6 weeks vs. 11.5 weeks; $p < 0.001$). Grip strength was slightly higher in the surgical group (30 kg vs. 28 kg; $p < 0.001$), and immobilization duration was markedly reduced (0.5 weeks vs. 8.3 weeks; $p < 0.001$). Revision rates were also lower in the surgical group (3.2% vs. 7.4%; $p = 0.02$), with no significant differences in overall complication rates between groups. **Conclusion:** Percutaneous screw fixation offers superior short-term outcomes compared to cast immobilization for non-displaced or minimally displaced scaphoid waist fractures. Further research should investigate long-term outcomes and the economic implications of these treatment modalities.

A DEDICATED TRAUMA OPERATING ROOM FOR HAND SURGERY REDUCES AFTER-HOURS CASES WITHOUT AFFECTING WAIT TIMES: A RETROSPECTIVE SINGLE-CENTER COHORT STUDY

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

RELATIONSHIP BETWEEN PROMININ-1 AND STAT3/JAK PATHWAY IN BILIARY ATRESIA

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Biliary Atresia (BA) is a congenital condition characterized by the obstruction of bile in the bile duct. Multiple studies have pointed out the possible connection between BA and a penta-span transmembrane protein named Prominin-1 (CD133). Prom-1 is a penta-span transmembrane protein found in many different cells types including liver cells and cholangiocytes, is a popular cancer stem cell marker. However, its contribution to bile duct regeneration has remained elusive. With this information, we aim to explore the link between prominin-1 and STAT3/Jak pathway in Biliary Atresia. A group of scientists from Korea have demonstrated the ability of Prom-1 extracellular domain 1 to bind to GP130, a glycoprotein acting up-stream of STAT3 signalling pathway, to rescue Prom-1 KO phenotypes3. Nonetheless, there is one more glycoprotein binding site located at the extracellular domain 2 of Prom-1 which they have failed to address. Here, we proposed to carry out a binding assay via immunoprecipitation on GP130 with different isolated domains of Prom-1 to investigate their ability to trigger STAT3 signalling in bile duct. Using RT-qPCR, we also aim to quantify mRNA level of STAT3/Jak related protein family such as Gil in injured bile duct tissue. Combining the result from the experiments, we hope to shred more light on the relationship between STAT3/JAK and Prom-1 in BA.

INSIGHTS INTO RADIOTHERAPY RESPONSE AND MENINGIOMA BIOLOGY THROUGH MOLECULAR CHARACTERIZATION OF RTOG-0539 CLINICAL TRIAL

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

A NOVEL INTRAOPERATIVE RADIATION-FREE TECHNIQUE FOR ACCURATE LUNG TUMOR LOCALIZATION IN VIDEO ASSISTED THORACIC SURGERY

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Hypothesis and Purpose: Localization of small, non-palpable lung tumors remains a challenge in video-assisted thoracoscopic surgery (VATS). Traditional localization methods, such as microcoils and hook wires, require intraoperative fluoroscopy, leading to radiation exposure. Previously, we demonstrated the accurate placement and stable detectability of the Magnetic Occult Lesion Localization Instrument (MOLLI) system - a commercially available technology used in breast cancer surgery - under respiratory motion without dislocation in *ex vivo* porcine lung models. This study evaluates the feasibility and accuracy of the MOLLI system for intraoperative radiation-free lung tumor localization in *in vivo* porcine models. **Methods:** The MOLLI system features a handheld probe for real-time position and distance detection of a 1 mm × 3.2 mm magnetic marker, preloaded in an 18-gauge needle. Under general anesthesia and mechanical ventilation, pseudo tumors (PTs) were created by transbronchial injection of an agar gel - barium mixture into the lung of Yorkshire pigs (n=4). CT-guided transthoracic insertion was used to place markers near the PTs. Intraoperatively, the MOLLI system enabled real-time marker localization without fluoroscopy, followed by a VATS wedge resection. **Results:** Six markers were placed in proximity to six separate PTs. One marker became dislodged from the lung surface after the insertion and fell into the thoracic cavity, leaving five PTs for analysis. The mean PT diameter was 7.94 ± 0.78 mm, and the mean depth from the lung surface was 6.84 ± 2.42 mm. The mean marker depth from the lung surface was 11.92 ± 8.19 mm, with a mean PT-to-marker distance of 7.32 ± 3.64 mm. No pneumothorax occurred. All five markers were successfully detected intraoperatively, and VATS wedge resections were performed with adequate surgical margins (median: 28.6 mm, range:11.8-54.1 mm). **Conclusions:** The MOLLI system enabled precise, radiation-free intraoperative localization of small lung lesions, supporting its potential as an alternative to fluoroscopy-based techniques for VATS wedge resection.

NEUROPROTECTIVE AND ANTI-INFLAMMATORY EFFECTS OF TRPM7 KINASE INHIBITION IN NEONATAL HYPOXIC-ISCHEMIC BRAIN INJURY

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

DIGITAL TWINS OF EX VIVO HUMAN LUNGS ENHANCE PRECLINICAL THERAPEUTIC EVALUATION

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Purpose and Hypothesis: Digital twins show great potential in transplant medicine for evaluating new therapies to repair injured donor organs. Ex vivo lung perfusion (EVLP) sustains donor lungs before transplantation and generates real-time, multi-modal data, offering a unique opportunity to train machine learning models to forecast lung function and create digital twins of human lungs. We hypothesize a digital twin of an ex vivo lung will accurately simulate donor lung function during EVLP and can be used as a robust control for clinical research.

Methods: Lung physiology, biochemistry, proteomic and metabolomic biomarkers, transcriptomics, and imaging features were derived from n=1000 EVLP cases performed at our centre (2008-2024). For each parameter, a multi-modal time-series forecasting model (XGBoost, gated recurrent unit) was trained to predict future lung function using baseline EVLP data, with mean absolute percentage error as the primary model evaluation metric. Therapeutic efficacy (pulmonary arterial pressure, PAP) and safety (edema) of a thrombolytic treatment were evaluated using the digital twins of n=14 EVLP cases with suspected pulmonary emboli.

Results: The digital lung model accurately predicted donor lung function for over 75 functional parameters during EVLP, with an average error of 5.5% compared to the observed values. The digital twin approach identified treatment-induced reductions in PAP without causing lung edema in thrombolytic-treated lungs, tailored to each individual case.

Conclusion: Digital twins enable comparisons between treated organs and their virtual digital twins, advancing precision medicine at the organ level and preclinical evaluations of therapies, leading to more efficient clinical trials in transplant medicine.

IDENTIFICATION OF PATIENTS AT RISK OF MODERATE-TO-SEVERE PAIN AFTER GASTROINTESTINAL CANCER DIAGNOSIS

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Hypothesis and Purpose: Pain is one of the most feared and debilitating symptoms among patients with cancer, with considerable impact quality of life and well-being. We hypothesize that specific baseline characteristics are associated with patients reporting moderate-to-severe pain after gastrointestinal (GI) cancer diagnosis. We aim to evaluate the patient-reported pain burden following a GI cancer diagnosis and to identify the risk factors known at the time of diagnosis associated with higher levels of pain, to develop a predictive nomogram and guide pain management strategies. **Methods** This retrospective cohort study included adult patients diagnosed with GI cancer between 2011-2019 at a Reginal Cancer Center in Ontario, with Edmonton Symptom Assessment System (ESAS) completion at diagnosis and 4 months post-diagnosis. The primary outcome was moderate-to-severe pain at 4 months. Univariate and multivariate logistic regression analyses were performed to identify independent risk factors for subsequent nomogram development. **Results** Of 7298 patients, 1538 patients reported moderate-to-severe pain at 4 months. Multivariable analysis identified baseline pain scores as the variable most strongly associated with patient-reported pain score at 4 months. Baseline reporting of moderate pain presented an aOR of 3.48 (95% CI 2.78, 4.35), and severe pain with an OR of 6.85 (95% CI 5.22, 8.99). Other factors associated with increased odds of reporting moderate-to-severe pain score at 4 months were higher material deprivation, higher comorbidity and diagnosis of pancreatic, gastric and esophageal cancer. **Conclusions** Patient reported pain burden at the time of diagnosis is the most predictive factor associated with reporting moderate-to-severe pain at 4 months. These findings inform the development of a nomogram to identify of patients at risk of significant pain in the future.

DETERMINING THE PRESENCE AND MECHANISM OF FERROPTOSIS IN STEEN-RELATED CELL INJURY IN A CELL CULTURE MODEL

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Purpose: *Ex-vivo* lung perfusion (EVLP) with Steen solution can support the donor lungs for several hours and has greatly improved donor lung assessment and utilization. However, Steen solution has limited nutrients and lacks cytoprotective components. This study aims to examine the effect of Steen solution on basic cellular functions and identify mechanisms of injury to target with nutrients and therapeutics. We hypothesized that Steen solution exposure to cells leads to activation of ferroptosis - an iron-mediated programmed cell death. **Methods**: Human bronchial epithelial cells and human pulmonary microvascular endothelial cells were cultured to sub-confluence at 37℃ and then exposed to either Steen solution or culture for 2, 4, 24 and 48h. Antioxidant and protein levels related to ferroptosis were examined with enzymatic assay and western blotting, respectively. **Results**: Glutathione levels were significantly depleted in BEAS-2B cells incubated in Steen solution compared to DMEM after 24h. Glutathione peroxidase 4 activity, which attenuates lipid peroxidation, was significantly decreased in Steen solution after 48h. However, no difference in protein levels was observed. SLC7A11 protein, involved glutathione synthesis, was increased in Steen solution after 48h. No significant changes in protein levels of the antioxidative transcription factors NRF2 was observed after 48h, however, its regulator, KEAP1, significantly decreased in both cell types. FTH1 (ferritin heavy chain, a ferroxidase enzyme) protein levels were significantly increased, while the levels of NCOA4, modulator for FTH1 degradation were decreased. **Conclusions**: Steen led to impaired anti-oxidative function in both cell types, which may reduce protection against ferroptotic mechanisms. Prolonged exposure results in compensatory changes towards anti-ferroptosis.

INVESTIGATING THE ROLE OF QKI IN TUMOR DIFFERENTIATION IN ESOPHAGEAL ADENOCARCINOMA

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Purpose and Hypothesis: QKI is a splicing factor gene encoding the RNA-binding protein Quaking. Previous studies have shown that it serves as a multifunctional regulator in various tumor progression, while its association with esophageal adenocarcinoma (EAC) has not been reported. We aimed to investigate QKI's role in the progression of EAC, focusing on its impact on clinical outcomes and potential mechanisms in regulating tumor differentiation. **Methods:** Bulk RNA sequencing data was obtained from 73 MOCHA patients and 26 organoids derived from these patients with laser capture microdissection (LCM) utilized to enrich tumor tissues. Samples were separated into two groups based on their QKI expression using K-means clustering. The association between QKI and clinical features such as tumor differentiation and survival rates were studied. Gene-level and transcript-level differential expression (DE) analysis were performed to explore the biological mechanism of QKI. 80 TCGA samples were used as an external validation dataset. **Results:** A bimodal distribution of the QKI expression was observed in all three datasets. High QKI was significantly associated with poor tumor differentiation ($p = 0.0043$). Although higher QKI expression exhibited a trend toward reduced survival rates, the difference was not significant ($p = 0.12$). DE analysis showed that EPCAM, an epithelial-to-mesenchymal transition (EMT) gene that plays a crucial role in cancer, was upregulated in the low QKI group. **Conclusions:** QKI plays a critical role in the progression of EAC, with elevated expression associated with poor tumor differentiation and reduced patient survival rates. Furthermore, high QKI expression is correlated to decreased EPCAM levels, suggesting a potential regulatory relationship in tumor development.

PROFILING RESECTED CHOLANGIOCARCINOMA TO INFORM THE RISK OF RECURRENCE: A WHOLE GENOME SEQUENCING ANALYSIS

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Purpose and Hypothesis: Surgical resection is the best curative treatment for cholangiocarcinoma (CCA). The purpose of this study is to describe the molecular landscape of CCA using whole-genome sequencing (WGS). We hypothesize that the mutational profiles between patients with and without recurrence are different.

Methods: In this retrospective, single-center study, we included 32 patients who underwent surgical resection for CCA between September 2018 and September 2024. Tumor samples were enriched for epithelial content using laser capture microdissection and underwent WGS.

Results: The cohort consisted of 18 men (56.3%) with tumor localization as follows: 18 (56.3%) intrahepatic (iCCA), 4 (12.5%) perihilar (pCCA), and 10 (31.2%) distal CCA (dCCA). According to histopathology, 15 patients (46.9%) were classified with AJCC stage II disease. The median tumor mutational burden was 2.1 (IQR: 1.5-3.9), with dCCA showing a higher TMB compared to pCCA and iCCA (6.2 vs 3.3 vs 3.8; p=0.97). Dominant single base substitution signatures across the cohort included SBS2, SBS6, and SBS8. Over a median follow-up period of 1 year, 13 patients (40.6%) experienced recurrence, with a median time to recurrence of 8.5 months (IQR: 4.6-20.1). None of the patients with recurrence beyond 8.5 months exhibited the SBS6 signature, which is commonly associated with mismatch repair deficiency and responsiveness to immunotherapy. Recurrence occurred in 50% (3/6) of patients with FGFR2 somatic structural variants and in 60% (3/5) of patients with IDH1 somatic single nucleotide variants.

Conclusion: Genomic evaluation of CCA may offer valuable insights for stratifying patients based on their risk of recurrence. Further studies are needed to determine which patients might benefit from re-resection and adjuvant systemic therapy.

AI-ASSISTED HISTOLOGICAL CLASSIFICATION IN EARLY GASTRIC CANCER: A NOVEL APPROACH USING ENDOSCOPIC IMAGES

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Purpose and Hypothesis: Endoscopic submucosal dissection (ESD) improves the quality of life in early gastric cancer (EGC) patients with a low risk of lymph node metastasis. ESD eligibility is determined by tumor size, depth of invasion, ulceration, and histological type. However, histological discrepancies between biopsy and surgical specimens can lead to unnecessary ESD or unnecessarily aggressive surgery. This study aims to develop an artificial intelligence (AI) model to predict histological classification using endoscopic images.

Methods: Patients who underwent radical gastrectomy for EGC at a high-volume center between 2013 and 2024 were included. Histological types were categorized as differentiated or undifferentiated. A total of 2,007 images (958 differentiated, 1,049 undifferentiated) from 2,007 patients were split into training (70%), validation (20%), and test (10%) sets. A deep learning model was developed and its performance was evaluated.

Results: Model specificity for predicting differentiated and undifferentiated EGC was 0.87 and 0.91, respectively. The test set's area under the receiver operating characteristic curve was 0.70. Among all patients, 41.8% were identified as suitable candidates for AI-assisted decision-making. However, 9.4% of differentiated types faced a risk of unnecessarily aggressive surgery, while 13.3% of undifferentiated type cases were at risk of unnecessary ESD.

Conclusion: We developed an AI model that predicts the histological type of EGC based on endoscopic images alone. When integrated into a clinical workflow, this model has the potential to serve as a clinical decision support tool for guiding treatment decisions between ESD and radical gastrectomy.

IS MEDIAL HEMIPLATEAU ELEVATION NECESSARY IN THE MANAGEMENT OF INFANTILE BLOUNT'S DISEASE?

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The authors have decided not to make the research results available at this time and will provide updates as soon as the results can be shared.

DESCRIBING THE TRANSCRIPTIONAL SUBTYPES OF UTERINE SMOOTH MUSCLE TUMOURS IDENTIFIED BY THE RACCOON CLUSTERING ALGORITHM.

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Purpose and Hypothesis: Uterine leiomyomas (uLM) are benign smooth muscle tumors while, uterine leiomyosarcomas (uLMS) are malignant, poor overall survival (OS). Intermediate tumours, such as the smooth muscle tumours of uncertain malignant potential (STUMPs) exist, complicating clinical decision-making with similarities in histology despite distinct outcomes. This project aims to investigate this spectrum of uterine smooth muscle tumors to identify biomarkers for improved prognostication. **Methods**: RNA was prepared from uLM (n=28), STUMP (n=5), and uLMS (n=7) fresh frozen samples for bulk RNA-seq and analysed with comparably processed datasets (n=229). Read count data was inputted into RACCOON, an unsupervised hierarchical clustering algorithm, to generate a transcriptomic taxonomy per established methods. Differential gene expression (DGE), gene set variance analysis (GSVA), and survival analysis were performed using R v4.4.1. **Results**: At the first level, 3 clusters emerged: uterine smooth muscle (uSM), uLM/STUMP/uLMS, and all sites of LMS. Within the LMS cluster, a uLMS group was identified. At the third level of the uLM/STUMP/uLMS cluster, a transcriptionally “low grade” (LG) uLMS cluster emerged. Despite no significant OS differences, GSVA showed RB/E2F target gene sets enriched in uLMS, with decreased *RB1* expression. **Conclusions**: The transcriptional spectrum of USMTs revealed 2 distinct uLMS clusters: uLMS and LG uLMS. Despite no differences in OS, there are significant biological differences, and further characterization is necessary to enhance diagnostic accuracy and clinical decision-making.

DEVELOPMENT OF AN ARTIFICIAL INTELLIGENCE BASED VIRTUAL TOOL FOR MEASURING DISTANCES DURING IMAGE-GUIDED SURGERY

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Purpose and Hypothesis: Image-guided surgery has unique depth perception challenges. This complicates procedures requiring intracorporeal measurements, including gastric bypass. Computer vision (CV) has been used for tool identification, which can locate key features for a mathematical prediction of 3D distance. This feasibility study aims to develop such a CV tool to objectively measure intraoperative distances.

Methods: The tool was developed by combing a computer vision (CV) instrument detection algorithm and a computer program to calculate distances between surgical graspers. The CV model was trained on annotated surgery videos to identify the grasper jaw assembly, then tested against ground truth annotations. The computer program was developed and tested in a bench-box simulator compared to a ruler. The combined pipeline was then validated in simulation compared to a testing group and on videos compared to an intracorporeal ruler.

Results: A total of 1205 frames (64 cases) were annotated and used to train the model. Compared to annotations, the model had a Precision-Recall AUC, accuracy, and Dice Score of 0.89, 0.99, and 0.80, respectively. 49 sample measurement frames were used to validate the computer program, with a mean error of estimation of 0.79 cm. Bench box testing compared to a test group showed the prototype's best performance at larger distances (150 cm), with a "human in the loop" system. In the video validation, the prototype demonstrated low measurement bias and variability, with a mean difference of 0.39 cm.

Conclusions: CV-based techniques can reduce subjectivity of intracorporeal measurement tasks by delivering an objective measurement during image-guided surgery.

STORAGE OF DONOR LUNGS AT 10°C REDUCES FERROPTOSIS – EVIDENCE FROM A CELL CULTURE MODEL OF LUNG TRANSPLANTATION.

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Purpose and Hypothesis: Storing donor lungs at 10°C improves outcomes compared to standard ice/4°C storage; however, the underlying protection mechanism(s) remain unclear. Using a cell culture model of lung preservation and reperfusion, we aimed to determine whether the 10°C cytoprotection can be partially explained by reduced ferroptosis and heightened metabolic activity. **Methods:** Human pulmonary microvascular endothelial and bronchial epithelial cells were incubated at 4°C and 10°C to simulate varying lengths of cold ischemic time (CIT). This was followed by re-introducing a cell-appropriate serum-containing culture medium at 37°C for 4h to simulate warm reperfusion (R) injury. At the end of CIT or 4h R, cell viability, metabolism, and ferroptosis-related mechanisms were measured. **Results:** 10°C preservation improved cellular metabolic activity in both cell types. In epithelial cells, 10°C also maintained cellular ATP levels throughout CIT. Intracellular labile iron levels were elevated at 6h and 24h of 4°C CIT in epithelial cells compared to cells at 10°C. To further investigate whether iron may contribute to higher levels of oxidative stress, we measured reduced glutathione (GSH) and GPX4 activity, which mitigate ferroptosis. Levels of GSH were significantly increased in epithelial cells stored at 10°C after 48h CIT. This was accompanied by improved GPX4 activity after 48h CIT with and without 4h R. Lipid peroxidation, the endpoint of ferroptosis, was also significantly reduced in epithelial cells stored at 10°C after 24h and 48h CIT. In both cell lines and at each time point, 10°C significantly reduced LDH release compared to cells stored at 4°C.

Conclusion: Compared to 4°C preservation, these findings suggest that a reduced ferroptosis may underlie 10°C cytoprotection. Additionally, 10°C preservation supports active mitochondrial respiration during the preservation period. These results may guide the development of targeted therapies to further improve 10°C preservation outcomes.