



(REVIEW ARTICLE)



Police prehospital trauma care and hemorrhage control training as an indicator for elevated performance: A systematic review of literature

Konstantinos Tsikouras ¹, Dimitrios Giotis ² and Christos Konstantinidis ^{2,*}

¹ Department of Emergency Police, "DIAS" Motorcycle Team, Thessaloniki, Greece.

² Department of Orthopedics & Trauma, General Hospital of Ioannina "G. Hatzikosta", Ioannina, Greece.

International Journal of Science and Research Archive, 2022, 06(01), 088–097

Publication history: Received on 04 April 2022; revised on 09 May 2022; accepted on 11 May 2022

Article DOI: <https://doi.org/10.30574/ijrsra.2022.6.1.0101>

Abstract

The global escalation of terrorist and felonious assaults in the civilian environment along with the Emergency Medical Services lack of training in tactical emergency casualty care lead the police forces to look for new training strategies regarding penetrating trauma management from Law Enforcement Personnel. USA police agencies approached the military committee for guidelines due to similarities presented between civilian incidents and warfare. Therefore, modified Tactical Emergency Casualty Care programs were developed. These programs were also adapted by the Hellenic Police Force, along with German, Italian, French and British Police. The aim was to elevate Law Enforcement Officers medical knowledge and practical skills in bleeding control, tension pneumothorax and airway management using hemostatic dressings, tourniquets, decompression needles and nasopharyngeal tubes respectively, in an ongoing situation. It is evident that LEOs training nowadays is more demanding as far as it concerns severe and life-threatening injury management, resulting to increased self-confidence and medical skill development. On the other hand, such training should be accessible and cost-efficient to the majority of field-operating personnel.

Keywords: Tactical Trauma; Police; Hemorrhage; Tourniquet; Training

1. Introduction

According to World Health Organization violence is "The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation" [1]. This definition includes beating, kicking, stabbing, shooting, pushing, slapping and under certain circumstances can be contemplated as a life threatening incident in which case a trained first responder must act in favor of the victim. It is understandable that law enforcement personnel frequently put themselves at risk in order to provide help to people in need under critical situations involving gunfire, active shooters, terrorists, vehicle accidents, assaults with knives and sharp objects.

The international literature lacks of information about Law Enforcement Officers (LEO) medical skills and their scientific evaluation, but still the rising awareness from expanding felonious assaults triggered their concern for a more substantial training.

The conflicts between drug producers, dealers and drug LEOs in Colombia in the mid 80's led to confrontations in an unsafe environment with increased violence from armed men. This forced the US government to provide economic aid and training support to LEOs from Colombia, Peru and Bolivia, offering them advice and assistance in counternarcotics techniques [2]. In addition, in the late '90 the reality for LEOs changed significantly because of incidents with rifle

* Corresponding author: Konstantinos Tsikouras
Department of Orthopedics & Trauma, General Hospital of Ioannina "G. Hatzikosta", Ioannina, Greece.

assaults and armed robberies (North Hollywood Bank in California) indicating that the ability to reach and treat those victims was zero because of no prior experience [3]. According to Pons et al [4], the 1999 mass shootings at Columbine High School in Littleton, Colorado raised the awareness for different emergency response from Leo's personnel and civilians.

After the 9/11/2001 event the expansion of worldwide terrorism led to tactical operations that were performed not only by specialized agencies but involved LEOs too due to unsafe access for Emergency Medical Service (EMS) [5]. Subsequently, the escalation of terrorist attacks in Europe from 2004 in Madrid, 2005 and 2017 in London, 2015 in Paris and the United States of America in 2013 during the Boston Marathon exposed civil areas to conditions mimicking combat environment [6].

In September 2012 in Minneapolis, Minnesota an active shooter incident took place [7]. Police forces once again responded by securing the area and the building for EMS to enter and provide medical help. This incident triggered the necessity of preparedness for police, firefighters and EMS for mass casualty situations, the need for collaboration of all three departments and finally the development of guidelines for hemorrhage control of injured civilians under ongoing high-risk situations and applying techniques (pressure, tourniquets, chest seals) essential for death preventing potential.

Summarizing, in the USA 57 officers lost their lives by felonious assault when on duty, during 2007 and more than 15,000 were injured [8]. In parallel, Cannon [3] documented that in the US during 2009 57,268 LEOs were victims of assault during their shift, thus in 2010 the deaths from gunfire increased significantly.

Regarding Europe, Police forces focus mostly on acute medical incidents and training in cardiopulmonary resuscitation with or without the use of an external defibrillator, although the need for trained and highly skilled officers as first aid providers in trauma is essential. It is evident that such training in Europe's Police is poor due to the low rate of felonious assaults as compared to the United States of America.

The purpose of this study was to search and evaluate differences and similarities in LEOs training around the world and to identify the necessity of trauma care skills. Moreover, it was aimed to evaluate and suggest modified tactical operation and medical care programs to meet the needs and previous knowledge of LEOs in situations of life-threatening hemorrhage, tension pneumothorax and airway management increasing the possibility of death rate induction due to trauma. In parallel, it was intended to familiarize with the educational level in life-saving skills and how this affects self-confidence of police officers and public safety awareness.

2. Materials and methods

A systematic review of literature was performed on PubMed and Scopus databases following the aspects of the Preferred Reporting Items for Systematic Review and Meta-Analysis Extension for Scoping Review Protocols (PRISMA-ScR) guidelines.

The objective was to conduct an effort to identify the existence of hemorrhage control skills of LEOs, to understand the background along with potential lack of knowledge upon prehospital life-saving skills and furthermore to develop and recommend suggestions for improvement and supporting prehospital knowledge and life-saving skills. Following the PRISMA protocol, answers were sought to questions concerning the education and level of knowledge, skills of LEOs for prehospital trauma care, potential materials for penetrating trauma control under fire and finally implementations of the potential differences of trauma manipulation among LEOs from different geographical regions.

The search had no limited publication date in the past due to the lack of targeted literature upon trauma managing from police officers, although the first available article recorded was in 1998, and was conducted until 2019, expressing the need to explore and evaluate the training and skills obtained of LEOs in penetrating trauma care. Also, an additional search within the article's literature for supplementary and relevant references was conducted. The primary search was based on keyword mapping focusing on penetrating trauma, police training and tactical trauma care, which resulted in a total of 61 papers. Then, the articles were evaluated by title and abstract excluding those of irrelevant to trauma police mentions and non-free access. Furthermore, the screening process by full text examination defined the eligibility of the remaining articles resulting to 20 articles for the qualitative and quantitative analysis. As mentioned, the incidents that were analyzed were reported from 1998 until 2016 due to limited access to police and federal agencies file reports and personnel reluctance to participate to interviews related to their training and field performance. The database exploration was limited only to articles written in English and with free access.

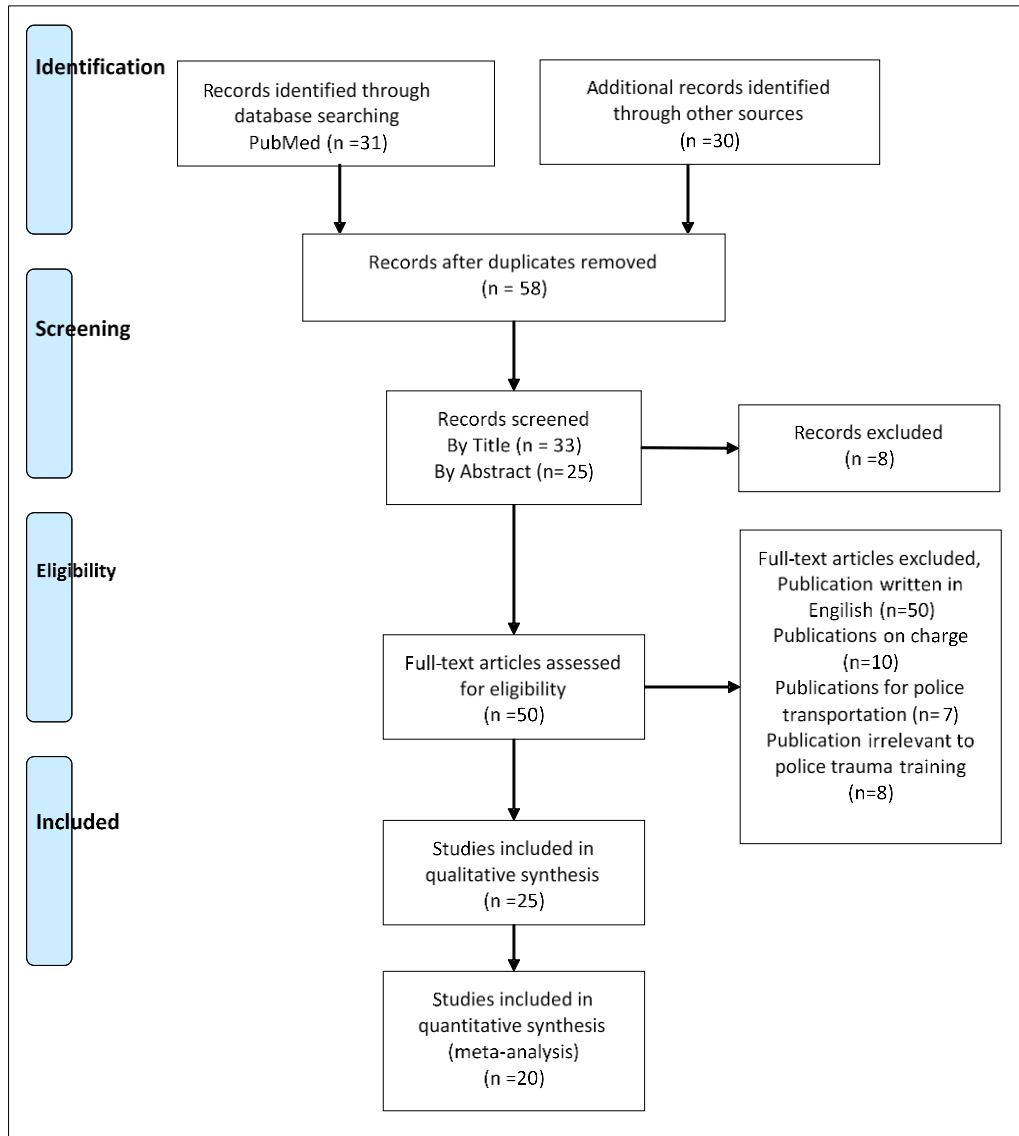


Figure 1 PRISMA flow diagram depicting literature for the Systematic Review

Table 1 Data analysis after review of literature displaying Leo’s deaths caused by penetrating trauma from felonious assaults

A/A	Authors/year published	Country / region	Medical care skills & training	Type of evaluation	Referential period	Participants
1	Sztajnkrzyca, 2010 ⁽¹²⁾	FBI	TCCC	Deaths from penetrating trauma	1998-2007	341 LEOs deaths
2	Mark et al., 2012 ⁽¹⁶⁾	US counties	penetrating trauma	Deaths recorded	1998-2007	33/533 LEOs deaths
3	Stiles et al., 2017 ⁽¹⁵⁾	Milwaukee Wisconsin,	mechanism of injury, TCCC/TECC	1-h, 8h and 40h programs	2014	117 LEO deaths & 13,654 injured
					January 2010 - December 2015	19 agencies/ 4,570 LEO
4	Hellenic Police Force ⁽⁸⁾	Greece	not recorded	not recorded	1984-2017	132 deaths

Table 2 Data after review of literature displaying tactical and medical care training of LEO & EMS

A/A	Authors/year published	Country/ region	Medical care skills and training	Training/ Evaluation	Referential period	Participants
1	Ciccone et al., 2005 ⁽⁵⁾	Quantico, Virginia	Providing medical care with less medical equipment, limited space, light, sound and without contact to medical control.	TEMS	July 2000 & April 2002	95 Drug Enforcement administration agents.
2	Jamaraman et al., 2009 ⁽²⁵⁾	Kampala	CPR, Triage, scene management, bleeding control.	45min skill sessions & questionnaires	not mentioned	police officers, taxi-drivers, Local Council Officials
3	Band, 2010 ⁽⁹⁾	Philadelphia, Pennsylvania	transportation of victims with penetrating trauma	data analysis	January 2003-December 2007	LEOs
4	Rubiano et al., 2010 ⁽²⁾	Colombia	theoretical sessions & simulation scenarios	Combat Medicine (MEDTAC), Tactical Course questionnaire	March 2006-July 2007	374 police nurse students
6	Mechem et al., 2014 ⁽¹³⁾	Philadelphia	Providing medical care with less medical equipment, limited space, light, sound and without contact to medical control.	Rapid Assessment Medical Support (RAMS)	not mentioned	EMS, LEO
7	Jones et al., 2014 ⁽¹⁴⁾	Boston	TCCC, ongoing tactical operation	4-h program.	not mentioned	256 EMS, LEO
8	Autrey et al., 2014 ⁽⁷⁾	Minneapolis	Penetrating trauma, Triage & First response	jointed training	2012	EMS, LEO, Firefighters
9	Pons et al., 2014 ⁽⁴⁾	Chicago	didactic lectures & skill stations	8h training	not mentioned	EMS, LEO, Firefighters
10	Lee et al., 2015 ⁽¹¹⁾	Canada	Triage for mass casualty incidents	didactic and testing sessions	October 2012-January 2013	485 EMS, LEOs, Firefighter students
11	Neals et al., 2018 ⁽¹⁷⁾	Western Pennsylvania region	skill sessions of penetrating trauma	Stop the Bleed (STB)	August 2016	72 counties, 27,291 participants (4,809 LEOs)

12	Beaucreux et al., 2018 ⁽⁶⁾	France	Civilian trauma, TECC, tourniquet use	systematic literature review	past 2016 until	24 cases of victims
13	Rothschild et al., 2018 ⁽¹⁰⁾	Fairfax & Arlington Counties	TECC/TCCC	data questionnaire TECC,	January 2015 - December 2016	2 Police Departments/46 incidents
14	Maguire et al., 2018 ⁽¹⁾	13 US counties	EMS, LEO tactical operation	Self-defence, questionnaire, joined training	April 2016- November 2016	1778 EMS, LEO
15	Meducation.org ⁽¹⁸⁾	Greece	TECC/TCCC	14 to 40-h courses	2015 -today	not defined

Table 3 Data after review of literature demonstrating BLS/AED skills of police personnel

A/A	Authors/year published	Country/region	Medical care skills	Training	Referential period	Participants
1	Kooij et al., 2004 ⁽²³⁾	Amsterdam, Netherlands	ARREST4	8-h program	September 1999-June 2000	823 police officers
2	Stein et al., 2017 ⁽²²⁾	Zurich, Switzerland	BLS/AED	6-h program	May 2004-December 2009 July 2010-July 2015	1554 STAPO police
3	Meducation.org ⁽¹⁸⁾	Athens, Thessaloniki, Greece	BLS/AED	5-h program	2015 -today	not defined

Furthermore, the authors tried to segregate the literature used in three groups, evaluation of medical care skills derived from penetrating trauma deaths (Table 1), bleeding control skills under dangerous situations (Table 2) and CPR skills (Table 3). In most cases the researchers approached the police training and medical skill by gathering and analyzing incidents involving injuries and recorded deaths from penetrating trauma [12, 15, 16]. Also, several studies were based on real-time programs evaluating medical and tactical skills of Law Enforcement Officers (LEOs) under TCCC, TECC, Bleeding control and appropriate materials (tourniquets, hemostatic dressings, chest seals) [2, 7, 14].

Finally, in the current manuscript, data reported for cardiopulmonary resuscitation (CPR) [20] situations were included, which indicate the medical care level of police personnel (Table 3). STAPO is the police that patrol the city of Zurich. 15 teams patrol the city every day and as compared to EMS, they respond faster to an emergency call. Although no data involving trauma injury were found, STAPO's CPR training was evaluated as a life-saving procedure to pathological life-threatening situations [18]. In parallel, the same approach was assessed in two police departments of Amsterdam [19].

3. Results

It should be taken into account that the literature upon LEOs training on trauma, and programs developed for their performance under life-threatening situations is fairly poor. Based on data selected and presented by FBI in the USA [12] the authors managed to carry out a short comparison of elevated felonious assault incidents, training programs upon operational and tactical action along with medical support for under fire ongoing situations in a domestic and civilian environment.

USA is considered the country where the most severe terrorist attacks and active shooters incidents in a domestic environment occurs [4, 7, 16]. The EMS, as it is introduced over the years, respond after LEOs declare the scene as safe and secure. Nowadays this could turn out to be a life-threatening delay, due to increased incidents [5, 14]. Therefore, it is evident that many counties reach out the military Committee [12, 15] for tactical operation guidelines and provision of immediate medical help under dangerous situations mimicking the battlefield.

LEOs usually act as first responders and while violent incidents involving penetrating trauma are escalated, they tend to attend and train at Bleeding control courses to adequately deal with those situations. As it is already mentioned, Police Departments facing severe penetrating trauma injuries and deaths, have incorporated TCCC and TECC programs to their basic training [6, 10].

From the review of the existing literature it is obvious that many tactical medicine programs are developed for combat (MEDTAC, TCCC, C4, BATLS) [2] and are differentiated from those responding to EMS (PHTLS, BTLs) [2, 13]. By taking in concern that civilian tactical situations simulate to those of a battlefield, a continuous training could increase the knowledge and improve the trauma care skills of the participants [2, 18]. As mentioned by Cannon [3], "The ultimate goal is to make a very dangerous job safer". Therefore, in spite of the differences between battlefield and civilian environment MCI, the similarities are stronger and so the military trauma is introduced to civilian guidelines. The US Border Patrol was the first force group with intense concern for "survival of the wounded" and attended TCCC/TECC seminars due to the incidents recorded. Knowledge of injury mechanism might be essential, especially for bleeding control and the use of tourniquets [6] to eliminate further damages. Similarly, Rothschild et al [9] reports the strategic turn of police force agencies to TCCC training and the use of medical trauma care materials like tourniquets, hemorrhage dressings, and hemostatic gauges for life-saving procedures.

It should also be noted that although LEOs were intrigued by penetrating trauma deaths and trained under TCCC guidelines gaining cost effective skills, the possibility to use their skills and knowledge to save civilian lives is more likely.

Several authors insist not only on skills development and maintenance but on the required equipment for appropriate trauma medical care. This may consist of a carry-on emergency kit containing hemostatic dressings and gauges, tourniquets, chest seals for open pneumothorax, decompression needle for tension pneumothorax and nasopharyngeal tubes [15].

Generally, as Jayaraman et al. [20] indicated that there is a need for trauma system development along with training for trauma medical care skills in order to provide proper help to injured victims.

4. Discussion

Extreme hemorrhage is the main cause of death in a tactical field operation. Over the year's violent incidents like terrorist attacks, felonious assaults and active shooters occurred presenting a new reality in tactical approach and trauma management in civilian environments [6, 10]. The original role of LEOs was to ensure the safety stage [3, 11] and threat restriction, because EMS lacks of tactical operation or experience [5]. When the threat is under control, EMS enter the restricted area, perform Triage in case of an MCI and provide medical care under PHTLS protocols, remove the injured and transport them to medical health centers [13].

In fact LEO is by nature a very difficult, dangerous and distressing job [3, 16]. The scaling up of felonious incidents made their agencies to turn to military Committee for guidelines [15, 16]. The absence of initial medical care training resulted to deaths from extreme hemorrhage of penetrating trauma to head, chest and abdomen, while, chest trauma and tension pneumothorax could be preventable if there was skill preparedness. The increase of mass casualty incidents, terrorist attacks or active shooters in a domestic area launched LEOs to focus on operational tactics and rapidly respond providing effective bleeding control techniques including pressure, hemostatic agents and tourniquets [6, 10], with a goal to prevent as many as possible deaths from extremity hemorrhage [10].

LEOs act as first responders to a mass casualty incident and their main concern is to secure and maintain the safe public environment and EMS performance [11]. Moreover, a mass casualty incident such as a terrorist attack or an active shooter, accidents with multiple victims, or even a disaster like earthquake, flood, rain etc., needs triage systems to evaluate the number and level of injured victims. It is well known that EMS are trained under Prehospital Trauma Life Support (PHTLS) courses following algorithms prioritizing the treatment of extreme hemorrhage, spinal stabilization, airway management, tension pneumothorax, fractures and mental awareness of the victim in order to maintain an overall objective condition under a safe environment [5, 12]. On the contrary they don't have any Tactical Combat Casualty Care (TCCC) experience to provide medical care under an active threat [2, 16]. It is also indicated that some EMS act along with LEOs to mass casualty incidents but under LEOs protection [4, 13] and still wait for safety scene assessment. This implies a potential increase of morbidity and mortality from time sensitive injuries and life-threatening circumstances [3, 12]. Despite the rapid deployment of LEOs, still enough time passes until the scene is declared safe for EMS, challenging both LEOs and EMS to learn to utilize alongside and co-train in TCCC/TECC courses [4, 14].

Both war and mass casualty incidents in civilian area present similarities to the mechanism of injury and the situations of the prehospital medical care from EMS as well as the safety of the scene by LEOs. This led the military and civilian emergency medical services to improve both training and equipment of the teams involved in situations similar to those in order to be able to control external hemorrhages with several techniques with the use of tourniquets and hemostatic dressing [6].

Stiles et al. [14] refer that there is an extensive literature about the possibility of preventing death during military combat, considering that exsanguinating hemorrhage represents the 35% of casualties. In addition, in 2010 due to felonious assaults, 139 LEOs died on duty in the USA potentially due to lack of immediate help from specific medical staff or by deficient medical training. Mark et al. [15] claimed that those deaths were possibly preventable. Thus, the police agencies contacted TCCC Committee for their experience in the battlefield for medical care under extreme incidents in order to begin a training program suitable for police personnel in civilian environment [10, 16]. Therefore, the Committee developed operational guidelines to improve the survival rate in the civilian area after considering the large number of LEOs that were lost and more than 13,000 sustained injuries only in 2014 from felonious assaults [15, 16]. The nature of these deaths is similar to those that soldiers meet during battlefield situations and respond mostly to bleeding control, and secondary to airway management. The mechanism of injury also presents similarities with the main causes that lead to battlefield trauma [12].

Ciccone et al. [5] also acknowledging this inconvenience of repeated felonious assaults, prompted that agencies should collaborate with tactical operation and emergency medical expertise and train the police personnel and prepare them for acting under difficult situations such as armed people, terrorists, exposure to hazardous substances, drugs and even car accidents. It is notable that the goal is to train the LEOs to provide support under limited provisions, equipment and medical support, and severe restrictions taking into consideration the limitations of space performing, light and sound [7].

Military TCCC is gradually adapted for LEOs training [12] because of the aforementioned increased ratio of policemen deaths in the line of duty. It is important to mention that TCCC combines tactical and operational management aiming to prevent farther injuries through a three-phase medical care, Care under fire, Tactical Field Care and Tactical

Evacuation Care. This is interpreted as hot, warm and cold zone respectively, mimicking the triage procedures and emphasizing to life-saving actions like the use of tourniquets, appropriate dressings for exsanguinating hemorrhage, and decompression needles for tension pneumothorax and finally nasopharyngeal tubes for airway management according to the guidelines given for these three most life-threatening conditions [12].

Since 2008 police departments changed their attitude towards first aid provision, by introducing new modifications along with a modernized program under the name of Tactical Emergency Casualty Care (TECC). It is a more appropriate training program regarding the civilian field –although there are similarities- indicating the growth of concern for survival of wounded officers [10]. Thus, the USA Border Patrol began a cross-training for selected agents with paramedic skills.

The evaluation of Neal et al. [16] depicted that deaths from penetrating trauma hemorrhage can be prevented. As known, LEOs respond initially to an incident of massive injury, so they can actually be an asset to bleeding control management. This involves a need for elevated training following the guidelines of TCCC and TECC courses for enhancing their medical and acting skills. They also presented the STB program which generated interest not only to LEOs but also to civilians. Both groups learned to perform TRIAGE [11, 16], were trained for bleeding control skills and appropriate equipment use to provide emergency medical care.

Terrorism and felonious assault incidents, along with gunfire and knife assaults are increased globally [3, 4, 7]. Therefore, several incidents that occurred not only in US counties but to Europe as well, lead the authorities to incorporate PHTLS, TCCC, B-Con to their basic training and equip units with the appropriate emergency medical material containing tourniquets, hemorrhage dressings, scissors, penetrating trauma seals and nasopharyngeal tubes [8].

TCCC program presents a high potentiality of trauma survival under life-threatening situations [4, 12]. Due to limited time for survival of an injured victim following penetrating trauma, a jointed training that aims to an alongside performance of LEOs and EMS is introduced [3]. The courses were modified for both LEOs and civilians and demonstrated high level skills of airway management, tension pneumothorax and extreme hemorrhage. Mechem et al. [12] indicate the need for a joint training TEMS program promoted to all agencies.

Autrey et al. [7] expressed the same opinion for jointed training of LEOs and EMS but insist on performing side by side. Whereas Maguire et al. [1] added the need for a better communication system between EMS and LEOs call centers. Upon the benefits of a jointed training and tactical rescue, Jones et al. [13] demonstrated the reluctance of EMS to proceed in an ongoing incident after all.

There are certain limitations concerning the selection of the papers reviewed. The main goal was the evaluation of the medical care level of LEOs globally and their skills in live-saving techniques concerning trauma, exsanguinating hemorrhage and airway management. Antiterrorist units, explosive devices disposal departments or special weapon and tactics (SWAT) were excluded from the research due to their specialized training to perform under fire and to follow guidelines of tactical operation according to TCCC and TECC programs. Furthermore, limitations were presented upon lack of data for casualty training, operational tactics and medical care skills for police officers in the US and Europe. In addition, the review was based on other studies, with minimum to none ability to retrieve initial information, with a retrospective approach and poor evidential information. Moreover, there is a heterogeneous training system of LEOs in different countries; hence it is difficult to compare their performance under similar perilous situations.

Abbreviations

- LEO: Law Enforcement Officers
- TCCC: Tactical Combat Casualty Care
- TECC: Tactical Emergency Casualty Care
- EMS: Emergency Medical Service
- PHTLS: Prehospital Trauma Life Support
- MEDTAC: Combat Tactical Medicine Course
- STB: Stop the Bleeding
- B-Con: Bleeding Control
- MCI: Mass Casualty Incident
- CPR: Cardiopulmonary Resuscitation

- BLS: Basic Life Support
- AED: Automated External Defibrillator
- TEMS: Tactical Emergency Medical Services

5. Conclusion

Prehospital trauma care under fire and dangerous circumstances in order to provide immediate life support is important in an ongoing situation. In Europe, police forces follow more or less the same guidelines as LEOs of the US but with no certification and often individually, at own expenses. So, it is notable that these programs although initially thought cost efficient, may in contrast appear expensive to both individuals and police force departments. This contradiction needs a smaller, sensible and more flexible program to meet the expectations for an enhanced and cost affordable training. As a consequence, training and essential equipment of LEOs personnel under the guidelines of tactical casualty care, remain necessary for providing medical and operational assistance to victims under a dangerous civilian environment. It is evident that both initial and periodic training helps to sustain good performance, and even improve the skills obtained during the courses. In closure, a more detailed and scientific study should be contacted to investigate the training of LEOs based on real and ongoing evidence, the knowledge obtained and the skills gained towards trauma care under unique and dangerous situations concluding at what should be the most abundant training course.

Compliance with ethical standards

Acknowledgments

The authors would like to sincerely thank Mr. Toumbelis Alexandros and “Meducation-Innovation in Medical Activities” organization for their valuable assistance in combat casualty care information and training programs, and for their fundamental contribution to various stages of this project.

Disclosure of conflict of interest

The authors declare that they have no competing interests.

References

- [1] Maguire JB, O’Neil JB, O’Meara P, Browne M. Preventing EMS workplace violence: A mixed-methods analysis of insights from assaulted medics. *Injury-International Journal of the Care of the Injured*. 2018; 49: 1258–1265.
- [2] Rubiano MA, Sánchez IA, Guyette F, Puyana CJ. Trauma Care Training for National Police Nurses in Colombia. *Prehospital Emergency Care*. 2010; 14(1): 124–130.
- [3] Cannon M. Law Enforcement and the Long gun: Do we need a face in the fight? *The Journal of Emergency Medicine*. 2013; 45(5): 710–713.
- [4] Pons TP, Jerome J, McMullen J, Manson J, Robinson J,Chapleau W. The Hartford consensus on active shooters: implementing the continuum of prehospital trauma response. *The Journal of Emergency Medicine*. 2015; 49(6): 878-885.
- [5] Ciccone TJ, Anderson PD, Gann CAD, Riley JM, Maxwell M, Hopkins R et al. Successful development and implementation of a tactical emergency medical technician training program for United States federal agents. *Prehospital and Disaster Medicine*. 2005; 20(1): 36-39.
- [6] Beaucreux C, Vivien B, Miles E, Aussete S, Pasquiere P. Application of tourniquet in civilian trauma: Systematic review of the literature. *Anaesthesia Critical Care & Pain Medicine*. 2018; 37: 597–606.
- [7] Autrey AW, Hick JL, Bramer K, Berndt J, Bundt J. 3 Echo: concept of operations for early care and evacuation of victims of mass violence. *Prehospital and Disaster Medicine*. 2014; 29(4): 421-428.
- [8] Band AR, Pryor PJ, Gaieski FD, Dickinson TE, Cummings D, Carr GB. Injury-adjusted Mortality of Patients Transported by Police Following Penetrating Trauma. *Academic Emergency Medicine*. 2011; 18(1): 32–37.
- [9] Rothschild HR, Mathieson K. Effects of Tactical Emergency Casualty Care training for law enforcement officers. *Prehospital and Disaster Medicine*. 2018; 33(5): 495–500.

- [10] Lee CWC, McLeod SL, Peddle MB. First responder accuracy using SALT after brief initial training. *Prehospital and Disaster Medicine*. 2015; 30(5): 447-451.
- [11] Sztajnkrycer MD. Tactical medical skill requirements for law enforcement officers: A 10-year analysis of line-of-duty deaths. *Prehospital and Disaster Medicine*. 2010; 25(4): 346-351.
- [12] Mechem CC, Bossert R, Baldini C. Rapid Assessment Medical support (RAMS) for active shooter incidents. *Prehospital Emergency Care*. 2015; 19(2): 213-217.
- [13] Jones J, Kue R, Mitchell P, Eblan G, Dyer KS. Emergency Medical Services response to active shooter incidents: provider comfort level and attitudes before and after participation in a focused response training program. *Prehospital and Disaster Medicine*. 2014; 29(4): 350-357.
- [14] Stiles CM, Cook C, Sztajnkrycer MD. A descriptive analysis of tactical casualty care interventions performed by law enforcement personnel in the State of Wisconsin, 2010-2015. *Prehospital Disaster Medicine*. 2017; 32(3): 284-288.
- [15] Mark AC, Wimberger N, Sztajnkrycer MD. Incidence of tension pneumothorax in police officers feloniously killed in the line of duty: a ten-year retrospective analysis. *Prehospital and Disaster Medicine*. 2012; 27(1): 94–97.
- [16] Neal DM, Reynolds RB, Bertoty D, Murray JK, Peitzman BA, Forsythe MR. Design and implementation of the Western Pennsylvania regional stop the bleed initiative. *Journal of Trauma and Acute Care Surgery*. 2018; 85(4): 684-690.
- [17] Perkins DG, Handley JA, Koster WR, Castren M, Smyth AM, Olsveengen T, et al. Resuscitation Council Guidelines for Resuscitation 2015: Section 2. Adult basic life support and automated external defibrillation. *Resuscitation*. 2015; 81-90.
- [18] Stein P, Spahn HG, Muller S, Zollinger A, Baulig W, Bruesch M, et al. Impact of city police layperson education and equipment with automatic external defibrillators on patient outcome after out of hospital cardiac arrest. *Resuscitation*. 2017; 118: 27-34.
- [19] Kooij OF, van Alemb PA, Kosterb WR, de Vos R. Training of police officers as first responders with an automated external defibrillator. *Resuscitation*. 2004; 63: 33–41.
- [20] Jayaraman S, Mabweijano RJ, Lipnick SM, Caldwell N, Miyamoto J, Wangoda R, et al. Current Patterns of Prehospital Trauma Care in Kampala, Uganda and the Feasibility of a Lay-First-Responder Training Program. *World Journal of Surgery*. 2009; 33(12): 2512-21.