Exosomes and Microvesicles from Adipose-derived Mesenchymal Stem Cells Protect the Endothelial Glycocalyx From Lipopolysaccharide Injury
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INTRODUCTION: Endothelial glycocalyx (EGX) damage occurs in various pathological states and results in endotheliopathy. Exosomes (ES) and Microvesicles (MS) isolated from adipose-derived mesenchymal stem cells (ASCs) have therapeutic potential. We hypothesized that ASC-derived ES and MS would not affect EGX shedding after injury.

METHODS: ES and MS were collected from ASC conditioned media by centrifugation (10,000g for MS, 100,000g for ES). Human umbilical vein endothelial cells (HUVECs) were exposed to 1 μg/mL lipopolysaccharide (LPS). LPS injured cells (n=578) were compared to HUVECs with concomitant LPS injury plus 0.1 or 1.0 μg/mL of ASC-derived ES or MS for 24 hours. These cohorts were compared to control HUVECs (n=786) and HUVECs exposed to ES (n=505) or MS (n=500) alone. Cells were fixed and stained with FITC-labelled wheat germ agglutinin (WGA) to quantify EGX.

RESULTS: 0.1 μg/mL of ES alone resulted in EGX reduction. Treatment with 0.1 μg/mL ES (n=514) after LPS injury increased EGX intensity compared to control and LPS injury alone. Treatment with 0.1 μg/mL of MS (n=467) after LPS injury resulted in similar EGX intensity compared to control. Treatment with a higher dose of 1.0 μg/mL of MS (n=467) after LPS injury resulted in further EGX protection compared to control (5.09 AU, p=NS). ES appeared to have increased therapeutic benefit. ES alone reduces the EGX. In addition, lower doses of ES are superior to higher doses.

CONCLUSION: While ES and MS protect the EGX after LPS injury, ES appear to have increased therapeutic benefit. ES alone reduces the EGX. In addition, lower doses of ES are superior to higher doses.

Expanded Field Artificial Intelligence Triage Tool: A Novel Prediction Tool for Internal Injury Patterns in Gunshot Wound Victims
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INTRODUCTION: The objectives of this study were to expand the capabilities and provide a proof of concept for the Field Artificial Intelligence Triage (FAIT) tool to assess model performance in predicting internal injuries in gunshot wound (GSW) patients.

METHODS: Using the 2015-2017 American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP) databases, we included all patients (16-60 years old) with truncal GSWs. Using supervised training, a novel deep regression neural network (DRNN) was trained using 80:20 train:test split for binary outcome predictions of internally injured structures. The DRNN’s performance was characterized using an Area Under the Receiver Operating Characteristics curve (AUROC). An auxiliary prediction model was developed using a novel constrained confidence NN (CCNN) to predict the true-class probability (TCP), an indicator of the DRNN’s degree of confidence.

RESULTS: The GSW database population was 28,138, with a median age of 27 (interquartile range, IQR [22, 36]) and a median injury severity score of 10 (IQR [5, 19]). The DRNN’s global AUROC for predicting internally injured structures was 0.957, AUROC extremity was 0.990, AUROC abdomen was 0.934, and AUROC vascular structures was 0.939. The TCP model correctly predicted 96.7% of DRNN’s incorrect predictions while maintaining 95.3% of correct predictions.

CONCLUSION: This iteration of FAIT resulted in a model capable of predicting internal injuries following truncal GSWs. Furthermore, our novel AI tool is able to produce confidence in its predicted outcomes. With further training and validation, these results expand FAIT’s capability of providing triage support and early injury identification to prehospital providers.

Extended Reality for Initial Trauma Patient Care Simulation: A Pilot Study
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INTRODUCTION: Extended reality (XR) integrates virtual reality, augmented reality, and mixed reality technologies. The effectiveness of XR in initial trauma patient care simulation has not been well studied. We conducted a pilot study to develop a simulation of initial trauma care using XR technology and evaluate its effectiveness.

METHODS: Clinical staff and residents at our trauma resuscitation center (n=30) viewed CT images on a conventional flat screen monitor of a scenario of a patient with severe trauma, to formulate a diagnosis and treatment strategy. Three-dimensional CT images were then viewed stereoscopically using the online application Holoeyes MD and projected into the air using a holographic lens. After the simulation, participants completed a survey comprising 13 questions on a 7-point Likert scale. Scores ≥ 5 were rated positive and scores ≤ 3 were rated negative. The median score for each question was analyzed.
CONCLUSION: The use of XR may make depth and space more recognizable and enhance the learning effect of initial trauma patient care simulation. Participants generally gave positive feedback. The median scores for effective depth perception, improvement in spatial awareness, and multifaceted view were 7 out of 7. Many participants found the simulation to be enjoyable (median 7) and useful for learning (median 7). However, some participants reported that the holographic lens made them feel nauseous (median 5), had a poor cost-benefit ratio (median 4), and was troublesome because it lacked hand representation (median 5).

CONCLUSION: The use of XR may make depth and space more recognizable and enhance the learning effect of initial trauma patient care simulation.

Factors Associated with Liberation From the Ventilator after Tracheostomy in Severely Injured Trauma Patients

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RESULTS: A total of 278 (Early: n = 141; Prolonged: n = 137) patients met the inclusion criteria. Severe chest injuries (AIS ≥ 3) were more common in the prolonged group (54% vs 41%, p=0.03). On multivariate analysis, severe chest injuries were independently associated with prolonged ventilator dependence (OR 1.75, CI 1.073 - 2.860, p=0.025).

CONCLUSION: Trauma patients with severe chest injuries require prolonged ventilator support even after tracheostomy. Patients without severe chest injuries should be considered for more aggressive efforts at extubation rather than proceeding with tracheostomy.

Manhandling Injury During Legal Intervention

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INTRODUCTION: Data concerning injuries resulting from physical force during legal interventions is scarce. The purpose of this study was to examine manhandling injuries occurring in both civilian suspects and law enforcement officials (LEO).

METHODS: Retrospective study using data from the National Trauma Data Bank (2015-2017). All patients who sustained manhandling injuries during legal interventions were identified using ICD-10 ecodes. The study groups were injured civilian suspects and LEO. The primary outcome was differences in the type and severity of injuries between the groups.

RESULTS: A total of 507 patients were included in the study. 426 (84.0%) were civilians and 81 (16.0%) were LEO. Overall, median age was 37 years (IQR: 28-48) and 90.3% were male. The median ISS was significantly higher in civilians compared to LEO (5 [4-10] vs 4 [4-9], p=0.023). Civilians were more likely to sustain injuries to the face (49.8% vs 35.9%, p=0.024) and abdomen (8.3% vs 1.3%, p=0.028). LEO were more likely to sustain tibia/fibula fractures (3.5% vs 9.9%, p=0.019). The mortality was 1.2% (5/426) in civilians and there were no deaths in LEO. There was a trend toward higher ICU admission rate in civilians (21.9% vs 13.6%, p=0.091), while the hospital length of stay and overall complication rate were similar between the groups.

CONCLUSION: Injury patterns and overall severity of injuries sustained from the use of physical force during legal interventions are different in civilians and law enforcement officials.

One Trauma Score Rules All: New Injury Severity Score Is Superior in Predicting Trauma Mortality

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INTRODUCTION: Trauma scores are used to give clinicians appropriate quantitative context in making decisions. There is a lack of literature on which trauma scores are the most effective at predicting mortality. We hypothesize that trauma scores have a hierarchy of efficacies at predicting mortality.

METHODS: We performed a retrospective analysis of our trauma patient database at a Level 1 Trauma center from 2016 to 2020 and calculated the following trauma scores: Glasgow Coma Scale (GCS), Revised Trauma Score (RTS), Trauma Injury Severity Score.