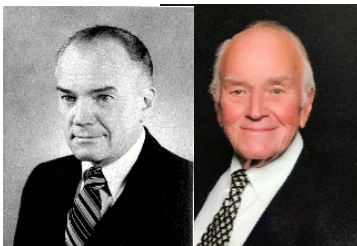


## The John MacArthur, MD, FACS Trauma Competition



John MacArthur, MD, FACS was born in Minnesota. Dr. MacArthur was graduated from the University of Minnesota Medical School. He completed his General Surgery Residency at Peter Bent Brigham (now Brigham and Women's Hospital) with Dr Fanny (Francis) Moore.

Dr. MacArthur joined Bridgeport Hospital as Chair of Surgery in 1979. In the 80's he worked with Lenworth Jacobs, MD, FACS, Chip Baker, MD, FACS, James Barone, MD, FACS, and Tony Morgan, MD, FACS to modernize the medical transportation system in Connecticut. Their work also included EMT training and certification. In the early 90's they testified in front of the State Senate encouraging Connecticut to adopt the ACS trauma designation system and use the "optimal resources" document as bases for the designation. They were successful and forever changed the way trauma patients are cared for in our state.

He served as President of this organization from 1995-1996 and retired from practice in Connecticut in the late 90s. Dr. MacArthur continued to practice in Nantucket for many years before moving to Colorado, where he now resides.

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York Lin Chew, MD	Saint Mary's Hospital	<a href="#">Incidences of Delayed Intracranial Bleed in 30-days in Patients Who Are on Anticoagulation or Antiplatelet After Sustaining a Fall.</a>
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### Idiopathic Traumatic Splenic Injury Following ESWL: A Rare Case Managed Conservatively

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**Background:** The spleen is frequently injured in blunt abdominal trauma, encompassing a spectrum of treatments from observation to splenectomy for hemodynamic instability. Delayed complications, such as subcapsular hematoma rupture and pseudoaneurysm rupture, can prove fatal. Splenic injuries following abdominal procedures are rare, predominantly occurring after colon manipulation. Splenic trauma post-extracorporeal shock wave lithotripsy (ESWL) is even more rare.

**Introduction:** We describe a rare case of idiopathic traumatic splenic laceration and subcapsular hematoma following recent ESWL. All 12 previously reported cases resorted to splenectomy (11) or embolization (1). Our unique case was managed conservatively, relying solely on observation.

**Case:** A 48-year-old female, with a recent history of ESWL (2500 shocks, 250 J) for a 6 cm left renal stone, presented to the Emergency Department. She complained of progressively worsening left flank pain, which became severe and constant the day prior to presentation. She denied recent trauma. On examination, vitals were stable, with satisfactory oxygenation on room air. Abdominal palpation revealed diffuse tenderness without peritoneal signs.

Hemoglobin was 13.2 g/dL. Abdominal and pelvic CT with intravenous contrast disclosed a Grade 2 splenic laceration (0.5 x 1.0 x 2.9 cm) and a subcapsular splenic hematoma (8 x 3.2 x 9.2 cm). Given the sudden onset severe presentation and concern of recurrent hemorrhage, decision was made to closely observe the patient in the intensive care unit for continuous hemodynamic monitoring and serial hemoglobin levels. Her hemoglobin levels continued to be closely monitored, which remained stable. Prior to discharge the patient underwent left upper quadrant ultrasound and CT angiography of the abdomen and pelvis to evaluate for pseudoaneurysm and was negative. The patient was discharged home and has been doing well.

**Discussion:** Extracorporeal shock-wave lithotripsy (ESWL) is a widely used non-invasive treatment method for renal and some ureteric calculi. There have been previous cases reported of splenic injuries after ESWL. All cases showed patients received more than 2000 shocks at moderate to high energy level and went on to have splenectomy. Non-operative management is considered the gold standard for treating a patient with blunt splenic trauma, with a success rate of near 90%. All the cases of splenic injury after ESWL described in the literature were treated with operative management (i.e., total splenectomy), except one treated with more conservative management (i.e., angiography and embolization). None of the patients had observation as management of the splenic trauma.

**Conclusion:** Our case marks the first documented instance of observation-only management for idiopathic traumatic splenic injury post-ESWL. This approach should be considered for hemodynamically stable patients with this rare presentation, challenging the prevailing trend toward surgical intervention. Further studies and collective data are needed to refine treatment strategies in this unique scenario.

### **Incidences of Delayed Intracranial Bleed in 30-days in Patients Who Are on Anticoagulation or Antiplatelet After Sustaining a Fall.**

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**Introduction:** Delayed intracranial hemorrhage (dICH) after an initial CT scan is a recognized complication in patients on anticoagulants or antiplatelets who sustained head trauma from a fall incident. However, the exact risk is yet to be determined due to the limited data available on the incidence of dICH. Hence, there is a lack of consensus in current major guidelines on the role of repeat head CT in this specific group of patients. Our aim is to provide data on the incidence of dICH in this group of patients and we hypothesize that the vast majority of patients will not have new dICH that would require further surgical intervention.

**Method(s):** We retrospectively reviewed patients receiving anticoagulant and antiplatelet who sustained a fall at a level II trauma center within a 1-year period. Patients were evaluated for mechanism of injury, heights of fall, alcohol and drug involvement, GCS score, age, gender, and types of anticoagulation or antiplatelet, and initial and subsequent (within 30 days) Head CT scans. Our inclusion criteria include patients with documented use of anticoagulant and antiplatelet (e.g. Warfarin, Elixquis, Xarelto, Aspirin, Plavix) for any medical conditions at the time of their fall. Exclusion criteria includes severe trauma or mechanism of injuries that is non-fall-related such as assault that is not classified as fall. Severe coagulopathy or bleeding disorders. Known intracranial abnormalities such as aneurysm and tumor. Documented missed anticoagulation use during the time of the injury.

**Results:** A total of 444 patients sustained a fall from July 2022 to July 2023; 198 patients fulfilled the inclusion criteria. The overall mean age is 76.7, 95% Confidence Interval (CI) (74.8 - 78.7) with a female predominance of 109 (55.1%). Twenty-six patients (13.1%) had intracranial hemorrhage on initial head CT while only 1 patient (0.5%) was found to have delayed head bleed confirmed on subsequent head CT. Meanwhile, the rest of the 171 patients (86.3%) do not have any intracranial hemorrhage after sustaining a fall.

**Conclusions:** Our data suggests that the incidence of patients (0.5%) who have delayed intracranial hemorrhage following an initial negative head CT scan after a fall in our community setting is very low. This finding does not

support the routine of obtaining repeat head CT after a negative initial head CT scan. It is unclear as to the significance and role of repeated head CT scans in patients who are on anticoagulation or antiplatelet after sustaining a fall and remains controversial in our current guidelines.

### **Increased Incidence of Venous Thromboembolism in Trauma Patients Receiving Tranexamic Acid**

Victoria Liang MD, Shubham Kanake MD, Irene Lazarus RN, Kevin Dwyer MD FACS

**Introduction:** The CRASH-2 trial demonstrated a decrease in mortality and transfusion rate with the administration of Tranexamic Acid (TXA) within the first 3 hours of injury and hemorrhage. The Crash-3 trial showed a decrease in mortality in mild to moderate traumatic intracranial hemorrhage if administered in 3 hours. All, if not most of the trauma centers have protocols to administer TXA to hemorrhaging trauma patients as soon as possible. Many trauma centers will administer TXA to TBI patients. In the CRASH trials, there was not an increased incidence of Venous Thromboembolism (VTE) noted. Recently, we had an increase incidence of deep venous thrombosis (DVT) and pulmonary embolism (PE). When reviewing these patients for Quality Review, we found that most patients received TXA. We then did a deeper review to see if TXA is a risk factor for VTE at our institution.

**Methods:** We retrospectively reviewed the past four fiscal years (FY) of our trauma registry. Fiscal years were used as that is how our registry is configured. FY 2023 is not complete, only through June 2023. We queried the registry and then will proceed with deeper chart review to look at our incidence of VTE, the use of TXA and the association of VTE with TXA. We also looked at other parameters such as ISS, shock, Transfusion rates over 2 and 24 hours and AIS and GCs of our patients with TBI.

**Results:** Over the review period, we had 1494 trauma patients entered in our registry. Of these 1494 trauma patients, 11 developed either a DVT or PE or both 0.75%. Of these 11 patients, 8 received TXA, 73%. There was a total of 44 patients that received TXA during the review period, 2.9%. Of the 8 patients that received TXA that also developed DVT or PE, the indication for TXA was hemorrhagic shock in 6 of the patients. These patients also had a high ISS, shock, and transfusion rate.

**Conclusions:** TXA has become established for early use in the initial treatment of hemorrhagic shock in trauma patients. It is also utilized in patients with TBI. Our review shows TXA as a factor in most of our patients that have VTE. While the benefit on mortality and transfusion with the use of TXA in hemorrhagic shock have made its use common practice, we should develop strategies to increase surveillance for VTE in trauma patients that receive TXA as well as consider earlier VTE prophylaxis in these highly injured patients.

### **Methylene Blue in Adult Patients with Septic Shock: A Systematic Review and Meta-analysis**

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**Introduction:** Methylene blue's vasoconstrictive properties stems from its ability to inhibit nitric oxide and to improve myocardial function. Recent studies have advocated the use of methylene blue as a rescue therapy for patients with septic shock. The primary aim of this study is to investigate the effect of methylene blue on the mean arterial pressure in adult patients with septic shock.

**Methods:** Databases of MEDLINE, EMBASE, and CENTRAL were searched from their inception date until July 2023. Randomized clinical trials (RCT) comparing methylene blue and placebo in adults with septic shock were included.

Observational studies, trials published as letters to editors, case series, case reports, observational studies and conference abstracts were excluded.

**Results:** Our systematic review included 6 studies (n= 295) for data analysis. As compared to the placebo group, our pooled analysis revealed that the methylene blue group had significantly increased mean arterial pressure (MD:5.86,95% CI:0.77 to 10.94,  $p=0.02$ ). Patients who were given methylene blue were associated with significantly higher systemic vascular resistance (MD:87.71, 95% CI:14.09 to 161.33,  $p=0.02$ ). Pooled results showed methylene blue statistically lowered mortality rate (OR:0.51,95% CI:0.28 to 0.93,  $p=0.03$ ) and lowered serum lactate levels (MD: -0.92, 95% CI: -1.31 to -0.53,  $p= <0.00001$ ) in comparison to the control group.

**Conclusions:** This meta-analysis showed that the administration of methylene blue improved hemodynamics parameters, namely mean arterial pressure, systemic vascular resistance, lactate level with lower mortality rate. However, substantial degree of heterogeneity and inadequate number of studies with low level of evidence warrant future adequately powered RCTs to affirm our results.

**Table : Data analysis of primary and secondary outcomes.**

Outcomes	Trials	n	I <sup>2</sup> (%)	MD/OR (95% CI)	p-value
Mean Arterial Pressure	6	231	73	5.86 [0.77, 10.94]	0.02
Systemic Vascular Resistance	2	60	0	87.71 [14.09, 161.33]	0.02
Mortality Rate	4	235	0	0.51 [0.28, 0.941]	0.03
Serum Lactate	6	306	58	-0.92 [-1.31, -0.53]	<0.00001
Heart Rate	5	140	63	1.53 [-6.57, 9.62]	0.71
PaO <sub>2</sub> /FiO <sub>2</sub>	4	100	0	8.23 [-33.86, 50.32]	0.70

Values are Mean Difference (MD)/Odds Ratio(OR) and 95% Confidence Interval.

### Outcomes-Based Assessment of Distal Third Femur Fractures: A Pilot Study

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**Introduction:** Selection of the most optimal fixation method for fractures of the distal femur, whether intramedullary nail (NL), lateral locking plate (PL), or nail/plate (NP) is not always clear. An adjunctive clinical and evidenced-based surgical tool to help guide orthopaedic surgeons deciding which fixation method to utilize for distal femur fractures would therefore be of value. This pilot study used cluster analysis to determine outcomes of patients with distal femur fractures based on fracture classification and type of surgical fixation.

**Method(s):** Using retrospective chart review, we identified patients 18 years of age or older who presented to a single Level-1 trauma center from January 1, 2012 to December 31, 2022 with a non-polytraumatic distal femur fracture. Cluster analysis using a partitioning-around-medoids (PAM) approach was used as it allowed grouping of patients based on fracture classification and implant type to identify which characteristics led to a certain outcome. The number of clusters which would yield the highest possible Silhouette Score (a measure of how well patients fit in a cluster based on shared characteristics), while not yielding clusters with redundant implant type and fracture classification combinations, was used for this study. A successful surgical outcome was defined as a surgery which did not result in infection, mortality, non-union, malunion, implant failure, or a substantial decline in ambulatory status. Success was determined for each cluster as the percentage of successful surgeries within a cluster.

**Results:** A total of 169 patients (68.64% female, average age 66 years) met the inclusion criteria. A total of 15 clusters were used, allowing for a high Silhouette Score (0.9078). Twelve clusters were 100% homogeneous, while 3 of the 15 clusters had approximately 60% of patients with the majority fracture classification. Extra-articular simple

spiral fractures (33A2.1) treated with a PL (n = 4) had a 75.00% success rate (vs 100% with NL [n = 12]). An oblique simple fracture at the distal metaphysis (33A2.2) stabilized with a NP (n = 3) had a 66.67% success rate (vs 72.73% with NL [n = 11] and 72.22% with PL [n = 18]). Extra-articular transverse simple fractures (33A2.3) had a 100.00% success rate with a dual construct [n = 6] (vs 78.57% success rate with PL [n = 14]; and 50.00% success rate with a NL [n = 2]). Extra-articular fragmentary wedge fractures (33A3.2) which were treated with a PL (n = 8) experienced a success rate of 75.00%. Extra-articular multi-fragmentary wedge fractures (33A3.3) treated with a PL (n = 11) had a success rate of 45.45% (vs 40.00% with NL [n = 5]). A partial articular fracture (33B) treated with a PL (n = 17) had a success rate of 88.35%. Patients with complete intra-articular fractures (33C) treated with a dual construct implant (n = 5) had a success rate of 100.00% (vs 61.36% with PL [n = 44] and 77.78% with NL [n = 9]). Other fracture classification/implant type combinations of the distal femur were not represented as a majority of any of the clusters.

**Conclusion(s):** This study demonstrates the application of cluster analysis to determine the rate of a successful surgical outcome based on fracture class and implant type. Patients with 33A2.1 fractures treated with a NL had a 100% success rate whereas those treated with a PL had a 75% success rate. All patients with 33A2.3 and 33C fractures treated with NP had a successful outcome whereas those treated with NL or PL alone had more variable outcomes. 33A3.3 fractures had a low overall success rate when treated with a NL or PL alone suggesting that these more comminuted extraarticular fractures may need an alternative fixation method such as a dual construct. However, before definitive conclusions are drawn and a clinical evidence based surgical tool is developed, future study with a larger sample size and inclusion of patient specific characteristics within the clustering analysis are needed.

### Outcomes of Trauma Patients After the Legalization of Marijuana in a Community Hospital

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**Introduction:** On July 1st, 2021, Connecticut became the 19th state to legalize marijuana for recreational use. To date, there are 23 states in which marijuana can be sold, purchased and used. Other states such as California have begun to investigate the impact of legalization of marijuana on the incidence of THC positive patients in trauma. Additional research has been performed to understand the rate of THC use in motor vehicle collisions. However, there is currently no data on the effect of legalization of marijuana on trauma in Connecticut. We sought to investigate the impact of marijuana legalization on trauma patient characteristics and outcomes in a single-institution Level II Trauma Center with 1701 trauma patients over a two-year period.

**Methods:** The authors performed a retrospective single-institution chart review of trauma patients with a recorded urine drug toxicology screening one year before and after the legalization of marijuana in Connecticut. The pre-legalization (PRE-L) group included trauma patients from July 1st, 2020, to June 30th, 2021 (n =358) while the post-legalization (POS-L) group was studied from July 1st, 2021, to June 30th, 2022 (n = 399). Patient factors such as age, race and hometown were compared amongst the two groups. Additionally patient outcomes were investigated including emergency room disposition, level of trauma activation, length of stay and mortality.

**Results:** There were 117 (32.7%) THC positive patients in the pre-legalization period and 111 (27.8%) THC positive patients in the post-legalization period (p = 0.145). There was no significant difference in sex, age or race between the two groups. Hometown was stratified as Waterbury and non-Waterbury residents. There were significantly less THC positive Waterbury trauma patients in the POS-L group as compared to the PRE-L group (p = 0.05). Emergency room disposition was defined as one of the following: Nursing Facility, Floor, ICU, OR, Morgue, Psych or Home. There was no significant difference between the two groups. There was additionally no difference in injury severity score (ISS), level of trauma activation, ICU admission rates, length of stay, usage of MTP or mortality.



**Conclusions:** Previous institutions have demonstrated an increase in the incidence of THC positive trauma patients after the legalization of marijuana, however that was not evident within our patient population. Our study suggests that marijuana legalization has not affected trauma patient outcomes. Limitations of our study include the number of patients removed from the study as they did not undergo urine toxicology testing. Within the hospital, urine drug testing is the only test we utilize for THC. However, this does not take into account if the patient was acutely intoxicated as the urine test may be positive up to two weeks after drug usage. We hope to gather further data to include all trauma centers of CT to further study the effects of marijuana legalization in trauma patient characteristics and outcomes in Connecticut

### Recovery from Multiple Organ Dysfunction Syndrome by Exosome therapy

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**Introduction:** Sepsis-induced multiple organ failure remains the major cause of morbidity and mortality in the health care system. Previously, we demonstrated increased survival and improved heart function when thioredoxin-1 overexpressed (Trx-1<sup>Tg/+</sup>) mice were subjected to Cecal Ligation and Puncture (CLP) compared to corresponding wild-type controls. Based on these observations, this project aims to evaluate and determine the therapeutic efficiency of exosomes collected from Trx-1<sup>Tg/+</sup> mice exposed to sepsis (CLP.Exo<sup>Trx-1Tg/+</sup>) and apply this treatment to septic mice.

**Method(s):** The CD-1 (8-12 weeks old) mice were divided into 4 groups as follows:

- Group 1. CLP surgery and PBS but without GW4869 (CLP + PBS);
- Group 2. CLP surgery and PBS with GW4869 (CLP + PBS + GW4869);
- Group 3. CLP surgery and Exo<sup>WT</sup> with GW4869 (CLP + GW + Exo<sup>WT</sup>); and
- Group 4. CLP surgery and Exo<sup>Trx-1Tg/+</sup> with GW4869 (CLP + GW + Exo<sup>Trx-1Tg/+</sup>).

All animals were subjected to cecal ligation and puncture surgery followed by administration of phosphate buffered saline or GW4869 or Exo<sup>WT</sup> or Exo<sup>Trx-1Tg/+</sup>. Administration of GW4869, a pharmacological agent will block the release of innate exosomes. We injected mice with GW4869 (2.5mg/g b.wt) 2 hours after CLP surgery to inhibit the release of innate exosomes. After 4 hours of CLP surgery, we injected either CLP.Exo<sup>WT</sup> or CLP.Exo<sup>Trx-1Tg/+</sup>, as appropriate to the group. GW4869 was also injected every 12 hours post-surgery into the mice till the end of the experiment. Mouse survivability (Kaplan-Meier Survival Curve) and heart function (echocardiographic analysis) were performed 1-7 days post-surgery.

**Results:** Kaplan-Meier survival curve analysis showed improved survival probability (%) [(Median Survival) (Log-rank test)] in the CLP+GW+Exo<sup>Trx-1Tg/+</sup> [60%; p=0.0003] treatment group compared to the CLP + GW + Exo<sup>WT</sup> (33%) group, CLP + PBS + GW4869 group (48%), and CLP + PBS group (24%). The percent survivability rate of mice in the GW4869 treated group alone was better than the PBS group.

Echocardiographic analysis revealed there was no significant difference in the cardiac function between CLP + PBS + GW4869 (EF: 49.62%±3.65; FS: 24.59±1.88) and CLP+PBS (EF: 41.31±6.77; FS: 20±4.01) (n=3-7) groups of mice exposed to sepsis. However, sepsis-induced mice treated with Exo<sup>Trx-1Tg/+</sup> (CLP+ GW + Exo<sup>Trx-1Tg/+</sup> group) showed preserved left ventricular ejection fraction (EF: 68.05±1.87 vs. 40.82±5.50) and fractional shortening (FS: 37.18±1.24 vs. 19.88±2.91) compared to CLP.Exo<sup>WT</sup> group (CLP+GW+Exo<sup>WT</sup>) respectively.

**Conclusion(s):** The results obtained from this study will help us to design synthetic or custom-made exosomes with desired cargos for therapy in sepsis subjects.