

Introduction of Video Laryngoscopes Did Not Improve Prehospital Intubation Success Rates in a Large EMS System

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Background: Many EMS systems have added video laryngoscopy (VL) as an alternative to standard intubation with a rigid laryngoscope. In the summer of 2014, King Vision video laryngoscopes were added to the ambulances in the Las Vegas, Nevada EMS system. The manufacturer instructed paramedics in proper use of the VL and EMS clinical personnel assured competency before being allowed to use the device.

Objective: The objective of this study was to determine whether the addition of video laryngoscopes improved the prehospital intubation success rate.

Design/Methods: This was a retrospective review of data from the Cardiac Arrest Registry to Enhance Survival (CARES) registry and the electronic prehospital care records for the two largest EMS transport services in Las Vegas. The study period was January 1, 2014 through December 31, 2014. Cases where endotracheal intubation was attempted were reviewed and data entered into a survey instrument. The data were summarized and statistical analyses completed. During the first half of the year all intubations were by standard laryngoscopes. After introduction of the video laryngoscopes paramedics were allowed to choose which device they would use for a particular intubation.

Results: A total of 805 intubations were reviewed. Of these, 454 (56.4%) were performed using standard laryngoscopy while 351 (43.6%) were performed with video laryngoscopes. The results are detailed in Table 1. There was no statistical difference in intubation success rates between the two techniques. First attempt intubation success rates were also similar for the two devices (80% for standard intubation and 77.2% for VL). The combined first attempt success rate was 76.5%.

Conclusion/Impact: No statistically significant improvements in prehospital intubation success rates were noted when VL was added to the EMS system. However, the addition of VL did not worsen prehospital intubation rates and may provide paramedics an alternative method for prehospital intubation.

Table 1.

| Device | Total Intubations | Successful Intubations | <i>p</i> |
|------------------------------|--------------------|------------------------|--------------|
| Standard Laryngoscopy | 454 (56.4%) | 366 (80.6%) | |
| Video Laryngoscopy | 351 (43.6%) | 301 (85.8%) | |
| Total | 805 (100%) | 667 (82.9%) | 0.562 |

Establishing the Basis of a Trauma Regional System: Pattern of Critical Trauma Patients Assisted in the Emergency Department of the Public Hospital Network of Aragon (Spain)

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Background: Aragón is characterized by a wide geographic dispersion (density: 27 inh/km²). The Aragón Health Service has a network of hospitals and prehospital resources (ground and helicopter units) but it does not have a Regional System Trauma or a Trauma Registry. One of the first steps to the development of a Trauma Care System is to know the volume of trauma patients in the region.

Objective: Identify the pattern of critical Trauma Patients assisted in Emergency Departments (ED) of Aragón Public Hospital Network.

Design/Methods: A retrospective review was conducted, analyzing all critical trauma patients assisted during 2014 (January to December) in the ED of the 9 centers integrated in the Aragón Public Hospital Network (2 tertiary hospitals, 4 secondary and 3 primary). Data were collected from ED electronic medical record system. Inclusion Criteria: trauma patients with age older than 14 who were classified as Triage level I and II by *Spanish Triage System*). Variables: Age, Gender, Destination (hospitalization, inter-hospital transfer, éxitus), Diagnosis - ICD 9-MC (up to 3 per patient).

Results: There were 685 patients included. Median Age 73 (IQR: 49-85). 53,1% Male. The most common diagnosis were: Head Trauma (40,3%), Lower Extremities Tr (29,5%), Thoracic Tr (15,5%), Polytrauma (14,7%). 53 admissions in Primary centers (45,1% transferred to higher level facilities), 482 (70,4%) in tertiary centers. Over 20% were admitted in ICU. Sixteen patients died in ED (2.3%).

Conclusion: Head trauma is the most common diagnosis. Most of critical trauma patients are admitted directly to a tertiary centers, but lower level hospitals also face to them. A Trauma Regional System is necessary to unify and optimize the survival trauma link.

Impact: We could consider it as a population-based study. These findings provided an overview of the profile of trauma patients assisted in Aragón and they will highlight the next steps about equipment, training and registry.

The Success of the Surgical Airway in Severely Injured Military Patients – Data From the Joint Theatre Trauma Registry (JTTR)

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Background: The placement of a surgical airway (SA) is an uncommon occurrence in normal UK clinical practice. The recent conflict in Afghanistan led to severely injured patients being managed in the pre-hospital environment, often by relatively junior personnel. Anecdotally, numerous SAs were placed.

Objective: This study evaluated all SAs performed by UK military medical personnel during the conflict, defining the stage of care at which it was performed, seniority of practitioner undertaking the procedure and procedural success.

Design/Methods: A retrospective database review was conducted using the UK Joint Theatre Trauma Registry (JTTR). All patients who underwent surgical airway by UK medical personnel from 2006 - 2014 were included. Data included demographics, injury severity score (ISS), successful placement (from review of clinical notes) and survival. Each patient identified was checked against the original clinical records. The data was analysed using SPSS.

Results: 88 patients met the inclusion criteria. The mean age was 25 years, (SD 5), with a median Injury Severity Score (ISS) of 59 (IQR 42). 81 (92%) of all SAs were found were inserted correctly. 7 (8%) were either inserted incorrectly or failed to perform. 79 (90%) of these procedures were performed either by medics or General Duties Medical Officers at point of wounding or Role 1. 6 (7%) were conducted by the Medical Emergency Response Team (MERT), whilst the remaining 2 (2%) underwent the procedure in the emergency department. 21 (26%) patients survived to hospital discharge.

Conclusion: SAs can be successfully performed in the most hostile of environments with high success rates by military medics or junior doctors. The majority of procedures were performed prior to arrival in the emergency department. These results compare favorably to US military data published from the same conflict.

Impact: If this can be replicated worldwide for both civilian and military patients a great number of lives could be saved.

Trauma Team Training and Sustainment: Fleet Surgical Trauma Training. The Perfect Rural Hospital Catastrophe Training Model

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Background: Rural hospitals in America rarely face the massive major catastrophic event such as seen with terror attacks, natural disaster, or unexpected events like the West Texas fertilizer plant explosion. High acuity, low frequency events require repetition to save lives. This training is now possible with Immersion training utilizing simulation.

Objective: To train for high acuity, low frequency events.

Design/Methods: The course included classroom didactics, Hyper-realistic "Cut Suit" based hands-on simulation and cadaver-based laboratory sessions. A pre-test was administered prior to the course, a post-test immediately upon completion, and a sustainment test 5 months following course completion.

Results: 159 participants, 28 clinical providers, 19 registered nurses and 112 corpsmen, have finished the initial course. 153 have finished the 5 month later sustainment portion. Eleven teams were involved in Pre, Post, and sustainment training. A mean improvement of 10.5 ± 4.50 minutes was observed in time to disposition, from 23.9 ± 6.21 minutes in the pre-test to 13.4 ± 2.63 minutes in the post test. The mean time to disposition during the sustainment testing was 16.2 ± 4.12 minutes; an increase of 2.82 ± 5.02 minutes from the post-test, but a decrease of 7.18 ± 7.05 minutes from the pre-test. The decrease in time to disposition from pre- to post-test and pre-test to sustainment test were determined to be statistically significant with P values of <0.0001 and 0.007 , respectively. Critical errors were counted during pre-testing and post-testing, as well as in the sustainment testing. The teams improved from 5 errors (5.2 ± 1.3) to 1 (1.0 ± 0.82) from pre-test to post-test. An improvement of 4.2 ± 1.1 errors per encounter. Errors made during the sustainment testing decreased further to a mean of 0.82 ± 1.1 errors per encounter, a reduction of 0.36 ± 1.3 errors per encounter from the post-tests. Similar to the statistical analysis for disposition time, the changes in critical errors observed during patient encounters from pre- to post-test and pre-test to sustainment test represented statistically significant changes with P values of <0.0001 in both instances. (A 12th team data will be added by the conference date)

Conclusion: This course showed its value in improving the teamwork and communication skills of the course participants, not only immediately following the course, but by sustainment at 5-6 months. Therefore, this course, with additional refresher courses within 6 months has the ability to substantially improve the readiness of communities to be prepared for catastrophic events.

Impact: Immersion Training has the capability and realism to Prepare both Military and Civilian mass casualty events.



* *International* TRAUMA CONFERENCE * LAS VEGAS, NEVADA 2015

The Continuum of Immersion Training - Moving the Training To Solid Objective Data - Part One: The Course is Developed

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Background: Early medical education prepares students to have purely academic knowledge. In order to bridge the gap between academic knowledge and clinical knowledge and skills, Rocky Vista University School of Medicine developed an Intensive Surgical Skills Course (ISSC) for second year medical students. The “willing suspension of disbelief” coined in 1817 by Samuel Taylor Coleridge, creates a situation in which the reader could be immersed in a fantasy they believed to be real. Modern Movie Making techniques on a movie set were used to accomplish the simulated reality. A human worn exo-skeleton with live actors (Cut-Suit) allowed for actual procedures to be safely performed. All levels of provider and teams from EMT to PACU were realistically performed. California Federal Firefighters, Medical Students from 2 Universities, residents in surgery and emergency medicine, and boarded physicians made up the cadre.

Objective:

1. To evaluate if realistic training for all members of medical care can be can accelerate conventional education.
2. To change the paradigm that it is no longer possible to train and perform real procedures on live patients. Thus the return of SEE ONE - DO ONE -TEACH ONE
3. To move from traditional cognitive and technical data to that, plus biochemical, human factor cardiac data, and brain activity data.
4. To make young physicians and medical personnel safe and confident for their first life-saving encounter.
5. To develop methods of team training that address all levels of the continuum of care.
6. To develop methods that produces a safe way to maintain skills on HIGH ACCUITY-HIGH VOLUME problems.
7. To develop methods that produces a safe way to develop and maintain skills as a team.
8. To develop methods that use realistic, not demeaning stress, that parallels the real stress of a situation.

Design/Methods: This training employs a team-based approach to educate personnel in emergency and surgical capabilities. It requires them to effectively communicate, triage, stabilize and treat anything from a minor surgical illness, on through a single critically injured patient, to multiple victims and mass casualty scenarios. It further provides the team opportunities to operate in a realistic, high stress, fast paced environment through point of injury or disease to triage, resuscitation, surgical operation, post-op care, packaging, and evacuation while tracking patients and flow of events. The study is a

prospective longitudinal observational study in which the participants served as their own controls.

The didactic topics and skills learned during morning lectures are reinforced in an immersive team-based simulation later that same day. The Cut Suit, an anatomically accurate simulator worn on a standardized patient, allows increased patient-provider interaction and therefore improves both patient-provider and team cohesion and capability that are central to physician education. These simulations build on one another, starting with a single disease or injury, increasing in complexity through the course of 4.5 days to multi-organ, multi-patient casualties and end with a mass casualty event. This team immersion training provides opportunities for the team to operate in a realistic, high stress, fast paced environment through triage, resuscitation, surgical operation, post-op care, packaging, and evacuation while managing critical multi-layer communication, patient tracking and flow. More importantly, the training allows the team to work on cohesion, asset management, communication and other team dynamics in order to take care of the overwhelming crises.

The hyper-realistic immersive training environment provided during the various exercises elicited various levels of physiological stress to the participants. The body's response to stress is a complex and integrated process. When confronted with a challenge, primary mechanisms like cognitive and behavioral adjustments are employed to control a situation. When these mechanisms do not suffice, the body responds physiologically. The main components of this response are the hypothalamic-pituitary-adrenal (HPA) axis and autonomic nervous system (ANS) which can be evaluated by measuring levels of salivary cortisol and salivary alpha amylase (sAA), respectively. (Hellhammer, D. H., Kirschbaum, C., & Hellmich, L. 1987), (Rohleder, N., & Nater, U. M., 2009), (McGraw, L. K., Out, D., Hammermeister, J. J., Ohison, C. J., Pickering, M. A., & Granger, D. A., 2013) Members of our research team have previously measured the HPA axis and ANS which are crucial parts of the body's physiologic response to stress and which promote adaptation and improved ability to manage similar scenarios. Novel experiences cause a spike in salivary cortisol levels. Our team hypothesized that (1) students would display anticipation to expected stress which would be correlated with high baseline cortisol levels because of expected stressful conditions. The team further hypothesized that (2) with repeated exposure to immersive, hyper-realistic scenarios over the 4.5 days of the ISSC, peak cortisol levels would trend downward, (3) rapid returns of cortisol to baseline would demonstrate habituation or effective stress response; and (4) elevations in sAA would demonstrate learning and active effort to control stressful situations.

Results: The First two courses (41 students, 4 ½ days each) produced spectacular cognitive and technical skill results. Knowledge Testing involves a pre and post-training written subject exam as well as a surgical instrument exam. Outcomes of this assessment are shown in the Figures below, and reveal a mean pre-test score of $45.8\% \pm 7.5\%$ (mean \pm SD), and a post-test mean score of $62.3\% \pm 8.5\%$. The mean score for the surgical instrument pre-test was $8.4\% \pm 9.0\%$, while the post-test mean score was 98.2

Skills Testing outcomes reported here (shown graphically in Figures below) include exercises in chest tube insertion and cricothyroidotomy procedures. Skills testing was performed on a human subject wearing the "cut suit" (human-worn partial task trainer) apparatus. Assessment outcome for the chest tube insertion pre-test was a mean score of $46.2\% \pm 10.3\%$, with a post-test mean score of $97.2\% \pm 6.4\%$. Similarly, mean pre-test score for the cricothyroidotomy procedure was $41.1\% \pm 10.1\%$, while the mean post-test yielded a score of $98.4\% \pm 3.5\%$.

Results of the Overall Stress/Confidence Surveys represent a summation of results from daily surveys taken by ISSC participants ($n=19$)(63 over 3 years) throughout the training week. Daily Perceived Stress and Daily Perceived Confidence are shown in the Figures below. For "Overall Stress", there were minimal reported levels of "no perceived stress" for any given training day. Reported stress levels perceived as "mildly stressful" decreased by 15% from Day 1 to Day 5. Reported stress levels perceived as "moderately stressful" and "very stressful" did not significantly vary throughout the week. The "extremely stressful" category was minimal, with no report of this category on any training day except Day 3. Data reporting Overall Confidence shows that self-reported confidence levels on Day 1 categorized the majority of students (over 60%) as "no confidence" or only "mildly confident". The percentage of students self-categorizing as "mildly confident" diminishes throughout the week, and was not reported on Day 5. The percentage of students self-reporting as "no confidence" disappeared completely on Days 3 and 4, but reappeared on Day 5 (with less than 10% of students self-rating in this category) on that day. In sum, there is a visible shift in self-reported confidence by Day 5, with over 50% of students self-rated as "very confident" to "extremely confident."

All results were $P>0.05$ or better. Multiple Tables and Graphs to place here.

Conclusion: The first two Intensive surgical skills courses were dramatic in their results. Cognitive knowledge learned and Technical skills performed in a simulated hyper-realistic environment returned education back to the days when the student, resident, nurse, firefighter, or any learning medical person had to make the critical decision without the "Staff" educator over their shoulder. In 4.5 days all learned the technical skills to save a life in a critical situation. All but one learned enough clinical cognitive knowledge to pass the equivalent of the exam for 3rd year medical school surgical rotation. Confidence soared and stress fell.

Impact: This stress was only evaluated subjectively. The Likert scale gave an excellent, verified subjective evaluation of the course as a whole but did not tell us where the course over stressed or overwhelmed the students. Or where the course under stressed and had no effect etc. Therefore we set out for the next 2 years looking for OBJECTIVE WAYS TO EVALUATE THE STUDENTS AND THE COURSE. This data will be presented in Part 2 of this presentation



First Immersion Training courses.

The Continuum of Immersion Training. Moving the Training To Solid Objective Data. Part 2: The Development of Objective Measurements of Course Value, Stress and Habituation. Finding the “ZONE” with Objective Data

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Background:

- Excessive amounts of stress results in deleterious effects on performance. Hyper-realistic training is a teaching modality which aims to improve proficiency by requiring students to perform and operate in simulated high stress situations.
- RVUCOM Immersion Training is based on these principles. RVUCOM conducts an annual training week inducing non-demeaning stress through simulated trauma and emergency scenarios in controlled environments.
- We wished to compare the effects of stress through verified subjective Likert scales and objective biochemical metrics.
- Biochemical data was obtained by measuring salivary cortisol and alpha amylase.
- Cortisol is an established marker for the negative effects of stress.
- Alpha amylase is a surrogate for ANS function. Higher levels of sAA activity represents active, effortful responses to challenges and thus **Habituation**
- The goal is to demonstrate how these subjective and objective metrics can be utilized to better appreciate the effects of stress throughout this training period.

Objective: Begin the process of moving training to indisputable objective data to be used in the design and execution of Trauma Education.

Methods

- This study was conducted during an intensive surgical skills training course. The participants were 20 medical students (age 20 to 27 years, 20% female) who had recently completed their 2nd year of medical school.
- Day 1 scenario measured base line values of a mock explosion with point of injury care, without ER/OR simulation.
- Two trauma scenarios were conducted each day following Day 1 . Students were divided into ER and OR roles and responsible for a 5 bed ER and 2 bed OR suite. Medical attention was provided by students from point of injury through admission and treatment in ER and OR. Students were debriefed following the event.
- The curriculum included designated time periods for didactic lectures, procedural skills practice, and formal ground rounds presentations.
- At each day's conclusion, students rated their performance on a Likert scale based on 3 parameters:

Overall Stress (scale from 1-5)

Overall Confidence (scale from 1-5)

Did stress help you learn? (Yes / No)

- Salivary biochemical samples were obtained at specific time frames during each trauma scenario (pre-event, post-event, 20 min post event, 40 min post event) measuring salivary cortisol and alpha amylase. These were evaluated in the method designed by Salimetrics inc.

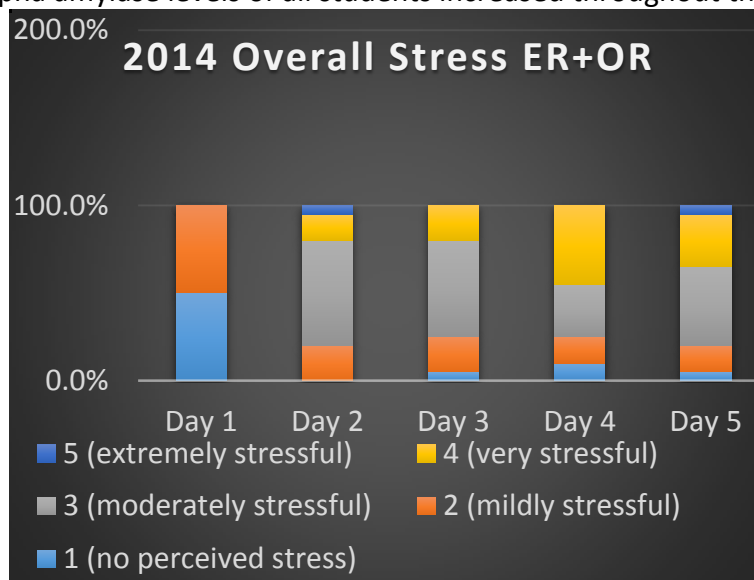
Results:

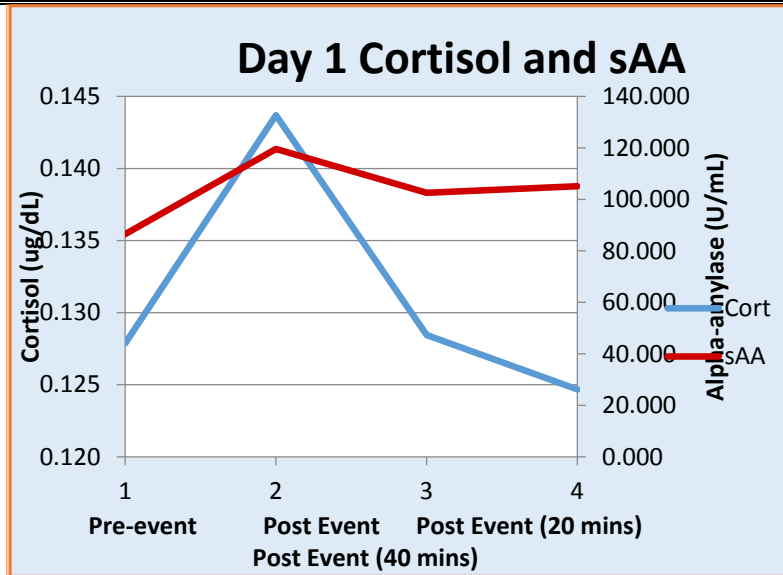
Likert Scale

- Overall stress: OR participants reported less stress by the end of the week. ER participants reported more stress by the end of week. (Table 1)
- Stress was recognized by students as beneficial to the educational process (Table 2).
- Overall confidence increased from 55% to 90% (Table 3).

Salivary Biometrics

- Salivary cortisol
- Prominent spike was observed on Day 1, as expected. Appropriately, peak cortisol present at post event collection with subsequent decline.
- Cortisol levels post Day 1 exhibit “anticipatory” stress response with pre-event levels highest. Pattern of rapid return to baseline is evident throughout all scenarios, with exception of Day 2 ER students.
- Alpha Amylase
- Alpha amylase demonstrates increasing trend from pre-event to post event, excluding Day 2 ER group.
- Increase from post event to 20 min post event in ER/OR groups day 2 the ER group in Day 3.
- Average alpha amylase levels of all students increased throughout the week .





| | ER | | OR | |
|-------|----------|--------------|----------|--------------|
| | Stressed | Not Stressed | Stressed | Not Stressed |
| Day 1 | N/A | N/A | N/A | N/A |
| Day 2 | 71.5% | 28.5% | 83.4% | 16.6% |
| Day 3 | 94.1% | 5.9% | 38.9% | 61.2% |
| Day 4 | 82.4% | 17.6% | 31.6% | 68.5% |
| Day 5 | 76.8% | 26.1% | 28.5% | 71.5% |



Conclusion:

- OR students self-reported Likert data is consistent with the salivary data.
- ER students self-reported Likert data does not fully correlate with the salivary data.
- Stress induced hyper realistic learning is an effective teaching modality in medical education.
- Likert scale and biochemical data used in conjunction offer deeper understanding of the physiological dynamics of stress and opportunity to improve future hyper-realistic training .This brought us to the conclusion that The LIKERT DATA WAS TOO VAGUE AND ONLY FROM THE END OF THE DAY. CONVERSLY THE SALIVARY DATA SHOWED US WHERE IN THE COURSE WE COULD ADD OR REMOVE STRESS AND THE AMOUNT OF HABITUATION (TRAINING) IT PRODUCED.
- WE now needed to know how the stress and habituation training could be brought into some form of real-time evaluation. Thus we proceeded to the evaluation of R-R 1/1000 of a second evaluation of the students in real time.

Impact:

- TRUE OBJECTIVE DATA WITH A SAFE EASY NON-INVASIVE APPROACH WILL REPLACE SUBJECTIVE DATA
- Biochemical evidence overall reflects habituation and increased executive function of students in both ER and OR students.
- Likert scales indicate reduced stress in OR participants but not ER participants.

The course curriculum deliberately emphasized expansion of surgical knowledge base and procedures. Course content did not heavily emphasize ER topics. This could also explain the elevated cortisol levels for the ER group on Day 2 as well.

Buggy (ATV) Accidents - An Emerging Public Health Problem in Kuwait

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Background: ATV injuries become very common with a sudden and great increase in mortality and morbidity so I carry out a retrospective clinical research study. Further to this, I conducted a ten year experience of ATV injuries from those patients who were admitted in ICU only but it was not completed and was not send to any medical journal for publication.

Objective: To assess the severity of All-Terrain Vehicle (ATV) Injuries and its impact on public health in Kuwait.

Design: Retrospective study conducted between January 2002 and August 2003.

Setting: Accident and Emergency (A&E) department of Adan Hospital, Kuwait.

Subjects and Methods: Medical records of 462 consecutive ATV accident victims seen at the A&E department of Adan Hospital were retrospectively analyzed.

Results: Out of 462 patients, 364 (78.8%) were male whereas 98 (21.2%) were female. Their ages ranged from 3.5 to 63 years (mean = 17.8 years). Out of 462 patients, 107 (23%) required admission to the hospital. 18.6% of these admissions (20/107) required ICU care. Fractures of extremities were common among admitted cases (44/107, 41%. Tibia, fibula and femur were the most common bones involved in these accidents. The face was the commonest site of injury in all patients.

Conclusion: The ATV accidents result in significant head injuries, fractures of extremities and skin injuries. Imposing an age limit and implementing state licensing, safety programs and the compulsory use of safety gear are required to reduce mortality and morbidity from this form of recreational riding.

KEY WORDS: All-Terrain Vehicles, Injuries

Preserving the Ability to Kill the Adversary Who Wounded You: Comparative Marksmanship With a Combat Application Tourniquet Versus the iTClamp 50 Hemostatic Clamp

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Background: A first line response to upper-extremity hemorrhage in an individual care under fire situation is to auto-apply a tourniquet and return fire until the threat is suppressed. This standard of care has saved lives, however, there is little understanding of how tourniquets and other hemorrhage control devices impact marksmanship. We are performing a series of experiments that compare the novel iTClamp vs CAT Tourniquet. Further development including clot enhancing sponges in an injury .

Objective: To identify the mechanisms and devices that allows soldiers and law enforcement officers to allow them to return fire after upper extremity injury.

Design/Methods: This project compared the impact of both a novel hemorrhage control device, the iTClamp50 (iTClamp) and the CAT tourniquet (CAT) on marksmanship, and pain experienced with both devices. Following randomization to either the iTClamp or CAT (which was applied to the dominant arm), trained marksmen shot four .556 x 55gr rounds at a 50m, 100m and 150m scaled silhouette target; using an AR15 in prone unsupported (shooting task). Subsequent to a control shoot (no device on), subjects then attempted to complete the shooting task at 5min, 10min, 15min, 30min and 60min post haemorrhage control device application.

Results: Thirteen (13) subjects were enrolled (7 clamp/6 CAT). 100% of the clamp group was able to complete the 60min shooting task. 5/6 of the CAT group completed the 5 min shooting task and 1/6 completed the 5 min and 10 min shooting task before withdrawing from the study. 4/6 of the CAT group were stopped by the RSO due to unsafe handling or inability to fire their weapon; 2/6 stopped due to pain. There was no significant difference between age or years of weapons experience between groups. The CAT group grip strength in both the dominant arm ($p=.000$) and non-dominant arm ($p=.05$) significantly decreased over time, with the dominant arm decreasing the most from 66.3kg to 26.3kg (60%). There was also a significant difference in the iTClamp group dominant arm grip strength ($p=.005$) with a drop from 52.6kg to 49.4kg (6%); the non-dominant arm was not impacted. The tourniquet was significantly more painful than iTClamp ($p=.003$), although over time pain reported with the clamp significantly decreased ($p=.000$). There was no significant difference in precision over time within group or between groups.

Conclusion: Application of a tourniquet to the dominant arm negates effective return of fire in a care under fire setting after a brief time-window. The iTClamp 50 impacts marksmanship

significantly less than the CAT tourniquet. For less devastating (non-amputation) peripheral wounds other hemorrhage control devices such as the iTClamp 50 may have operational merit in care under fire situations, as preserving effectiveness in returning fire has obvious operational merits. He may be even more true when the deep wound may require an expandable or combat gauze packing.

Impact: Usage of such devices likely do not affect nerve ischemia to the same effect as a tourniquet does.