

I.	Introductions
II.	Approve Agenda
III.	Minutes
IV.	Medical Issues
	A. DuoDote shortage and shelf life extension
	B. Normal Saline Shortage
	C. Humeral I.O. Access - Mark Komins
	D. Other
V.	New Business
	A. Other
VI.	Old Business
	A. 705.17 – Nerve Agent Poisoning - Draft
	B. Other
VII.	Informational/Discussion Topics
	A. Other
VIII.	Policies for Review
	A. 306 – Requirements to Staff an ALS Unit
	B. 330 – EMT/Paramedic/MICN Decertification and Discipline
	C. 613 – Do Not Resuscitate
	D. 625 - POLST
	E. 701 – Medical Control: Paramedic Liaison Physician
	F. 722 – Interfacility Transport of Patient with IV Heparin
	G. 802 – Emergency Medical Technician - I Defibrillation (EMT-ID) Medical Director
	H. 803 – EMT Automatic External Defibrillation (AED) Service Provider Program Standards
	I. 805 - Emergency Medical Technician Defibrillation (EMT-ID) Medical Cardiac Arrest
	J. 1400 – Trauma Care System – General Provisions
	K. 1406 – Trauma Center Standards
	L. Other
IX.	Agency Reports
	A. Fire Departments
	B. Ambulance Providers
	C. Base Hospitals
	D. Receiving Hospitals
	E. Law Enforcement
	F. ALS Education Program
	G. TAG
	H. EMS Agency
	I. Other
X.	Closing

Topic	Discussion	Action	Assigned
II. Approve Agenda			Approved by Debbie Licht Seconded by Matt Beatty
III. Minutes	Replace AMR with Lifeline in Agency Reports.		Approved by Robin Shedlosky Seconded by Betsy Patterson
IV. Medical Issues			
A. air-Q Trial	Angelo gave a brief update on this trial. It is important to show that V.C. can do a study like this. There is no date of approval, depends on IRB and may take months.		
V. New Business			
VI Old Business			
A. Encounter Number on ePCR	Chris reported that the hospital side is delayed. The field side is up and running. An MCI field will now be required.	Chad said that AMR will have 1 unit in each area that will demo and work out any problems before it is rolled out to the County.	
B. Prediction of Sudden Death in Multi-Ethnic Communities Trial - Update	Angelo gave a brief overview. Continuing to gather data.		
VII. Informational/Discussion Topics			
A. Community Paramedicine Program – TB and Hospice Projects -Update	Mike stated that this program started 1 year ago and provides great support for Co. TB Team. They have 4 patients at this time and mostly visit the patients outside of the normal office hours, 7 days a week.		
VIII. Policies for Review			
A. 332 – EMS Personnel Background Check	Steve C. requested that this policy be placed on hold. This policy may not be		

	Requirement	required. Information can be found in other policies.		
B.	625 - POLST	Mark Komins asked that we table this for 4 months.	Steve C. approved tabling this policy for 4 months.	
C.	701 – Medical Control: Paramedic Liaison Physician	Problem with Header on Page 2	Approved with change	Approved by Robin Shedlosky Seconded by Betsy Patterson
D.	705.17 – Nerve Agent Poisoning	Chris will research new dose information and bring back to PSC in the future. Remove "Buddy and Self" under ALS.	Chris will make changes.	
E.	722 – Interfacility Transport of Patient with IV Heparin	There was a debate among committee members regarding Heparin concentrations.	Angelo requested that each hospital check their internal policy and discuss at the next PSC.	
XI	TAG Report			No meeting
X.	Agency Reports			
A.	Fire departments	<p>VCFPD – Chief LaPlant will retire in March and Vaughn Miller will replace. Norm is being promoted to Div. Chief and this is his last PSC. They have had 30 CPR saves in 2013. New Academy begins Feb. 3 with 21 recruits.</p> <p>VCFD – They are doing joint Active Shooter Training with VCPD. They have 3 new FF's. The chief retires in March.</p> <p>OFD – There are 16 new FF's in the field. OFD is purchasing portable devices for ePCR's. They had 14 cardiac arrest saves in 2013.</p> <p>FFD –</p> <p>Fed. Fire –</p>		
B.	Transport Providers	<p>VCSO –</p> <p>AMR/GCA – They are in the process of hiring. Chad has conducted CAM training all over the county. He wanted to thank everyone who helped on the CAM comm.</p>		
C.	Base Hospitals	<p>SVH –</p> <p>LRRMC – Current CEO was promoted, they are looking for a new CEO. They will change documentation systems in Feb. The CVUSD will begin teaching CPR to 6th, 9th and 12th graders during their P.E. class. This program may begin in the Fall.</p> <p>SJRM –</p> <p>VCMC –</p>		
D.	Receiving Hospitals	<p>CMH – Construction continues, let Cheryl know if it causes any problems for the ambulances. Working on Sepsis program.</p> <p>PVH - Changes in personnel</p> <p>OVCH – Continued construction issues.</p>		

E. ALS Education Programs	Ventura College – They have 11 students.	
F. EMS Agency	<p>Angelo - TAG is being reworked. FYI – A patient was found in PEA who had choked. The CAM training may overlook airway obstruction issues. Advise personnel to be on the lookout for airway obstruction issues.</p> <p>Steve – Reddi-net will have back-up satellite connection to all dispatch centers and hospitals. The EMS Agency may be moving to a larger space upstairs in the future. Ambulances are being held in E.R.'s for up to 2 hours. This is unacceptable and cannot happen. There will be a countywide Sidewalk CPR project in June. There is an EMS conf. in May on Coronado Island. We are in the process of hiring new front office staff. Please send information that previously went to Nikki to: emsagency@ventura.org.</p> <p>Chris - Will be coordinating with PCC's to set MICN Training.</p>	
G. Other		
XI. Closing	Meeting adjourned at 1100.	



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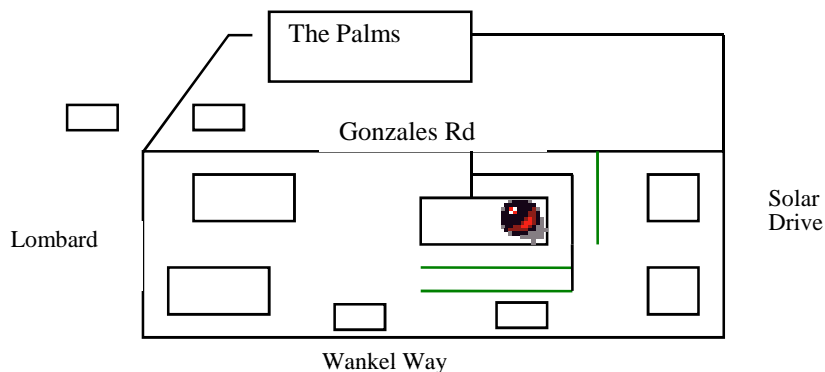
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The Palms - shopping mall

Enter The Palms at Lombard and Gonzales. Allow for a ten minute walk to venue location.

Additional parking is available on side streets, Lombard, Solar and Wankel Way.





Memorandum

Date: September 5, 2013

To: Pfizer/Meridian Medical Technologies

From: Janet Woodcock, MD, Director, Center for Drug Evaluation and Research, and
Luciana Borio, MD, Assistant Commissioner for Counterterrorism Policy and
Director, Office of Counterterrorism and Emerging Threats

Subject: DuoDote[®] (atropine and pralidoxime chloride injection) Auto-Injector Expiry
Dating

On August 27, 2013, you issued a Dear Healthcare Provider Letter regarding DuoDote auto-injector potential under-dosing or failure to activate. In the letter, you explained that “based on a review of product lots at its manufacturing site, Meridian personnel determined that a small number of DuoDote[®] Auto-Injectors are out of specification” and that “FDA is actively reviewing data related to DuoDote[®] performance beyond its labeled expiration date, and will provide additional information and guidance regarding expired product or product nearing its expiration date. Product beyond expiry should be held for the time being until further guidance can be provided by FDA.”

In follow up to the letter, FDA requests that this memorandum regarding expired product or product nearing its expiration date be communicated to the wholesalers, healthcare professionals, and emergency personnel who received the August 27 letter. FDA is aware that the following lots of DuoDote are approaching expiration or have already passed their original expiry date (see table below). Based on FDA’s review of scientific data, FDA has concluded that, provided the products have been stored under labeled storage conditions, it is scientifically supportable for lots of DuoDote listed in the following table to be used for an additional year (1 year) beyond the manufacturer’s original labeled expiry date.

DuoDote product is used for organophosphorous nerve agent or insecticide poisoning. FDA authorizes, pursuant to Section 564A of the Federal Food, Drug, and Cosmetic Act (FD&C Act), the following lots of DuoDote to be stored or used for nerve agent poisoning up to one (1) year beyond the manufacturer’s original labeled expiry date, provided that the products have been stored under the labeled storage conditions.¹ While Section 564A does not apply to product held

¹ Section 564A of the Federal Food, Drug, and Cosmetic Act (FD&C Act) authorizes FDA to extend the shelf life of certain stockpiled medical countermeasures intended to support the nation’s ability to protect the public health or military preparedness and effectiveness. Under Section 564A(b) of the FD&C Act, products with extended expiry will not be deemed unapproved, adulterated, or misbranded. An expiration date extension must be supported by an appropriate scientific evaluation that is conducted or accepted by FDA. This authority is limited to eligible products

or used for insecticide poisoning, FDA will not take enforcement action with regard to the storage or use for insecticide poisoning of the following lots of DuoDote up to one (1) year beyond the manufacturer's original labeled expiry date, provided that the products have been stored under the labeled storage conditions.

FDA is not requiring or recommending that the identified lots be relabeled with the new use date.

DuoDote Auto-Injector Lots

Lot Number	Manufacturer's Original Expiry Date	New Use Date (up to 1 year beyond manufacturer's original expiry date)
9AE307	March 31, 2013	March 31, 2014
9AE356	March 31, 2013	March 31, 2014
9AE545	March 31, 2013	March 31, 2014
9AE548	May 31, 2013	May 31, 2014
9AE636	May 31, 2013	May 31, 2014
9AE645	June 30, 2013	June 30, 2014
9AE835	September 30, 2013	September 30, 2014

For questions related to this memorandum, please contact Brad Leissa at brad.leissa@fda.hhs.gov or Brooke Courtney at brooke.courtney@fda.hhs.gov.

(as defined in FD&C Act Section 564A(a)) that are intended for use to prevent, diagnose, or treat a disease or condition involving a chemical, biological, radiological, or nuclear (CBRN) agent, including a nerve agent. This authority does not extend to non-CBRN uses of products, such as insecticide poisoning uses, but, as noted, FDA will not take enforcement action with respect to such uses.

Drugs

FDA extends expiration dates of additional lots of DuoDote auto-injectors manufactured by Meridian Medical Technologies

[12/24/2013] FDA is now alerting health care providers and emergency responders of more lots of DuoDote auto-injectors, manufactured by Meridian Medical Technologies, a Pfizer, Inc., company, that can be used for up to an additional year past the manufacturer's labeled expiration date. To help assure patient safety, products should have been stored under labeled storage conditions.

In follow up to the [November 22, 2013, FDA drug safety statement](#)¹, the following table is a cumulative list of DuoDote lots listed in FDA's [September 5, 2013, memorandum](#)² and additional lots identified by FDA in December 2013 to further address stakeholder needs.

For questions related to this table, please contact Brad Leissa at brad.leissa@fda.hhs.gov or Brooke Courtney at brooke.courtney@fda.hhs.gov.

DuoDote auto-injector lots eligible for use up to one year beyond the manufacturer's labeled expiration date (updated December 24, 2013)

	Manufacturer's Original Expiry Date	New Use Date (up to 1 year beyond manufacturer's original expiry date)
9AE307	March 31, 2013	March 31, 2014
9AE356	March 31, 2013	March 31, 2014
9AE545	March 31, 2013	March 31, 2014
9AE548	May 31, 2013	May 31, 2014
9AE636	May 31, 2013	May 31, 2014
9AE645	June 30, 2013	June 30, 2014
9AE835	September 30, 2013	September 30, 2014
OAE158	December 31, 2013	December 31, 2014
OAE159	December 31, 2013	December 31, 2014
OAE287	February 28, 2014	February 28, 2015
OAE458	April 30, 2014	April 30, 2015
OAE500	May 31, 2014	May 31, 2015
OAE501	May 31, 2014	May 31, 2015

FDA alerts health care providers and emergency responders of a potential extension of expiration dates for certain auto-injectors manufactured by Meridian Medical Technologies

[11/22/2013] The U.S. Food and Drug Administration is aware of a disruption in supply to health care providers and emergency response personnel of Atropen (atropine), DuoDote (atropine/pralidoxime chloride) morphine sulfate, pralidoxime chloride, and diazepam auto-injectors manufactured by Meridian Medical Technologies, a Pfizer Inc. company. FDA and Meridian are working together to resolve the disruption as quickly as possible, but it is unclear how long this disruption may persist.

As communicated on [September 5, 2013 \(PDF - 39KB\)](#)³, FDA concluded that it was scientifically supported that certain lots of DuoDote can be used for an additional year beyond the manufacturer's original labeled expiration date. FDA is continuing to assess whether these identified lots of DuoDote can receive further expiration date extensions if needed, and whether additional lots of DuoDote that were not listed in FDA's September 5, 2013, memo can have their expiration date extended.

FDA is currently reviewing data for the potential use of Atropen (atropine), DuoDote (atropine/pralidoxime chloride), morphine sulfate, pralidoxime chloride, and diazepam auto-injectors beyond their labeled expiration dates in order to mitigate any potential shortages of these medically necessary drugs. Products nearing or beyond their labeled expiration dates **should be retained** until further guidance is provided by FDA.

What health care providers and emergency response personnel should know:

- Health care providers and emergency response personnel who have any of the auto-injectors manufactured by Meridian identified above that are nearing or beyond the labeled expiration date should retain the products until FDA is able to provide additional information regarding the continued use of these products.
- Due to medical necessity and potential drug shortages, FDA is reviewing data for the potential use of these products beyond their labeled expiration dates.
- FDA will provide additional information about use of these products beyond the labeled expiration date in the coming weeks. Until FDA provides additional information, these expired auto-injectors may be used for patient care under emergency situations when no other product is available.
- Health care providers and emergency response personnel should maintain and monitor these products under the storage conditions described in the product labeling information.
- FDA continues to work with Meridian to resolve manufacturing issues.
- It is unclear at this time when Meridian will have additional inventory of these auto-injectors available.

If health care providers and emergency response personnel have additional questions about these auto-injectors, please contact Meridian's customer service office at 1-866-478-6277.

FDA asks health care providers and consumers to report any adverse events that are associated with the use of any of these products to either Pfizer Safety (1-800-438-1985) or to the [FDA's MedWatch Adverse Event Reporting](#)⁴ program by:

- completing and submitting the report online at www.fda.gov/medwatch/report.htm⁵; or
- downloading and completing the [form](#), then submitting it via fax at 1-800-FDA-0178.

Page Last Updated: 12/26/2013

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Memorandum

Date: February 14, 2014

To: Angelo Salvucci, MD, Ventura County EMS Medical Director
Cc: Steve Carroll, Ventura County EMS Agency Administrator
Chris Rosa, Ventura County EMS Agency Deputy Administrator
Jeff Winter, Ventura County PSC chair

From: Mark Komins, M.S., Paramedic

Re: PSC Agenda Item Request - Policy change to allow for Humeral I.O.

Dr. Salvucci

I am writing to request consideration of an County EMS Policy change to allow for Humeral I.O. insertion.

Reason for request: There are some circumstances where a tibial I.O. is not possible and other I.V. access is also not available, ie: Bilateral knee replacement or entrapment including building collapse secondary to earthquakes or traffic collisions where both legs are pinned. There is also better absorption in through the Humerous.

Description/Justification: If I.V. and/or Tibial I.O. access is not available, Paramedics in Ventura County will not have another option for fluid or medication administration in trauma situations. To this end, adding Humeral I.O. gives us another option. The FDA has approved the E-Z IO device to be used in the Humerus for up to 24 hours just like the Tibial insertion.

Supporting Documentation:

"Paramedics successfully perform humeral EZ-IO intraosseous access in adult out-of-hospital cardiac arrest patients"

"Proximal Humerus Intraosseous Infusion: A Preferred Emergency Venous Access"

"Intraosseous vascular access in adults using the EZ-IO in an emergency department"

"Hurts So Good"

Affected VC EMS Policies: Policy 717, IV.A.2

Thank you for your consideration.

Mark Komins - Re: E-Z IO

From: "David Chase" <dgcmd@pacbell.net>
To: "Mark Komins" <Mark.Komins@ventura.org>
Date: 10/28/2013 16:18
Subject: Re: E-Z IO

I am for it. Let's wait till CAM training is done....although I guess we could start the conversation sooner. David

From: Mark Komins <Mark.Komins@ventura.org>
To: D. Chase <dgcmd@pacbell.net>
Sent: Monday, October 28, 2013 10:36 AM
Subject: E-Z IO

Hi Dr. Chase

I was wondering what your thoughts are about using the E-Z IO for Humerus injection? I am an advocate for it for a few reasons:

1. Patients with bilateral knee replacements cannot use the proximal tibia
2. better absorption rate
3. If a person is pinned in a car crash or crushed and we cannot gain access to the legs

I am getting some literature on it but I am not going to proceed if I don't have your approval. Dr. Salvucci is quite against it but I feel we need to change that.

thanks

Mark Komins, M.S., Paramedic
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EMS Training Manager
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Original Contribution

Paramedics successfully perform humeral EZ-IO intraosseous access in adult out-of-hospital cardiac arrest patients[☆]

David Wampler PhD, LP^{a,b,*}, Daniel Schwartz MD^{a,b}, Joi Shumaker RN, LP^{a,b},
Scotty Bolleter BS, EMT-P^c, Robert Beckett EMT-P^b, Craig Manifold DO^{a,b,c}

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Received 8 May 2011; revised 14 July 2011; accepted 15 July 2011

Abstract

Objective: Studies on humeral placement of the EZ-IO (Vidacare, Shavano Park, TX, USA) have shown mixed results. We performed a study to determine the first-attempt success rate at humeral placement of the EZ-IO by paramedics among prehospital adult cardiac arrest patients.

Methods: A retrospective cohort analysis of data prospectively collected over a 9-month period. Data are a subset extracted from a prehospital cardiac arrest study. The cohort consisted of adult cardiac arrest patients in whom the EZ-IO placement was attempted in the humerus by paramedics. Choice of vascular access was at the discretion of the paramedic; options included tibial or humeral EZ-IO and intravenous. Primary outcome is the percentage of successful placements (stable, flow, without extravasation) on first attempt. Secondary outcomes are overall successful placement, complications, and reason for failure. Data were collected during a post-cardiac arrest interview.

Results: Humeral intraosseous (IO) access was attempted in 61% (n = 247) of 405 cardiac arrests evaluated with mean age of 63 (±16) years, 58% male. First-attempt successful placement was 91%. Successful placement was 94%, considering the second attempts. In the unsuccessful attempts, 2% reported obesity as the cause, 1% reported stable placement without flow, and 2% reported undocumented causes for failure. There were also 2% reports of successful placement with subsequent dislodgement.

Conclusions: The results of this study suggest a high degree of paramedic proficiency in establishment of IO access in the proximal humerus of the out-of-hospital cardiac arrest. Few complications suggest that proximal humeral IO access is a reliable method for vascular access in this patient population.

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[☆] This project was funded by the Office of the Medical Director for San Antonio Fire Department. Vidacare Corporation also provided supplies and administrative support.

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E-mail address: wamplerd@uthscsa.edu (D. Wampler).

1. Introduction

1.1. Background

Intraosseous (IO) access has been well established as an efficacious method of fluid and drug administration [1,2]. Recent advanced cardiac resuscitation recommendations have recognized the IO infusion as efficacious as intravenous cannulation for fluid and drug administration [1]. The noncollapsible nature and reliable portal to central venous pathways make IO an attractive first-line option in the prehospital patient in extremis. This is true particularly in the setting of cardiac arrest.

The Food and Drug Administration has approved IO access at the proximal humerus, proximal tibia, and the sternum for fluid and drug administration for the adult cardiac arrest. The humeral site is attractive because of a presumed shorter drug delivery time due to the proximity to the central circulation and higher fluid administration rates [3]. The humerus, however, may be more difficult to access than other sites.

1.2. Importance

During low perfusion states where delivery of fluid and/or medications may be time sensitive, humeral access may provide faster delivery to the central circulation. Several studies have documented high success rates and reduction of time-to-first-drug administration within the controlled environments of the laboratory and emergency department (ED) [3-7]. Limited data exist, however, regarding the success rates of proximal humerus IO placement by paramedics in the out-of-hospital environment.

1.3. Goals of this investigation

The objective of this project was to evaluate the success of paramedic IO placement in the proximal humerus in the adult out-of-hospital cardiac arrest (OHCA).

2. Methods

2.1. Study design

This is a report from a retrospective cohort analysis of prospectively collected data. The cohort consisted of patients that presented in cardiac arrest during a 9-month interval of a larger quality improvement project focused on improving outcomes from OHCA through the early and rapid administration of epinephrine. The University of Texas Health Science Center at San Antonio Institutional Review Board approved this study and made the determination that it is a component of a comprehensive quality improvement project.

2.2. Study settings and population

San Antonio, Texas, is the 7th largest city in the United States with approximately 1.4 million residents [8]. San Antonio Fire Department is (SAFD) the exclusive provider of 911 emergency medical services for the City. SAFD responds with a minimum of 2 paramedics per mobile intensive care unit ambulance, typically supported by Fire Division First Responders. Approximately half of the first responders have at least 1 paramedic with Advanced Life Support (ALS) capabilities. SAFD responds to approximately 125,000 medical calls per year with approximately 650 annual resuscitation attempts. The San Antonio area has 23 EDs receiving emergency medical service cardiac arrest patients. SAFD medical oversight and quality assurance and quality improvement is provided by the University of Texas Health Science Center at San Antonio, Department of Emergency Health Sciences, Office of the Medical Director by written medical protocol, and direct online medical consultation. All resuscitation attempts require a postevent debriefing with online medical control. Debriefing includes immediate quality assurance and quality improvement feedback and data collection.

2.3. Methods

All paramedics had prior experience with tibial IO insertion; each received 1.5 hours of didactic and hands-on instruction on humeral IO insertion. The didactic component included education on the indications, contraindications, landmark identification, insertion procedure, and demonstration. Didactics were followed by hands-on training including insertion into raw egg model and a simulated proximal humerus model (Sawbones, Vashon, WA). The training was conducted by faculty experienced in both prehospital medical education and IO access. At the conclusion of the training period, paramedics were evaluated on both cognitive understanding and insertion technique.

The resuscitation standing medical operating procedures for the SAFD indicated that humeral access was the preferred site for vascular access with no more than 1 attempt per bone, that is, a maximum of 2 humeral attempts could be made. Although the protocol indicated that the proximal humerus was the preferred access site, paramedics had the autonomy to opt for alternative sites as the situation dictated. Other sites available were tibial IO and intravenous access but were deemphasized if humeral was available. The treatment protocol directed that the preferred catheter length for humeral and tibial access was 45 and 25 mm, respectively. The treating paramedic maintained discretion as to catheter length. Once the humeral IO space was accessed, the affected arm was secured to the torso by whatever mechanical means were readily available, typically a strap.

In addition, a video was produced and available online for the paramedics to reference. This video highlighted the sequence of events expected for cardiac arrest management.

A mandatory postresuscitation debriefing with online medical control also provided immediate feedback on protocol compliance.

2.4. Data collection

Data were collected during the immediate postresuscitation time frame and stored in a database maintained by the Office of the Medical Director. Every resuscitation attempt undergoes a mandatory debriefing immediately after the final patient disposition. This debriefing involves an interview of the lead medic with a faculty nurse or paramedic from the Office of the Medical Director. Specific to this project, data collected included patient demographic data, insertion site, number of attempts, paramedic performing, time elapsed from arrival at patient side to successful placement, number of attempts required for successful placement, total volume infused, and complications.

2.5. Outcome measures

The primary end point for this project was first-attempt successful placement. Successful placement defined as stable placement of the cannula with the ability to administer medication and/or fluid without signs of extravasation. Secondary end points were successful placement after the second attempt and identification of complications resulting in failure.

2.6. Data analysis

Descriptive statistics were used to represent the percentage and SDs of reported parameters. Data analysis was accomplished using Microsoft Excel (Microsoft Corporation, Redmond, WA).

3. Results

During the study period (July 2009 to March 2010), 405 resuscitation attempts were initiated, with an average age of 63 (±16) years and 58% male (Table 1). Humeral access as the initial site was attempted in 61% (n = 247) of these

Table 1 Characteristics of patients observed during study period

	Other	Humeral	P
Resuscitation attempts	n = 161	n = 244	N/A
Average age	63 (±16)	63 (±17)	1.0
% male	58%	58%	1.0
% survival to hospital discharge	6.8%	5.4%	.51

N/A indicates not applicable.

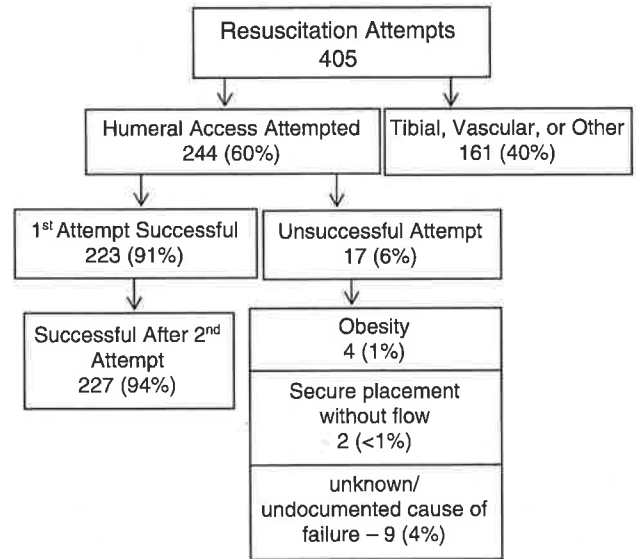


Fig. 1 Descriptive analysis of humeral IO success data.

cardiac arrests. First-attempt successful placement was 91% (n = 224). The secondary end point resulted in successful placement after second attempt of 94% (n = 232). See Fig. 1. Other sites were accessed in 40% (n = 161) of patients. Of cardiac arrest patients not receiving humeral IO access, 63% had intravascular or preexisting vascular access, and 38% had tibial placement. Success rates for the tibial subgroup were 95% and 98% for first and second attempt, respectively.

There was a 6% (n = 15) insertion failure rate in proximal humerus placement. Of this subgroup, there were 4 reports of obesity as the cause for nonsuccessful placement, 2 reports of stable placement without sufficient flow, and 9 were “other” or undocumented causes of failed attempts. There were also 4 reports (2%) of successful placement with subsequent dislodgement.

4. Discussion

Our study presents high success rates for proximal humeral IO placement by paramedics during cardiac arrest resuscitation with few complications. We observed 247 humeral attempts by paramedics with a 91% success rate on the first attempt. This was improved to 94% after the second attempt. Only 2% of all successful placements were reported to have dislodged during resuscitation efforts and/or transport to the ED.

Intraosseous infusion has been described as an adjunct to resuscitation since the early part of the 20th century [9,10]. The relative difficulty of establishing intravenous access in the child during emergency resuscitation and comparable success rates of IO placement led to the advocacy of IO placement by the American Academy of Pediatrics and the American Heart Association during the resuscitation of

pediatric patients [11,12]. Multiple highly vascular sites with minimal overlying soft tissue have been proposed for IO placement. To date, Food and Drug Administration clearance has been obtained for access of the proximal and distal tibia, proximal humerus, and the sternum [12].

The preponderance of early data regarding IO placement can be found in pediatric studies, with most IO placements performed manually. As a result of the aforementioned and as a result of familiarity, the most commonly advocated site in both children and adults has been the proximal tibia [12]. Powered IO devices allow for rapid IO access with minimal manual effort. It is also a skill easily taught to hospital and prehospital providers [13-15].

EZ-IO use on the proximal tibia has been studied in the civilian and military setting of trauma resuscitation [2,16], and proximal humeral placement has been analyzed in the emergency department laboratory [3]. In both environments, the power-assisted device was found to be effective in establishing rapid IO access in the adult. Ong et al [5] found that physicians in the ED had a remarkably high success rate in establishing both proximal humeral and tibial IO on the first attempt, 100% and 96%, respectively. The study of Ong et al was conducted using a convenience sample in the ED setting and directly compares tibial vs. humeral placement. Paxton et al [3] had similar placement success but showed a high occurrence of dislodgement. During this study, however, the investigator reevaluated the 25-mm catheter and began using the 45-mm catheter resulting in a significantly decreased dislodgment rate. Reads et al [17] reported poor paramedic success rates using the EZ-IO in both the proximal humerus and tibia during out-of-hospital resuscitation. This study observed only 30 proximal humeral and 58 tibial insertions with 60% and 90% first-time success, respectively. Reads et al also reported a disturbingly high rate of displacement, 33% in the humerus, throughout the study. It is unclear why the results from this study differ so remarkably from previously published reports, although small sample size and paramedics without previous IO experience may be contributing factors. In addition, we hypothesize that their high incidence of displacement is a result of the reported lack of a standardized securing method for either the arm or the IO catheter. The report of Paxton et al [3] clearly emphasizes the critical importance of securing the arm to prevent dislodgement.

Of the placement failures, obesity was noted as a factor in 4 of these patients. Although obesity has not been suggested to be a risk factor for humeral IO placement failure, the increased difficulty in landmark identification may increase the risk of failure. This risk must be recognized as a potential issue that may impede success. The obesity rate in our study population was not identified. The preference in the use of the 45-mm catheter for humeral cannulation may be a contributing factor to improved success rates as compared with Reads et al [17].

Preference for the proximal humerus is based on several factors, one being the proximity of the humerus to the central circulation. This proximity may provide shorter drug delivery time to the vital organs in the extremis patient as

compared with the tibia. This time saving may have importance for resuscitative drugs and for use in the initiation of therapeutic hypothermia. Iced saline infusion has been shown to be a very effective method for induction of therapeutic hypothermia in the postresuscitation care for cardiac arrest victims [18], and the high flow rates obtainable via the humeral IO access [3] make this an attractive method for iced saline delivery.

5. Limitations

This study is a subset analysis of a drug study, therefore, not specifically designed to compare the efficacy of proximal humeral vs proximal tibial or intravascular access.

The data presented here were collected during a post-cardiac arrest debriefing. The debriefing occurs immediately after the resuscitation encounter is complete, and data collection relied on self-reporting by the paramedics directly involved in the resuscitation. Data were not collected to identify the justification for tibial or intravenous at the initial site selection instead of humeral access.

This study also used 1 form of mechanical IO placement. Further studies will be needed to evaluate other devices for similar results.

6. Conclusion

In this retrospective study, paramedics successfully accessed the proximal humerus in 91% of initial IO attempts during resuscitation of the adult OHCA patient. Relatively, few complications suggest that humeral IO access is a reliable method of vascular access in this patient population. The proximal humerus should be considered a useful location for vascular access during prehospital cardiac resuscitation.

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Proximal Humerus Intraosseous Infusion: A Preferred Emergency Venous Access

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Purpose: To assess the proximal humerus intraosseous (PHIO) catheter placement as a preferred method for venous access over conventional methods, including peripheral intravenous (PIV) and central venous catheters (CVCs), during emergency room resuscitation.

Methods: In phase 1, conventional methods for venous access (PIV and CVC) were assessed for all patients presenting to the emergency department resuscitation bay. Outcome measures in both phases were speed, immediate complications, and pain. CVC placement was performed when PIV access was deemed impossible or when rapid volume resuscitation was needed. In phase 2, resuscitations requiring venous access or complicated by failed PIV access attempts underwent PHIO catheter placement.

Results: Sixty-two patients received either PIV (57) or CVC (5) catheterization, and 29 patients received 30 PHIO catheters. PHIO catheter placement was significantly faster than conventional methods (1.5 [SD 1.1] versus 3.6 minutes [SD 3.7; $p < 0.001$ for PIV, and 15.6 minutes [SD 6.7; $p < 0.0056$] for CVC). No major complications were identified in either phase. Minor complications for PIV access included extravasation and placement failure. Minor complications for CVC placement included inability to thread the guidewire. Minor complications with PHIO catheter placement included placement failure, poor flow, and catheter dislodgement. Pain scores associated with PHIO insertion and infusion were higher than those associated with PIV and CVC catheter placement.

Conclusion: PHIO catheter placement is significantly faster than PIV and CVC placement with increased minor complication profile and perceived pain. PHIO venous access is absolutely life saving when PIV or CVC placement is difficult or impossible.

Key Words: Humerus, Intraosseous infusion, Catheter, Resuscitation.

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Intraosseous (IO) cannulation for the infusion of fluids and medications was first described by Drinker et al.¹ in 1922. In recent years, the IO route has become increasingly popular for emergent vascular access in pediatric patients,² largely

replacing the endotracheal route for medication administration when peripheral intravenous (PIV) access is not available.^{3–8} The use of IO catheters in adults has been largely restricted to the prehospital setting in the civilian world,^{9,10} although IO is also gaining popularity among military providers.^{11,12} Previous studies have shown that the IO catheterization is a rapid and easy method for obtaining emergent vascular access, regardless of intravascular volume status.^{13–15} Importantly, most medications may be safely administered via the IO route, and blood taken from IO catheters may be used for most laboratory studies.^{16–19} Flow rates differ between IO sites, however, with the highest rates associated with the proximal humerus in animal studies.²⁰ Contrast injection through the proximal humeral IO catheter under fluoroscopy shows almost immediate flow into the central circulation.²¹ We hypothesized that proximal humerus intraosseous (PHIO) catheterization would be faster and easier than conventional venous access methods for the emergent resuscitation of critically ill or injured patients.

METHODS

This prospective cohort study was conducted at a single major urban level I trauma center, with an annual emergency department (ED) volume of approximately 92,000 patients and an admission rate of 21%, including 10% intensive care unit admissions. The research team included one attending physician and one resident physician from the Department of Emergency Medicine and one attending physician from the Department of Surgery. Approval from the institutional review board (IRB) was obtained before initiation of the study. Consent for catheter placement was waived by the IRB, which deemed the various methods of venous access to be provider preference because all three were consistent with standard of care, with implied consent due to the emergent nature of resuscitation. All venous access was obtained by either an attending or resident physician or a resuscitation nurse under direct attending physician supervision. All healthcare providers involved in the study underwent educational training in-services and standardized testing on IO catheter placement, management, and removal before placing the IO catheters.

To compare the speed and utility of PHIO infusion with conventional venous access methods, PIV, and central venous catheter (CVC), the study was conducted in two phases. Only patients who required venous access and arrived at the resuscitation bay without adequate preexisting venous access (two PIVs or one CVC) were included in either phase of the study.

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During phase 1 (mid-February to mid-April 2008), a series of consecutive trauma (room 1) and medical (room 2) resuscitations was observed, and data were collected on a predetermined set of variables including time to catheter placement (first PIV or CVC) with good flow, perceived pain from insertion, complications of catheterization before leaving the ED, presenting complaint, initial vital signs, comorbidities, resuscitation medications administered, and disposition. This data were collected on an IRB-approved standardized data collection form by scribe resuscitation nurses at the time of emergency resuscitation. Measurement of the time to catheter placement with good flow began at the moment when the skin was sterilized before catheter insertion and ended when the flow of intravenous fluids was subjectively deemed to be adequate for resuscitative purposes. In those cases in which the first PIV resulted in extravasation (i.e., a “blown vein”), end time was recorded as the moment in which a subsequent attempt resulted in satisfactory flow of intravenous fluids. In those cases in which multiple PIV attempts failed or PIV was otherwise deemed inappropriate and CVC catheter placement was attempted, beginning time was recorded as the time that the first access intervention (PIV or CVC) was attempted, and ending time was called when the CVC line was in place and adequately secured. All times were rounded up to the nearest minute. Visual Analog Scale (VAS) pain scores were only obtained from patients with a Glasgow Coma Scale (GCS) score of 15.

During phase 2 of the study (mid-June to mid-August 2008), a series of consecutive patients requiring new vascular access during emergent resuscitation in rooms 1 or 2 underwent PHIO catheter placement with either the Vidacare Corporation (San Antonio, TX) EZ-IO AD 15-gauge 25-mm stainless steel needle set or the Vidacare OnControl 15-gauge 68-mm stainless steel needle set. The 68-mm needle set was used in those cases in which the 25-mm needle set was deemed too short for adequate placement. Patients were deemed to require new vascular access if they did not have two functioning PIVs or one CVC in place before arrival in the resuscitation bay. Contraindications to PHIO placement on a given side included ipsilateral humeral fracture, inability to identify anatomic landmarks, previous ipsilateral PHIO catheter placement in the last 24 hours, injury or infection at the insertion site, and provider preference. Providers were instructed to evaluate for PHIO placement on the contralateral side in the event of contraindications for placement on the first side considered. All patients receiving a PHIO catheter received a standard dose of 2 mL to 5 mL (40 to 100 mg) of 2% Lidocaine prepared for IV injection through the PHIO catheter for intraosseous local anesthesia before infusion of fluids or medication, unless the patient had a stated or previously documented allergy to Lidocaine. Data similar to that collected during phase 1 were collected on all PHIO patients and recorded by the scribe nurse on an IRB-approved standardized data collection form. Body mass index (BMI) was also recorded for all patients undergoing PHIO catheterization. Measurement of time to good flow began when the skin was sterilized and ended after successful placement of a PHIO placement, when satisfactory flow of intravenous fluids

was observed. In those cases in which good flow was not obtained, the time to catheter insertion placement was recorded, and lack of good flow was recorded as a complication of the procedure. In both phases, complications of line placement during the time that the patient remained in the ED were recorded. All PHIO catheters were placed in one of two ED resuscitation bays, and all PHIO catheters were removed before the patient leaving the ED unless alternate venous access could not be obtained before hospital admission. Regardless of alternate venous access availability, all PHIO catheters were removed within 24 hours of catheter placement.

Patients were monitored for PHIO catheter complications for the duration of their hospitalization, and all PHIO catheter removals were performed by trained study personnel. After PHIO catheter removal, the insertion site was covered with a single band-aid. No pressure dressings or gauze pads were applied to the insertion site at any time after removal. Nurses caring for those patients admitted to the hospital with PHIO catheters in place received a brief in-service from study personnel at the time of the patient’s arrival to the floor or intensive care unit. Healthcare providers were instructed that any medication that could be safely infused through a PIV could be infused through the PHIO catheter, and no medication or fluids requiring central venous access (e.g., hypertonic saline) were permitted to be infused through the PHIO catheter. The administration of intravenous dye for computed tomography or other contrast studies through the PHIO was not permitted due to institutional radiology protocols. Patients and healthcare providers were instructed not to move the arm in which the PHIO was placed, although no sling or other tethering device was applied to the arm for immobilization. The only exception to this was in those cases in which the patients required restraints for behavioral or other indications unrelated to the study.

RESULTS

A total of 62 patients (57 PIV and 5 CVC) were enrolled in phase 1 of the study and four (80%) of the five CVC placements were performed after multiple unsuccessful attempts at PIV catheter placement. One CVC line placement was performed as the first vascular attempt for a patient who was deemed on presentation to have a poor peripheral venous access by the attending physician. Mean time to catheter placement with good flow was 3.6 minutes (SD = 3.7; range, 1–16) in the PIV group and 15.6 minutes (SD = 6.7; range, 11–25) in the CVC group. Successful catheter placement in the PIV group required an average of 1.5 attempts (SD = 1.2; range, 1–8) due to catheter infiltration (i.e., “blown vein”) or catheter dislodgement. In the CVC group, an average of 2.4 PIV attempts failed before the first attempt at CVC placement. Once the decision to place a CVC was made, successful placement occurred on the first needle stick attempt in four of the five patients, with one failed attempt due to inability to thread the guide wire in one patient. VAS pain scores averaged 0.9 (SD = 1.4; range, 0–5; n = 42) with PIV insertion and 1.0 (SD = 1.7; range 0–3; n = 3) with CVC insertion in patients with a GCS score of 15. All PIV placements were performed by nurse providers, and all CVC placements were

TABLE 1. Comparative Data for Phase I and Phase II Venous Access Methods

	PIV	CVC	IO
Number of patients	57	5	30
Number of line attempts	86	17	31
First-attempt success rate (%)	73.7	20.0	80.6
Mean time to good flow (min)	3.6	15.6	1.5
Mean pain score (insertion)	0.9	Unable	4.5
Mean pain score (infusion)	0	Unable	3.8
Extravasation in Resus Bay (%)	33.7	70.6	44.0
Percent died in Resus Bay (%)	5.3	0	6.7

performed by attending or resident physician providers. CVC catheters were placed in the subclavian vein in three cases, the femoral vein in one case, and the internal jugular vein in one case. No pneumothoraces or major complications were noted in the CVC group. The only minor complication noted in the CVC group was inability to thread the guide wire in the femoral attempt.

Twenty-nine patients received PHIO catheter placement in phase 2, including one patient who received PHIO placement in the same arm with two subsequent resuscitations 2 weeks apart. Comparative data for phases 1 and 2 venous access methods are recorded in Table 1. Mean time to access with good flow in the PHIO group was 1.5 minutes (SD = 1.1; range, 1–6; n = 30), significantly faster than that with PIV ($p < 0.001$) or CVC ($p = 0.0056$) placement. VAS pain scores were higher in the PHIO group with a mean pain from insertion of 4.5 (SD = 4.2; range 0–10; n = 15) and a mean pain from infusion of fluids or medication after Lidocaine administration of 3.8 (SD = 4.1; range 0–10; n = 12). Fifteen (50%) PHIO placements were made on patients with GCS <15, and infusion of fluids or medication was not attempted in three (10%) cases due to poor flow. PHIO catheters remained in place for an average of 4.6 hours (SD = 5.7; range, 0.17–21; n = 30) before planned removal or inadvertent dislodgement. No major complications were noted in the PHIO group. Minor complications with PHIO placement included a failed attempt to place the catheter in 2 (6.7%) cases, inability to flush in 3 (10%) cases, slow flow in 1 (3.3%) case, and catheter dislodgement in 11 (36.7%) cases. Ten (90.9%) of the 11 catheter dislodgements occurred with the 25-mm needle set. The average time from catheter placement to dislodgement with the 25-mm needle set was 6.9 hours (SD = 7.3; range 0.17–21; n = 10), and it was 2 hours in one case of 68-mm needle set dislodgement. The average BMI of patients who underwent successful PHIO placement was 24.0 kg/m² (SD = 4.2; range, 19.0–33.0; n = 20) for the 25-mm needle set versus 34.4 kg/m² (SD = 3.2; range, 31.1–38.6; n = 5) with the 68-mm needle set.

Demographics and comorbidities were similar between study groups and are recorded in Table 2. Most patients were African American (79.0% in phase 1 and 93.1% in phase 2) and had multiple comorbidities, including end-stage renal disease, diabetes mellitus, and past or current intravenous drug use (IVDA). No significant difference was seen in the rate of hospital admission (72.6% in phase 1 vs. 70.0% in phase 2; $p =$

TABLE 2. Demographics and Comorbidities Comparison Between Study Groups

Patient Characteristics	PIV	CVC	IO
Mean age (years)	50.8	56.2	46.9
Percent male (%)	50.9	80.0	63.3
Percent African American (%)	77.2	100.0	93.3
Percent trauma activations (room 1) (%)	22.8	0	40.0
Initial SBP \leq 100 (%)	12.3	20.0	13.3
Initial HR \geq 100 (%)	54.4	80.0	33.3
GCS <15 (%)	28.1	100.0	50.0
Intubation in Resus Bay (%)	10.5	20.0	13.3
Diabetes mellitus (%)	29.8	0	20.0
ESRD on HD (%)	10.5	0	16.7
Hypertension (%)	56.1	40.0	63.3
IVDA (%)	10.5	80.0	20.0
Steroid use (current; %)	5.3	20.0	0.0

HR, hazards ratio.

0.800). Two patients (3.2% of patients in phase 1 and 6.7% in phase 2) died during resuscitation in each group.

DISCUSSION

The intraosseous approach has been recommended for emergency venous access when conventional methods fail or require prolonged attempts.^{3,4,13} Although most studies to date have focused on the proximal tibial insertion site,^{11,21} the proximal humerus offers a readily available location for IO catheter placement with rapid access to the central circulation.²⁰ Our objective was to evaluate the PHIO insertion site for speed of insertion, immediate complication profile, and overall efficacy. We hypothesized that PHIO placement was faster than CVC or PIV insertion, with fewer complications than CVC placement. Although the present study did not have sufficient power to adequately assess for safety of PHIO catheter placement relative to CVC or PIV catheter placement, our initial experience with the PHIO catheter has provided us with several important clinical insights into both the ease and efficacy of its use. To the best of our knowledge, this study represents the largest published clinical trial involving the PHIO insertion site in adults to date, although we would like to acknowledge recent experiences that have been published since the inception of our study.^{11,22}

Our results conclusively demonstrate that PHIO catheterization is a quick and easy alternative for venous access in the resuscitation of critically ill patients. The greater tubercle of the humerus offers a large target that, even in obese patients, is easy to hit. In fact, it is difficult to miss. Although all times were rounded up to the nearest minute, venous access was generally obtained in less than 5 seconds. Additional time was required before administration of medication or fluids for slow infusion of 40 mg to 100 mg (2–5 mL) of 2% Lidocaine into the medullary space (more than 10–20 seconds), followed by a rapid 10 mL flush of normal saline, as well as preparation of a pressure bag for IV fluid infusion. We found that this initial rapid saline flush is very helpful in clearing the medullary space to facilitate subsequent good

flow of fluids through the catheter. Despite these additional time requirements, the time from site selection to good flow of IV fluids was still less than that for PIV or CVC insertion.

In regards to CVC line placement, it should be emphasized that the time to successful CVC line placement included all previous attempts at intravenous access, and that in four of the five cases an average of three PIV attempts were made before CVC placement was deemed necessary by the attending physician. In only one case was CVC access the first provider preference for purposes of resuscitation. The decision to record time to successful CVC placement in this manner was made before the study's initiation, because the measured outcome in this study was time to the establishment of satisfactory IV access with good flow. Consequently, this data should not be taken out of context or interpreted as the time needed for CVC placement alone. Only five CVC placements were observed in this study, which further limits our ability to provide an accurate assessment of the time needed to perform CVC placement. The time needed to establish reliable CVC access may be highly variable between institutions and should be determined by the institution or provider on an individual basis before any conclusions are drawn on the relative speed or utility of this access method.

Once the IO catheter was in place, we found that a number of medications could be safely and effectively administered, including most medications needed for cardiopulmonary resuscitation (Table 3). The use of IO infusion for the administration of resuscitative medications is supported by other studies.²³⁻²⁵ Two of our patients were within therapeutic range on Coumadin (one for atrial fibrillation and one for pulmonary embolus), and neither patient experienced significant bleeding as a result of IO catheterization, either during catheter placement and use or after catheter removal. Neither anticoagulated patient received or required a pressure dressing over the insertion site. Only a simple band-aid was used. Consequently, we believe that patients who may require infusion of tissue plasminogen activator, heparin, or other anticoagulant during the course of their ED treatment are unlikely to incur additional bleeding risks with IO catheterization.

Although the IO route is clearly effective for the infusion of resuscitative medications, we did not find it effective for the delivery of high volumes of IV fluids. This is consistent with several preclinical studies that have shown slower or, at best, equivalent rates of rapid fluid infusion between the PIV and IO routes.^{20,26} As suggested by the package insert,

flow through the intraosseous catheter must be initiated by an initial flush of at least 10 mL of normal saline and maintained with use of a pressure infusion bag inflated to 300 mm Hg. Although not precisely measured, we found IV fluid flow rates to be quite variable, with a maximal infusion rate in the range of 70 mL/min to 100 mL/min with the use of pressure bag inflated to 300 mm Hg. Even with pressurized infusion, most catheters supported little more than a fast drip rate, and only a few achieved the kind of continuous stream of infusion required for high-volume resuscitation. Anecdotally, we noticed that infusion rates seemed to improve after administration of certain medications, specifically magnesium and dopamine, and that flow rates seemed to be higher in our anticoagulated patients. Further studies may be warranted to support these findings. Higher infusion pressures (>300 mm Hg) may also increase flow rates through the PHIO catheter, and Lairet and coworkers are currently investigating this hypothesis using swine animal models (Julio Lairet DO, January 30, 2009, personal communication). Although their preliminary results are promising, the results of this study have not yet been released. However, Ong et al.²⁷ have shown that EZ-IO catheter flow rates at the proximal humerus with a standard pressure bag are not statistically different from rates through the proximal tibia site (153.2 mL/min vs. 165.3 mL/min). These results agree with our conclusion that greater pressure is needed at the humeral site to produce the high flow rates needed for large volume crystalloid resuscitation.

Many different types of complications have previously been attributed to intraosseous catheterization in case reports, including iatrogenic bone fracture, growth plate disruption, fat embolism, hematoma formation, osteomyelitis, compartment syndrome, neurovascular injury, and tissue necrosis.²⁸⁻³⁴ Even death from cardiac perforation with the use of the sternal route has been reported.³⁵ In the present study, we did not observe any of these complications, although our study was not powered to appropriately assess for catheter safety, and we did not follow-up patients after their discharge from the hospital. However, we did encounter a number of catheter dislodgements with resultant subcutaneous infusions of fluid. In every case, extremity swelling subsided within a few hours of catheter removal without any identifiable sequelae. All of these infiltrates were identified early and none led to neurovascular compromise or significant discomfort for the patient. We believe that dislodgements represent a learning curve that can be overcome with appropriate assessment of BMI relative to intraosseous needle length, as well as to enhanced attention to arm immobilization.

It is worth noting that several cases of osteomyelitis reported in the literature have been associated with the infusion of either epinephrine or hypertonic solutions through the IO route, perhaps through medication-induced tissue necrosis.^{32,36,37} Although we did administer epinephrine to one patient during cardiopulmonary resuscitation without complications, we did not infuse hypertonic saline through any of the IO catheters. Although hypertonic saline may seem to be a potential adjunct to IO catheter resuscitation considering the slow rates of flow we observed, we cannot recommend the infusion of hypertonic solutions through the IO route for this reason.

TABLE 3. Medications Safely Administered Via IO Catheter

Ativan	Labetalol
Atropine	Lidocaine
Calcium chloride	Magnesium sulfate
Decadron	Morphine
50% Dextrose	Narcan
Epinephrine	Nimbex
Etomidate	Potassium chloride
Fentanyl	Sodium bicarbonate
Haldol	Solumedrol
IV fluids (0.9% NaCl)	Succinylcholine

TABLE 4. Comparison Data for 25-mm and 68-mm IO Needle Sets

Needle Length Statistics	25-mm	68-mm
Number placed (success rate %)	24 (76.9)	5 (100)
Mean BMI (kg/m ²)	24.0	34.4
Extravasation rate (%)	40.0	20.0
Mean time to extravasation (h)	6.9	2.0

In regards to needle length, we found that patients with a BMI of greater than 30 kg/m² (obese) required a needle length greater than the standard 25-mm set supplied with the adult (AD) EZ-IO system. In these patients, the flange of the shorter needle often indented the skin, leading to almost immediate catheter dislodgement as arm elevation or abduction pried the catheter loose. In our study, we adapted the Vidacare 68-mm OnControl needles, originally designed for iliac crest bone marrow aspiration, for use with our obese patients. Results of PHIO catheterization with this longer needle set were quite satisfactory and are recorded in Table 4. Only one of the five 68-mm PHIO catheters placed in this study extravasated because of excessive manipulation of the catheter during the patient's early resuscitation efforts. However, our experiences have prompted the catheter manufacturer to develop a mid-sized 45-mm needle set for use in patients with excessive adipose or muscle tissue overlying the humeral insertion site. We believe that this longer needle may offer a better solution for PHIO access in certain patient populations. It may also be advantageous to assess the thickness of subcutaneous tissues at various potential insertion sites (i.e., proximal humerus, proximal tibia, etc.) before needle selection and insertion to potentially eliminate this dislodgement problem.

We found that extensive arm elevation or abduction can cause dislodgement of the PHIO catheter, even in very thin patients. Consequently, although we relied on patient compliance for arm immobilization in the present study, we recommend complete immobilization of the arm to prevent inadvertent dislodgement with patient activity or transfer. This can be accomplished either with a sling or by taping the arm to the side of the chest. Early in our study, we realized that patients requiring computed tomography scans of the thorax with arms extended over the head were at high risk for catheter dislodgement. Although the quality of computer tomography (CT) imaging obtained may be slightly reduced by artifact from the patient's arm tucked alongside the thorax, we recommend this modification to the usual CT protocol in PHIO patients. In all of our cases, the quality of the CT imaging obtained using this modification was adequate to evaluate for intrathoracic pathology.

The second most common complication was pain. The pain response both to initial insertion and to subsequent infusion was, as expected, highly variable. Some awake patients complained of significant pain, even with very slow rates of infusion (10 mL over 2 minutes), whereas others cited only minor discomfort at the same infusion rates. Interestingly, when hypersensitive responders were asked which hurt them more, IO placement or Foley catheter placement, they almost invariably reported that the Foley catheter insertion hurt more. Regardless, patients clearly experienced more pain with

TABLE 5. Presenting Complaints Addressed by Study Group

Presenting Problem	PIV, n (%) = 57	CVC, n (%) = 5	IO, n (%) = 30
Acute renal failure	1 (1.7)		
Atrial fibrillation	2 (3.5)		
Blunt trauma	9 (15.8)		5 (16.7)
Cardiopulmonary arrest	2 (3.5)		2 (6.7)
Chest pain (r/o MI)	7 (12.3)		
ETOH/drug intoxication	2 (3.5)	1 (20.0)	1 (3.3)
Hypoglycemia			2 (6.7)
Neurologic change (r/o CVA)	10 (17.5)		4 (13.3)
Penetrating trauma	4 (7.0)		5 (16.7)
Poisoning/drug overdose	2 (3.5)		2 (6.7)
Seizure/post-ictal	5 (8.8)		2 (6.7)
Respiratory failure	9 (15.8)	2 (40.0)	5 (16.7)
Sepsis/shock/hypotension	4 (7.0)	2 (40.0)	2 (6.7)

PHIO catheterization than with PIV placement, leading us to recommend PHIO catheterization only in obtunded patients. In those cases in which PHIO catheterization is the only viable venous access route, judicious use of 2% Lidocaine for local anesthesia of the medullary space may be beneficial in reducing the pain from insertion and infusion. Of course, the maximum safe dose of Lidocaine should be calculated and strictly adhered to in all cases, and only Lidocaine prepared for intravenous use should be administered. Although we used only 2 mL to 5 mL (40–100 mg) of 2% Lidocaine in this study, higher doses may be safely used for intramedullary anesthesia in many patients.

Even in our small series, there were a number of cases in which IO access was absolutely life saving. Immediate PIV and central IV access was or would have been impossible given the circumstances of a combative or seizing patient or an IV drug abuser, renal dialysis patient, or morbidly obese patient with no identifiable peripheral veins. Table 3 provides a list of medications infused within seconds of PHIO venous access that enabled life-saving clinical interventions. Surprisingly, only one patient in the CVC group required transfusion of blood products in the resuscitation bay, although 32 of 57 (56.1%) PIV patients, three of five (60%) CVC patients, and 15 of 30 (50%) IO patients received at least one bolus of crystalloid (0.9% normal saline) before leaving the resuscitation bay. Table 5 provides a list of the presenting complaints treated with conventional intravenous access methods and those treated with PHIO catheterization. As this table demonstrates, many of the patients who received PHIO catheterization had serious life-threatening conditions that would reasonably be expected to require immediate access to the venous circulation for the administration of medications and fluids. These cases alone established the value of PHIO that will define its place in the venous access algorithm at our institution.

As these results demonstrate, PHIO catheterization may be successfully used in a wide variety of resuscitative encounters, including both medical and trauma resuscitations. Of course, limitations on the use of PHIO access may apply to specific trauma populations, including those in need of immediate large volume resuscitation, with suspected or known hu-

meral fractures, and those with soft tissue compromise (e.g., burn, infection) over the proposed insertion site. Decisions regarding the type of venous access needed must always be tailored to meet the specific needs of the patient and situation. However, at the present time, we can only recommend PHIO access for those patients in which traditional IV access methods are difficult or impossible, and for whom the need for immediate access outweighs the potential for patient discomfort. That said, we believe that anticipated future advances in local anesthesia and infusion methods will undoubtedly expand the role of IO access in emergent resuscitation, benefiting both the medical and trauma resuscitation populations alike.

CONCLUSIONS

In conclusion, we found that PHIO is best used in the obtunded patient with difficult peripheral venous access and can be life saving in extreme emergencies where immediate intravenous access is needed to deliver medications. We found PHIO catheterization to be extremely useful in morbidly obese patients, IV drug abusers, and renal dialysis patients with poor peripheral veins. We also found it useful in combative or seizing patients in whom PIV or CVC placement was exceedingly difficult or dangerous to the patient or to the provider. PHIO catheterization can provide immediate access to the central venous circulation for sedative and anticonvulsant medications, glucose, and a host of other potentially life-saving medications. Future studies are needed to develop a complete venous access algorithm and practice management guidelines for the optimal use of either conventional or IO venous access relative to the need for rapid insertion, safety, and efficacy to meet the level of emergency at hand.

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AQ: 3

This study was approved by our hospital Ethics Committee. Waiver of consent was obtained as the procedures were deemed to be life saving in the critically ill requiring peripheral access that would not have otherwise been obtained by traditional methods quickly. If the patient was awake enough to understand, verbal and if possible written informed consent was obtained from the patient.

The study population included patients who presented to the Department of Emergency Medicine of Singapore General Hospital (SGH), an urban hospital that is Singapore's oldest and largest acute tertiary hospital and national referral centre.

The SGH Department of Emergency Medicine handles nearly 120,000 patients annually, of which about 9% are resuscitations (priority 1), 33% are major emergencies (priority 2), 56% are ambulant/minor emergencies (priority 3) and 2% are non-emergencies (priority 4).

Inclusion criteria were patients who presented to the ED with age greater than 16 years or >40 kg body weight requiring intravenous fluids or medications and in whom an intravenous line could not be established in two attempts or 90 s. They also had to be seriously ill or injured and possess one or more of the following:

1. An altered mental state [score on the Glasgow Coma Scale (GCS) of 8 or less]
2. Respiratory compromise [oxygen saturation (SaO₂) 80% after appropriate oxygen therapy, respiratory rate <10 or >40/min]
3. Haemodynamic instability [systolic blood pressure (BP) of <90] or profound hypovolaemia (signs and symptoms of shock)
4. Cardiac arrest (medical or traumatic)

Insertion of an IO needle was contraindicated if there was a fracture of the tibia or femur, recent surgery in the extremity to be used or previous orthopaedic procedure (knee replacement) or IO within 24 h (consider alternate tibia), pre-existing medical condition (tumour near insertion site or peripheral vascular disease), infection at insertion site or significant oedema in the extremity to be used. The use of the alternate tibia would be considered in those scenarios. Inability to locate landmarks, significant oedema and excessive tissue at insertion site were relative contraindications to insertion.

The EZ-IO™ utilizes a reusable battery-powered driver and a disposable IO needle set that powers into the IO space by rotating a hollow drill to a preset depth (EZ-IO™ System Driver model number 9050, PD needle set model 9018, AD needle set model 9001, Vidacare Corporation, San Antonio, TX, USA).

Sites of insertion included the tibia and the humerus. The landmark for the insertion point of the proximal tibia is 2 fingerbreadths below the patella and 1–2 cm medial to the

tibial tuberosity. The landmark for the insertion point for the proximal humerus is the most prominent aspect of the greater tubercle's outer margins, with the patient's hand on his abdomen to ensure the safest position. A pressure bag device would be applied to the infusion if its rate of infusion was deemed to be too slow.

The outcomes that were assessed included the success rate of EZ-IO™ insertion by operators as defined by the ability to place the IO needle, as well successfully infusing fluids and drugs. Flow rates using normal saline infusion were measured by an independent nurse observer. Methods of IO needle placement confirmation, estimated total time of insertion, fluids and drugs administered, ease of use and the control and function of the EZ-IO™ device, any complications, difficulties in using the device, adverse events to operator and types of malfunction of device were evaluated by a questionnaire.

Placement time was recorded by the individual operator, recorded as the time the operator placed the needle set into the driver till the time the needle was successfully inserted into the bone. The difficulty of insertion was recorded by the physicians on a 10-cm visual analogue scale (VAS) with 0 representing very easy placement and 10 representing very difficult placement.

Only emergency physicians and medical residents who were trained in the use of the EZ-IO™ by completing the manufacturer's training programme and who were familiar with the protocol were allowed to use the device. Standard training for IO insertion was straightforward and lasted less than 2 h. This consisted of a lecture and hands-on training [20, 21]. The physicians were given instructions on the use of the EZ-IO™ and observed a demonstration on its use on a standard plastic bone model of the tibia as provided for by the manufacturer. The physicians were subsequently allowed multiple practices to obtain IO access using the EZ-IO™ on the plastic bone model.

During the actual IO placement, needle placement was confirmed by visualization of blood on the stylet, ability to aspirate bone marrow, firm placement of the needle in the bone and ability to smoothly deliver a fluid flush. Operators were instructed to give a rapid flush (bolus) of 10 ml of saline with a syringe through the EZ-IO™ once needle placement was confirmed. For conscious patients, a prior flush (bolus) of 20–50 mg 2% lidocaine (preservative free) through the EZ-IO™ was recommended for local anaesthesia.

Patients were followed up until hospital discharge for any complications of IO insertion, including needle displacement, failure of the drill device to function properly, fractures, infection of the insertion site, osteomyelitis, fat embolism, extravasation of fluid or medication and compartment syndrome.

Data were entered using Microsoft Excel 2002 (version 10) and data analysis was performed using SPSS Statistics 15.0.

Intraosseous vascular access in adults using the EZ-IO in an emergency department

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Abstract

Background Intraosseous (IO) access is an alternative to conventional intravenous access.

Aims We evaluate the use of the EZ-IO™ as an alternative vascular access for patients in the emergency department.

Methods A non-randomized, prospective, observational study was performed in adults using the EZ-IO™ powered drill device.

Results Twenty-four patients were recruited. There were 35 intraosseous insertions, including 24 tibial and 11 humeral insertions. All EZ-IO™ insertions were achieved within 20 s and were successful at the first attempt except for one. Of the intraosseous insertions, 88.6% were reported to be easier than intravenous cannulation. We found flow rates to be significantly faster using a pressure bag. The seniority of operators did not affect the success of insertion. Complications included a glove being caught in the drill device and extravasation of fluid although they were easily preventable.

Conclusion The use of the EZ-IO™ provides a fast, easy and reliable alternative mode of venous access, especially in the resuscitation of patients with no venous vascular access in the emergency department. Flow rates may be improved by the use of pressure bags.

Keywords Intraosseous needle · Intravenous access · Infusion rates

Introduction

The intraosseous (IO) route for vascular access was initially described in 1922 [1] and was used commonly during World War II [2]. Although the intravascular route is the standard for venous access in medical practice, IO administration of fluids and medications can be an alternative option when the conventional method of intravenous access fails.

Drugs administered intraosseously enter the circulation as fast and in the same concentration as those administered intravenously [3, 4]. However, there have not been any published clinical trials assessing the use of the EZ-IO™ in the busy emergency department (ED) of a tertiary hospital setting although there have been studies on the paediatric population [3–11].

Intraosseous access has recently been revived in adults as an alternative when conventional intravenous access may be difficult or impossible [3, 12–15]. The standard IO needle has been compared with needles having a newer design and most recently with IO access devices [3, 11, 12, 16–19]. The EZ-IO™ is one such device for adult IO vascular access.

We carried out a non-randomized, prospective, observational study evaluating the use of the EZ-IO™ powered drill device for IO access in adults presenting to a local tertiary ED.

Methods

We conducted a non-randomized, prospective, observational study in adults using the EZ-IO™ powered drill device.

The views expressed in this paper are those of the author(s) and not those of the editors, editorial board or publisher.

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Descriptive frequencies and means/standard deviations are reported as appropriate. Fischer's exact test was used for categorical comparisons and the Mann-Whitney U test for equivalent non-parametric comparisons.

Results

From 1 March 2006 to 30 July 2007, 24 patients were recruited. The tibia was the first site of insertion, and a second IO was inserted in the humerus if clinically indicated for the same patient. Although there were 24 patients, there were 24 tibial insertions and 11 humeral insertions on the same patient where clinically indicated for a second peripheral access. The characteristics of the patients are listed in Table 1.

All EZ-IO™ insertions were successful at the first attempt except for three tibial insertions that were successful on the second attempt. All insertions were firmly placed, with good control of the needle set and separation from the driver.

Table 2 shows a comparison between junior operators (residents) and senior operators (attendings). Both groups had 100% success rates for insertion. The average insertion time was less than 5 s for both groups. In our study, the VAS was 1.06. We noted that 88.6% of physicians in our study reported easier insertion with the EZ-IO™ as compared to an intravenous cannula.

The junior operators required more repeated attempts and encountered low flow rates as compared to the senior operators.

There were two complications encountered by a senior operator. A glove was caught in the drill device during the IO insertion. The physician had held the IO needle to stabilize the needle's position on the patient's tibia while applying the drill. As such, the glove was caught in the needle and wound around the IO needle as the drill was

Table 1 EZ-IO: characteristics of study participants

	N=24	%
Age 16–29 years	2	8.3
Age 30–59 years	6	25
Age > 60 years	16	66.7
Race		
Chinese	17	70.8
Indian	4	16.7
Malay/others	3	12.5
Male	12	50
GCS 8–15	8	33.3
GCS 3–7	16	66.7
Trauma	4	16.7

Table 2 Comparison of intraosseous insertions between operators

	Resident, N=8 (%)	Attending/ consultant, N=27 (%)	P value
EZ-IO placed successfully (%)	8 (100.0)	27 (100.0)	1
Multiple attempts needed (%)	2 (25)	1 (3.7)	0.083
Visual analogue scale (0–10)	1.1	1.0	0.920
EZ-IO firmly placed (%)	8 (100.0)	27 (100.0)	1
Good control of needle set (%)	8 (100.0)	27 (100.0)	1
Needle separated from driver easily (%)	8 (100.0)	27 (100.0)	1
Stylet separated from needle easily (%)	8 (100.0)	27 (100.0)	1
Easier placement with the EZ-IO than an intravenous cannula (%)	8 (100.0)	23 (85.2)	0.553
No flow initially	1 (12.5)	0	1
Low flow rates	3 (37.5)	1 (2.9)	0.030
Complications	0	2 (5.7)	1
Insertion time (average), s	3.9	4.3	0.862

applied. Another complication encountered was extravasation of infusion fluid at the site of insertion of the IO needle.

Table 3 shows the flow rates of intraosseous infusions with and without pressure bag application. Flow rates were significantly faster with a pressure bag than without. Tibial flow rates were 204.6 ml/min with a pressure bag as compared to 68.2 ml/min without a pressure bag, difference -129.5 ml/min [95% confidence interval (CI): -218.2 to -40.3]. Humeral flow rates were significantly faster using a pressure bag (148.1 ml/min) as compared to without (81.8 ml/min), difference -69.6 ml/min (95% CI: -113.9 to -25.3). But the difference of changes (with or without pressure bag) of flow rate between the tibia and humerus did not show any significance ($P = 0.157$, Mann-Whitney test).

There were no complications of needle displacement, failure of the drill device to function properly, fractures, infection of the insertion site, osteomyelitis, fat embolism or compartment syndrome.

Discussion

Available IO devices have included manual needles including the Cook device and the Jamshidi needles, spring-loaded "punch devices" including the First Access for Shock and Trauma (F.A.S.T., Pyng) IO device in the sternum [22] and the Bone Injection Gun (B.I.G) in the tibia [23], which has been extensively used by the Israeli military [24].

Preparation and insertion for the Pyng approaches 50 s [22] with success rates of 74% for first time users and 95%

Table 3 Comparison of flow rates with/without pressure bag

Flow rate	Tibia (<i>N</i> =10), ml/min	Humerus (<i>N</i> =8), ml/min
No pressure bag	68.2 (42.1)	81.8 (38.4)
With pressure bag	204.6 (156.0)	148.1 (75.3)
Difference	-129.5	-69.6
95% CI	-218.2 to -40.3	-113.9 to -25.3

P=0.157 (Mann-Whitney test)

for experienced users. This may be particularly useful for patients with lower extremity or pelvic trauma [25]. The B. I.G. is reported to require about 17 s for preparation and insertion [26]. Preparation and insertion time for the EZ-IO is reported to be approximately 10 s [27]. Prehospital trials on the EZ-IO device show an 87% success rate. The F.A.S. T.1 device used in the same trial showed 72% success [28].

In our hospital, the usual practice was to attempt multiple peripheral IV insertions even though access may be difficult or impossible. Central venous access is usually not attempted, as it takes too long as compared to the intraosseous method.

In our study, we had 100% success rates for both junior and senior operators. Intraosseous flow rates were significantly faster with a pressure bag infusion than without.

The IO needle had previously been shown to be a rapid and effective method of vascular access [3, 4, 11, 13, 16, 19]. We found that even previously inexperienced operators could rapidly and safely insert the IO needle. Previous studies have also shown that emergency drugs and fluids can be rapidly delivered to the systemic circulation, at rates comparable to the intravenous and central venous routes [28, 29]. All medications and blood products that are approved for IV infusion can be given via an IO access. In our study, the fluids and drugs used included normal saline, dextrose, calcium chloride, atropine, epinephrine, frusemide and ceftriaxone.

The maximum rate of administration through the IO needle was reportedly equivalent to a 21 G peripheral cannula [23]. The flow rates of an intravenous cannula are typically in the range of 200 (16 G peripheral cannula) to 20 ml/min (24 G peripheral cannula) [30]. EZ-IO™ tibial flow rates ranged from 20 to over 3,000 ml/h under pressure [27].

In our study, we found that use of a pressure infusion bag significantly improved fluid flow rates via the IO needle. This is similar to a previous report using paediatric IO needles [31], although we were able to achieve higher flow rates using adult IO needles, hence subjectively able to provide the necessary volume resuscitation in such circumstances. Pressure pumps improve flow of the IO needle. Flushing of the IO needle after insertion seems to improve flow rates as well [27].

Various site have been proposed as suitable for IO insertions, including the proximal tibia [3, 4, 13], distal

tibia [2], sternum [4, 12, 13, 22], radius [32], clavicle [14], proximal humerus and calcaneum [33]. The proximal tibia and proximal humerus sites were chosen for this study. The proximal tibia site was the initial insertion site of choice, as the landmarks were easily identifiable, superficial, easy to access percutaneously and proximal enough to allow rapid access of fluids or medications into the central circulation. In addition, it is away from vital areas where other resuscitation procedures are ongoing as well as vital structures that might get inadvertently punctured during insertion. For example, the sternal and clavicular sites present problems when airway procedures and cervical immobilization are ongoing in trauma resuscitation. Likewise, the investigators felt that the distal tibia, radius and calcaneum sites would be relatively distal to the central circulation. The proximal humerus was the secondary site, in the event that intravenous cannulation was still unsuccessful after initial resuscitation.

Previously reported complications associated with IO insertions include osteomyelitis [34], extravasation [35], fat embolism [36], compartment syndrome [37], growth plate abnormalities [38] and myonecrosis with hypertonic saline infusion [39]. There were no reported complications with the device in this study, except for two cases. One was where the operator's glove was caught in the IO drill device during insertion. This could be easily prevented by not holding the IO needle during the insertion process but just allowing the drill to insert the IO needle.

Another complication was that of extravasation of fluid at the site of insertion. Extravasation of fluid is the most common complication [40]. It typically occurs when a needle is misplaced. It seldom occurs with a properly placed needle, and it is associated with excessive movement during or after insertion, which may lead to enlargement of the entry site in the bone relative to the diameter of the needle. Compartment syndrome is a risk with extravasation although our patient did not develop compartment syndrome. The needle must enter through the cortex and into the marrow cavity without passing through the cortex on the other side. If the needle is passed through the opposite cortex, infused fluid enters the calf rather than the venous system. Fluid accumulation may lead to a compartment syndrome. This complication can also be limited by making frequent checks and allowing only one attempt per tibia. Repeated attempts in the same bone allow fluid to flow

through the previous holes produced in the bone. Extravasation of hypertonic or caustic medications, such as sodium bicarbonate, dopamine or calcium chloride, can result in necrosis of the muscle.

There were two more cases where ward staff reported difficulty removing the needle. However, the needles were both successfully removed once the correct technique was applied. The correct technique involves using a rotating and pulling movement, rather than rocking the needle, which may cause it to break. Also the needle comes with a Luer lock which can be attached to a syringe to use as a handle for additional traction during removal.

Limitations of the study include the relatively small sample size. In many cases, subsequent intravenous cannulation was successful, once initial resuscitation had been initiated through the tibial IO access.

Also the insertion times were not recorded by an independent observer due to the logistic difficulty of having an investigator present at every resuscitation. We also noted that insertion times may be longer in a true clinical setting, as some time was required to assemble the driver and needle. However, this time is minimal compared to the actual insertion procedure.

The EZ-IO™ allowed medical personnel with little prior experience of adult IO access to be able to achieve successful placement in a fast mean. We also recommend routine use of a pressure infusion bag in order to improve flow rates.

Conclusion

The EZ-IO™ is a feasible, useful and fast alternative mode of venous access especially in the resuscitation of patients with no venous access or when conventional intravenous access fails. Flow rates may be improved by the use of pressure bags. Complications encountered such as extravasation of fluid and gloves being caught in the drill device can be easily prevented.

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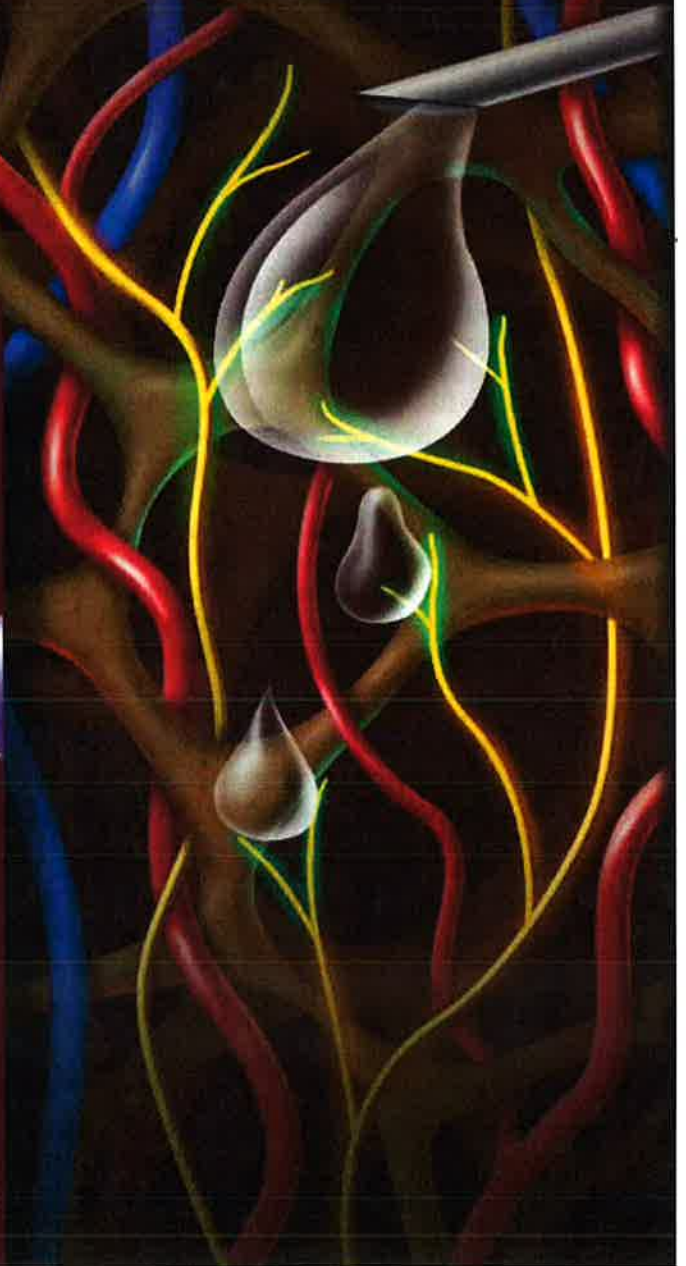
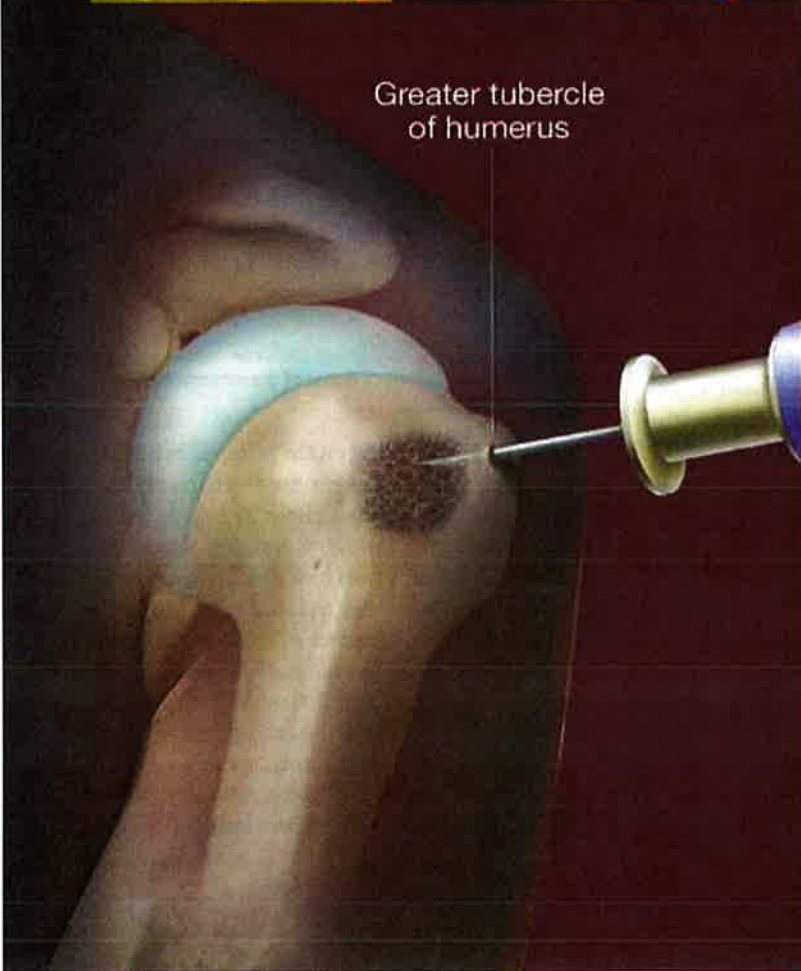
This clinical review feature article is presented in conjunction with the Department of Emergency Medicine Education at the University of Texas Southwestern Medical Center, Dallas.

Hurts So Good

EASING IO PAIN AND PRESSURE

>> BY THOMAS E. PHILBECK, PHD; LARRY J. MILLER, MD; DIANA MONTEZ, RN, BSN; & TATIANA PUGA, BS

Greater tubercle
of humerus



Intraosseous (IO) vascular access, which involves inserting a needle into the bone-marrow cavity for administering fluids and medications, was first proposed in the 1920s.¹ Studies from the '40s showed the effectiveness of the IO route in children, which led to its acceptance as a clinically useful technique.^{2,3}

During World War II, IO was widely used for adults. However, IO use declined in the late '40s due to a lack of advanced-level civilian prehospital emergency care following the war and increased popularity of plastic catheters for IV access.⁴ Today, improved IO devices enable clinicians to consistently and safely access the vascular system quickly. Drug delivery through the IO route to the systemic circulation is often as quick as through central venous catheters and faster than through peripheral lines.^{5,6}

In most cases, two conditions must be met for optimal IO flow rates. First, the IO space must be flushed under high pressure with a syringe. Then, to achieve and maintain adequate infusion pressure, a pressure-infuser bag or a standard automated IV infusion pump that generates 300 mmHg is required. Gravity alone will rarely generate an adequate flow rate, and sufficient pressure can't be attained by manually squeezing the IV bag because of the inherent IO pressure of the **medullary space**.

Although the pain is known to immediately **desist** with cessation of the infusion pressure, higher pressures yield faster infusion flow rates and are considered essential in the delivery of emergency medications and fluids.

But pain associated with IO insertion and infusion in conscious patients is a well-documented reality that must be dealt with in the field. One study found the mean pain level in patients with a Glasgow Coma Scale (GCS) score of > 12 increased from 3.5 on insertion, to 5.5 on infusion.⁷ Their assessment—and the observation that the patient's pain level can be substantially reduced by injecting preservative-free lidocaine through the IO port prior to the infusion—coincided with the **anecdotal** experiences often described by users of any IO device.

Anecdotal experience and published literature support the effectiveness of the lidocaine

injection prior to IO fluid infusion to control the pain.⁸⁻¹⁰ The dosage typically administered to adults—40 mg, occasionally followed by another 20 mg—is well below the maximum dosage of 300 mg over a one-hour period that's recommended by lidocaine manufacturers.¹¹

Traditionally, the proximal **tibia** has been the site most commonly used for IO insertion. But there's new interest in the proximal **humerus** as a preferred site because fluids tend to flow easier through the humerus, requiring less pressure to deliver the initial flush.^{12,13} Less pressure results in less pain.

Until recently, no studies have compared the levels of pain experienced during IO infusion at the tibial and humeral sites, nor have they evaluated the effectiveness of lidocaine to mitigate the pain. To validate recommendations on humerus use and IO pain management, we designed two studies to compare lidocaine's effect on pain during fluid infusion through the tibial and proximal humerus sites and to determine the relationship between infusion pressure and flow rates delivered through the two sites.

METHODS

Design and setting: Two non-randomized studies were approved by the IntegReview Institutional Review Board (IRB) and conducted in a dedicated multi-specialty research facility. The first study used the proximal left and right tibial sites. The second study used the right proximal humeral site.

Participant selections and interventions: Healthy, pain-free, adult volunteers were recruited for and consented to the studies. Following a review of medical history, physical examination and vital signs, baseline pain scores using the **visual analog scale (VAS)** ranging from 0 to 10 were collected, and participants were connected to a cardiac monitor for observation during the study procedures. A 15-gauge IO catheter was inserted into the proximal tibia or

proximal humerus.

For the tibial study, the left tibia was accessed first, and 40 mg of 2% preservative-free lidocaine was administered through the IO catheter over about two minutes, followed by a 10 mL normal saline bolus over five seconds. An additional 20 mg of lidocaine was then administered over 30 seconds. Eighty mg of lidocaine was administered through the right tibia IO catheter over about two minutes, followed by a 10 mL normal saline bolus over five seconds, and then, an additional 20 mg of lidocaine was administered over 30 seconds.



PHOTO: MEDVACARE CORPORATION

Studies first showed the effectiveness of the intraosseous route in pediatric patients.

For the study on the proximal humerus, 40 mg of 2% preservative-free lidocaine was administered through the IO catheter in the right humerus over a period of about two minutes, followed by a 10 mL normal saline bolus over five seconds and an additional 20 mg of lidocaine over 30 seconds. A normal saline infusion was started, and infusion pressure was set at 100 mmHg using a 1,000 mL pressure bag. It was monitored by use of an electronic digital manometer connected in-line with the IV tubing. After 60 seconds, the infusion pressure was increased to 150 mmHg, and the same sequence was fol-

LEARNING Objectives

- >> Describe the historical origins of IO vascular access.
- >> List two advantages of IO infusions.
- >> Identify two acceptable landmarks for IO needle infusions.
- >> Identify the IO site that provides the least amount of pain and has the best fluid flow rate.
- >> Report the purpose of lidocaine use in IO infusions.

lowed for pressure increases to 200 mmHg, 250 mmHg and 300 mmHg.

Using the VAS, pain assessments immediately followed each injection and infusion pressure increase. If the pain became intolerable to the volunteer at any point during infusion, the pressure was released to relieve the pain instantly.

Measurement methods: At each pressure level, the IO infusion flow rate was calculated by visually counting the drops of fluid as they passed through the IV tubing drip chamber and converting the drops per minute to milliliters per hour.

As the infusion rate increased to the point that the drops couldn't be counted, the flow rate was calculated by weighing the infusion bag on a digital scale, timing the infusion for 60 seconds, weighing the bag again and subtracting the second weight from the first.

To determine the duration of the lidocaine's effectiveness for pain management, the infusion pressure was reduced to 200 mmHg, and the volunteer was observed for up to 90 minutes starting at the time of the second lidocaine injection.

In the tibial study, this observation period occurred following the interventions in the right leg only, which included a total of 100 mg of lidocaine. For the humeral study, this observation occurred following interventions in the right arm, which totaled 60 mg of lidocaine. During this observation period, pain was assessed every 10 minutes, and subjects experiencing a pain score of 5 or higher were given another 20 mg lidocaine injection.

At the end of each 90-minute study period, the IO catheter was removed, and volunteers were asked to score the pain of catheter removal.

To ensure safety following the IO catheter removal, volunteers were required to

wait in the study facility at least 30 minutes before departure. Follow-up telephone calls for pain assessment and complications were made at 24 hours and seven days.

Data collection and processing: Data were initially captured on paper data collection records and subsequently entered into an electronic database. Descriptive statistics were calculated using predictive analytics software (PASW) statistics.

RESULTS

Ten volunteers were selected for each study. Five participants from the first (tibial) study also participated in the second (humeral) study. One participant who started the humeral study withdrew after the IO insertion, due to intolerable pain and anxiety, and was replaced by a standby volunteer candidate. Of the 16 total participants, nine were female and seven were male. The mean age was 34.3 ± 7.7 years (range=23–48).

All IO insertions in both studies were successful on the first attempt. The mean IO insertion VAS pain score was 4.4 ± 2.6 (range=0–6) for left tibial insertions, 3.6 ± 2.3 (range=1–10) for right tibial insertions and 3.0 ± 1.5 (range=1–7) for humeral insertions.

For the duration of each study, the highest mean VAS pain score occurred during the normal saline flush: The mean score was 6.8 ± 2.9 (range=1–10) for the left tibia, 7.9 ± 2.8 (range=2.5–10) for the right tibia and 4.6 ± 2.9 (range=1–10) for the humerus.

During the 90-minute observation period following the initial interventions, eight of 10 volunteers in the tibial study (who had previously received 100 mg of lidocaine) required an additional 20 mg dose of lidocaine to keep the pain level less than 5.

The mean amount of elapsed time before the additional dosing was required was 39 ± 20 minutes. No volunteers in the humeral study (who had previously received 60 mg of lidocaine) required additional lidocaine dosing to keep the pain level to less than 5.

The highest mean infusion flow rate was achieved at 300 mmHg infusion pressure for both studies. For the left tibia, the mean flow rate at that pressure was 828 ± 231 mL/hour (range=360–1,152 mL/hour). For the right tibia, the mean flow rate at 300 mmHg was $1,048 \pm 831$ mL/hour (range=336–3,300 mL/hour). For the humeral study, the mean flow rate at that pressure was $5,093 \pm 2,632$ mL/hour (range= 828–9,000 mL/hour)

GLOSSARY TERMS

Anecdotal: Based on random observations rather than scientific investigation.

Desist: To stop or cease an activity.

Humerus: The bone that makes up the proximal portion of the upper limb.

Intraosseous: Situated within a bone or entering a bone.

Medullary space: The inner cavity located inside the bone.

Tibia: The bone that makes up the distal portion of the lower limb.

Visual analog scale: A subjective pain scale that's used to rate the presence of pain in a patient who's undergoing a potentially uncomfortable procedure. Pain is rated on a 1 to 10 scale. A score of 0 means that there's no pain. A score of 10 is considered agonizing pain.

LIMITATIONS

We believe that actual patients, rather than volunteers, might have provided more relevant feedback. However, assessments of pain levels in actual emergency patients generally present the following challenges:

- >> Distracting injuries make assessment of the primary pain unreliable. For example, neck fractures may be missed if there's also a leg fracture.
- >> Such painful interventions as IV access, spine boards and patient movement to the back of an ambulance tend to modify pain levels in the primary site.
- >> The physical and psychological stressors of the emergency situation result in the release of catecholamines, which mitigate pain in some cases and exacerbate it in others.
- >> Several concurrent activities with different priorities are usually going on at an emergency scene. Many reports of pain levels and response to treatment are anecdotal. For example, the patient was screaming, so the pain was recorded as level 10, and the patients stopped screaming after an intervention; therefore, the pain must be much less or gone. It may not be possible to consult with the patient.

In emergency situations, it would be difficult to brief patients on a pain study and expect them to concentrate on accurate reporting of such pain for study purposes. Patients can be affected by scene distractions, anxiety about their condition or the perception that exaggerating or denying pain levels may alter their course of treatment.

We considered these limitations and decided to use healthy volunteers in a controlled setting, who were briefed on the procedures and understood the metrics used to assess pain levels during the study.

Patient understanding of dental procedures and pain relief are well documented.¹⁴⁻¹⁶ In the case of pain associated with the insertion of the IO device and pain levels during various infusion pressures, it would be impossible to subject an actual emergency patient to an hour of systematic induction of pain to various infusion pressures and perform studies with scientifically reproducible results.

Yet, as use of IO infusion becomes more widespread and is used in conscious patients for medically necessary procedures, it will become increasingly important to understand the relation of infusion pressure to pain and the amount of lidocaine necessary to reliably alleviate the pain.

Another limitation of the flow-rate portion of our study is that participants were relatively young adults who were healthy and normotensive. It's unknown how these pain levels and flow rates might have differed in pediatric or elderly patients. We're unable to predict

HURTS SO GOOD

>> CONTINUED FROM PAGE 61

how the flow rates might differ in hypertensive patients or those in shock. However, we believe the results showing higher infusion flow rates in the proximal humerus would be replicated in actual patients.

DISCUSSION

The authors of one retrospective study of 1,128 patients receiving IO vascular access reported that patients with a GCS score > 12 experienced VAS pain levels of 3.5 on IO

stated because bone marrow blocks the flow. Often, pressures as great as 300 mmHg aren't enough to overcome this resistance.¹

In addition, an inherent pulse pressure must be overcome before any positive flow can be achieved. But the higher pressure delivered through a 10 cc handheld syringe effectively flushes the marrow and fibrin into the circulation, leaving behind an open channel for IV fluid flow.

Recently, a non-randomized prospective



PHOTO COURTESY AL HEBERTMAN

Until recently, no studies have compared the levels of pain experienced during IO infusion at the tibial and humeral sites.

insertion and 5.5 on infusion.⁷

The IO insertion site for most of these patients was the proximal tibia. The mean insertion pain in that study was similar to that experienced by volunteers in our tibial study (mean VAS score of 4.0) and somewhat greater than that experienced in our humeral study (mean VAS score of 3.0). Perhaps more importantly, the infusion pain of 5.5 in the retrospective study was greater than that generally experienced in ours, which peaked at 2.9 during infusion in the tibial and 1.4 in the humeral study.⁷

This can be attributed to several factors. IO infusion through the tibia is typically more painful, and the pain is more difficult to manage than when infusing through the humerus for conscious patients.

In our study, pain was greatest with the normal saline flush prior to infusion, but the need to deliver the quick flush over a period of five seconds or less can't be over-

observational study compared flow rates.¹⁷ Flow rates in our study were typically substantially lower than the mean flow rates of 9,900 mL per hour and 9,180 mL per hour for the tibia and humerus, respectively, but still adequate for most EMS applications.

The proximal tibia is most often used for IO vascular access, and the clinical literature supports it. But that trend may be changing.^{4,7-9,16} In a 2009 study that reported using the proximal humerus as a primary site, the first of its kind, the authors made a strong case for using both the tibia and the humerus based on the ease and speed of obtaining access and the outstanding infusion flow rates.¹⁷

A more recent study, designed to assess humeral IO catheter placement as a preferred method for venous access compared to using peripheral IV (PIV) and central venous catheters (CVC) during emergency resuscitation, concluded that humeral IO place-

HURTS SO GOOD

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ment is significantly faster than PIV and CVC placement.¹⁸ Our studies generally validate and complement these two studies, including by obtaining vascular access quickly and on the first insertion attempt with both sites.

One purpose of the tibial study was to compare the levels of pain with an initial dose of 80 mg of lidocaine to the pain experienced with an initial dose of 40 mg. We concluded there was no clinical difference between the two initial doses and that an initial dose of 40 mg, followed by an additional 20 mg dose after the normal saline flush, provides reasonable pain management. For the humeral study, we opted to examine the 40 mg lidocaine/normal saline flush/20 mg lidocaine schema only. It's important to note that we firmly believe that in most cases, the second dose—20 mg in our study—of lidocaine, following the saline flush, is key to keeping the patient comfortable during IO infusion.

The reason for this is unclear. But we postulate that, following the initial lidocaine dosing, the saline flush opens new pathways in the IO space that are susceptible to infusion pain. We suspect the second dose of lidocaine reaches those areas and provides additional relief.

Overall, pain was successfully managed for the tibia and the humerus using 2% preservative-free lidocaine, and adequate infusion flow rates were obtained. But at every intervention, the pain was substantially less using the humeral site, and the difference was clinically significant. In our humeral study, one volunteer experienced intense pain during the IO placement and declined further participation in the study.

Recognizing the subjectivity of measuring pain in general and the variability among study participants, we consider the level of pain experienced by this participant as an outlier and not representative of the pain experienced by other participants in either of the two studies.

Operators should review the manufacturers' recommendations on the use and contraindications for use when administering lidocaine. Ultimately, EMS medical directors or attending physicians must determine the appropriate dosage of lidocaine.

The proximal humerus site should be strongly considered for optimal infusion flow rates and easier pain control. In the proximal humerus, a longer (45 mm) IO needleset may be the catheter length of choice.

In the tibial study, 100 mg of lidocaine was

administered during the initial intervention while only 60 mg of lidocaine was administered in the humeral study. During the 90-minute observation period that followed initial interventions in the tibial study, eight volunteers required an additional 20 mg dose of lidocaine to keep the pain level less than 5. For these volunteers, the extra dosing was required after an average of 39 minutes, following their second dose of lidocaine. No volunteers in the humeral study required additional lidocaine during the 90-minute observation period. This is further evidence of the ability of the clinician to better manage pain with less medication when using the humeral site.

Moreover, there was a tremendous difference in infusion flow rates, again, in favor of the humeral site. For these reasons, we believe the proximal humerus should be strongly considered as the primary site when IO vascular access is needed.

Finally, a needle as short as 25 mm is usually adequate for tibial access due to minimal tissue between the skin and the bone. Due

to the thicker tissue overlaying the proximal humerus, we used a 45 mm needleset, and there was little to no excess needle length remaining once the catheter was in place.

None of the participants were obese, and only one was heavily muscled. Based on this experience, we recommend that a longer needle be used for humeral insertion, rather than the shorter needleset typically used for tibial insertion. To avoid catheter dislodgement from the humerus, conscious patients should be instructed to avoid excess movement of the arm and to keep the arm in the same position as when the IO was inserted. In unconscious patients, the arm should be well secured in an adducted position.

CONCLUSION

For adequate IO infusion rates, a rapid 10 mL syringe flush is required, followed by a pressure infusion. The higher the infusion pressure, the higher the flow rate in all sites. The humerus site provides a higher flow rate than the tibia.

For tolerable pain control during fluid

administration, 40 mg of preservative-free lidocaine may be needed, followed by a rapid normal saline syringe flush of at least 10 mL and another 20 mg of lidocaine. Additional dosing and flushing may be required. **JEMS**

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REVIEW QUESTIONS

Test your comprehension with this post-article quiz. Answers are provided at the end. Photocopying is permitted for non-profit training purposes only. For readers in need of continuing education credits, please visit JEMSprepare.com to choose from courses that are CECBEMS approved and meet NREMT refresher requirements.



1. Which of the following statements regarding the origins of intraosseous (IO) infusion is accurate?
 - a. IO infusion was proposed by Nancy Caroline in the 1960s.
 - b. During the 1950s, IO infusion was widely accepted and used in civilian populations.
 - c. IO infusion was made popular because plastic catheters became unsafe during World War II.
 - d. IO was proposed in the 1920s and is faster than peripheral lines.
2. Which two conditions must be met for optimal IO flow rates?
 - a. IO space flushed with a high-pressure syringe and the use of pressure bags, which can generate pressures of > 300 mmHg
 - b. Gravity and manually squeezing of an IV solution bag
 - c. Gravity and the use of pressure bags, which can generate pressures of < 300 mmHg
 - d. High-pressure syringe for flushing and a high-pressure syringe for aspiration for needle placement assessments
3. Of the following sites, which is considered a desirable IO insertion site?
 - a. The distal portion of the humerus
 - b. The proximal portion of the humerus
 - c. The distal portion of the tibia
 - d. The mid-shaft portion of the tibia
4. Which IO site provided the best IV solution flow rate and the least amount of pain?
 - a. The sternum
 - b. The proximal tibia
 - c. The proximal humerus
 - d. The distal femur
5. What's the primary role of lidocaine use in IO infusions?
 - a. The reduction of pain associated with IV fluid flow
 - b. The treatment of possible premature ventricular contractions
 - c. The stabilization of membranes and depression of action potentials
 - d. The reduction of intracranial pressure and prevention of bradycardia

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: INTRA OSSEOUS INFUSION		Policy Number: 717	
APPROVED: Administration: Steven LCarroll Paramedic		Date: December 1, 2012	
APPROVED: Medical Director: Angelo Salvucci, MD		Date: December 1, 2012	
Origination Date: September 10, 1992 Date Revised: July 12, 2012 Date Last Reviewed: July 12, 2012 Review Date: July, 2014		Effective Date: December 1, 2012	

- I. PURPOSE: To define the indications, procedure, and documentation for intraosseous insertion (IO) and infusion by paramedics.
- II. AUTHORITY: Health and Safety Code, Sections 1797.178, 1797.214, 1797.220, 1798 and California Code of Regulations, Title 22, Sections 100145 and 100169.
- III. POLICY: IO may be performed by paramedics who have successfully completed a training program approved by the EMS Medical Director.
 - A. Training

The EMS service provider will ensure their paramedics successfully complete an approved training program and will notify EMS when that is completed.
 - B. Indications

Patient with an altered level of consciousness (ALOC) or in extremis AND there is an urgent need to administer intravenous fluids or medications AND venous access is not readily available.

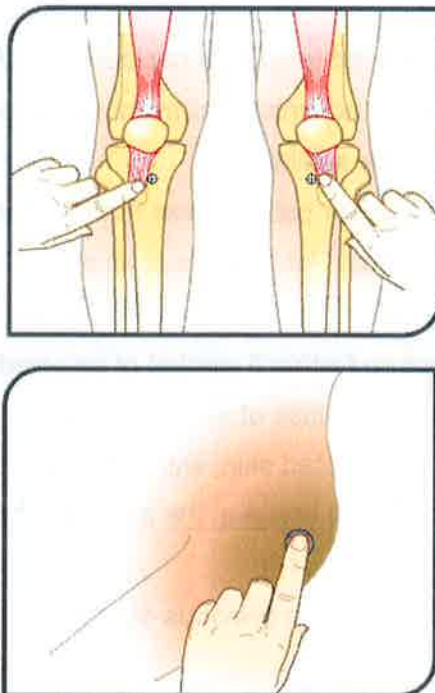
 1. Manual IO: For patients less than 8 years of age.
 2. EZ-IO device: For patients of all ages.
 - C. Contraindications
 1. Recent fracture (within 6 weeks) of selected bone.
 2. Congenital deformities of selected bone.
 3. Grossly contaminated skin, skin injury, burn, or infection at the insertion site.
 4. Excessive adipose tissue at the insertion site with the absence of anatomical landmarks.
 5. IO in same bone within previous 48 hours.
- IV. PROCEDURE:
 - A. Manual IO insertion
 1. Assemble the needed equipment

- a. 16-18 gauge IO needle (1.5 inches long)
- b. Alcohol wipes
- c. Sterile gauze pads
- d. Two (2) 5 mL syringes and a primed IV line (with or without stopcock)
- e. IV fluids: 500 mL NS only
- f. Tape
- g. Splinting device

2. Choose the appropriate insertion site.

Proximal Tibia: Locate the landmarks approximately 2 cm below the patella and 1 cm medial, on the anteromedial flat bony surface of the proximal tibia.

Proximal Humerus: The most prominent aspect of the greater tubercle's outer margins, with the patient's hand on his/her abdomen to ensure the safest position.



3. Prepare the site utilizing aseptic technique with alcohol wipe.
4. Fill one syringe with NS

5. To insert the IO needle:
 - a. Stabilize the site.
 - b. Grasp the needle with obturator and insert through skin over the selected site at a 90° angle to the skin surface.
 - c. Once the bone has been reached, continue to apply pressure rotating and gently pushing the needle forward.
 - d. When the needle is felt to 'pop' into the bone marrow space, remove the obturator, attach the empty 5 mL syringe and attempt to aspirate bone marrow.
 - e. For responsive patient infuse 2% cardiac lidocaine prior to fluid/medication administration for pain management: 1 mg/kg (max 40 mg) slow IVP over 60 seconds.
 - f. Attach the 5 mL syringe containing NS and attempt to flush the IO needle. If successful, remove the syringe, connect the IV tubing and secure the needle.
 - g. Infuse NS and/or medications.
 - h. Splint and secure the IO needle.
 - i. Document distal pulses and skin color to extremity utilized for IO insertion before and after procedure. Monitor for complications. B
- EZ-IO insertion
1. Assemble the needed equipment
 - a. Choose appropriate size IO needle

- 1) 15 mm needle sets (pink): 3-39 kg
- 2) 25 mm needle sets (blue): \geq 40 kg
- 3) 45 mm needle sets (yellow): For patients with excessive adipose tissue at insertion site
- b. Alcohol wipes
- c. Sterile gauze pads
- d. 10 mL syringe
- e. EZ Connect tubing
- f. IV fluids
 - 1) 3-39 kg: 500 mL NS
 - 2) \geq 40 kg: 1 L NS
- g. Tape or approved manufacturer securing device
2. Prime EZ Connect tubing with 1 mL fluid
 - a. If less than 2 years old, prime with NS
 - b. If \geq 2 years old and conscious prime with 2% cardiac lidocaine (20 mg)
3. Locate the appropriate insertion site on the anteromedial flat surface of the proximal tibia.
 - a. Pediatric: 2 cm below the patella, 1 cm medial
 - b. Adult: 2 cm medial to the mid tibial tuberosity
4. Prepare the site utilizing aseptic technique with alcohol wipes.
5. To insert the EZ-IO needle:
 - a. Connect appropriate size needle set to the EZ-IO driver.
 - b. Stabilize the site. .
 - c. Position the EZ-IO needle at 90° to the underlying bone and insert it into the skin. Continue to insert the needle until contacting the bone. Ensure at least one black band is visible above the skin.
 - d. Once contact with the bone is made, activate the driver and advance the needle without pressure until the bone has been penetrated.
 - e. Once properly placed, attach primed EZ Connect tubing and attempt to aspirate bone marrow.
 - f. For responsive patients, slow infusion of 2% cardiac lidocaine over 60 seconds prior to fluid/medication administration for pain management.

- 1) 3-39 kg: 1 mg/kg
 - 2) ≥ 40 kg: 40 mg
- g. Flush with 10 mL NS to assess patency. If successful, begin to infuse fluid.
 - h. Splint the IO needle with tape or an approved manufacturer stabilization device.
 - i. Document time of insertion on included arm band and place on patient's wrist.
 - j. Document distal pulses and skin color before and after procedure and monitor for complications.
- C. IO Fluid Administration
1. Active pushing of fluids may be more successful than gravity infusion. Use of a pressure to assist with fluid administration is recommended, and usually needed, but not required.
 2. Fluid administration on smaller patients should be given via syringe boluses to control/monitor amount infused. Close observation of the flow rate and total amount of fluid infused is required.
 3. If infiltration occurs or the IO needle is accidentally removed, stop the infusion, leave the connector tubing attached.
- D. Documentation
1. Document any attempt(s) at establishing a peripheral IV prior to attempting/placing an IO infusion in the Ventura County Electronic Patient Care Report (VCePCR) system.
 2. The site and number of attempts, success, complications, and any applicable comments related to attempting an IO infusion shall be documented on the VCePCR. Any medications administered shall also be documented in the appropriate manner on the VCePCR.
- E. Quality Assurance
- Each use of an IO infusion will be reviewed by EMS. Data related to IO attempts will be collected and analyzed directly from the VCePCR system.



**VENTURA COUNTY
EMERGENCY MEDICAL SERVICES AGENCY**

Skills Assessment

Name _____ Agency _____ Date _____

- Demonstrates, proper body substance isolation
- States indication for EZ-IO use
- States contraindication for EZ-IO use
- Correctly locates target site
- Cleans site according to protocol
- Considers 2% cardiac lidocaine for patients responsive to pain
- Correctly assembles EZ-IO Driver and Needle Set
- Stabilizes the insertion site, inserts EZ-IO Needle Set, removes stylet and confirms placement
- Demonstrates safe stylet disposal
- Connects primed extension set and flushes the catheter
- Connects appropriate fluid with pressure infuser and adjusts flow as instructed
- Demonstrates appropriate securing of the EZ-IO
- States requirements for VC EMS documentation

Instructor Signature: _____ **Date** _____

Nerve Agent Poisoning	
The Incident Commander is in charge of the scene and you are to follow his/her direction for entering and exiting the scene. Patients in the hot and warm zones MUST be decontaminated prior to entering the cold zone.	
ADULT	PEDIATRIC
BLS Procedures	
<p><i>Patient's that are exhibiting obvious signs of exposure (SLUDGE) of Organophosphate exposure and/or Nerve Agents</i></p> <p>Maintain airway and position of comfort</p> <p>Administer oxygen as indicated</p> <p>Mild Exposure: Mark 1 or Duodote Antidote Kit IM X 1 (Atropine 2.1 mg and Pralidoxime600mg)</p> <p>Moderate Exposure: Mark 1 or Duodote Antidote Kit IM X 1 (Atropine 2.1 mg and Pralidoxime600 mg), may repeat in 10 minutes if symptoms persist</p> <p>Severe Exposure: Mark 1 or Duodote Antidote Kit IM X 3 (Atropine 2.1 mg and Pralidoxime600mg) in rapid succession, rotating injection sites.</p>	<p><i>Patient's that are exhibiting obvious signs of exposure (SLUDGE)of Organophosphate exposure and/or Nerve Agents</i></p> <p>Maintain airway and position of comfort</p> <p>Administer oxygen as indicated</p>
ALS Prior to Base Hospital Contact	
<p><i>Patient's that are exhibiting obvious signs of exposure (SLUDGE) of Organophosphate exposure and/or Nerve Agents If not administered BLS:</i></p> <p>Mild Exposure: Mark 1 or Duodote Antidote Kit IM X 1 (Atropine 2.1 mg and Pralidoxime 600 mg)</p> <p>Moderate Exposure: Mark 1 or Duodote Antidote Kit IM X 1 (Atropine 2.1 mg and Pralidoxime 600 mg), may repeat in 10 minutes if symptoms persist</p> <p>Severe Exposure: Mark 1 or Duodote Antidote Kit IM X 3 (Atropine 2.1 mg and Pralidoxime 600 mg) in rapid succession, rotating injection sites.</p> <p><u>For seizures:</u></p> <ul style="list-style-type: none"> • Midazolam <ul style="list-style-type: none"> ○ IV/IO – 2 mg <ul style="list-style-type: none"> • Repeat 1 mg q 2 min as needed • Max 5 mg ○ IM – 0.1 mg/kg <ul style="list-style-type: none"> • Max 5 mg 	<p><i>Patient's that are exhibiting obvious signs of exposure (SLUDGE) of Organophosphate exposure and/or Nerve Agents</i></p> <ul style="list-style-type: none"> • Atropine for patients less than 40 kg • IM – 0.05 mg/kg q 5 min for pediatric patients less than 40kg <ul style="list-style-type: none"> • Minimum dose – 0.1 mg • May use Atropen 0.5mg IM for patients up to 25kg or Atropen 1.0mg IM for patients up to 50kg • Repeat until symptoms are relieved • Mark 1 or DuoDote Antidote Kit IM x 1 (Atropine 2.1 mg and Pralidoxime 600 mg) for pediatric patients greater than 40 kg <ul style="list-style-type: none"> • Repeat x 1 in 10 minutes if symptoms persist <p><u>For seizures:</u></p> <ul style="list-style-type: none"> • Midazolam <ul style="list-style-type: none"> ○ IM – 0.1 mg/kg <ul style="list-style-type: none"> • Max 5 mg
Base Hospital Orders only	
Consult with ED Physician for further treatment measures	Consult with ED Physician for further treatment measures
<ul style="list-style-type: none"> • Duodote may be administered by Paramedics to themselves, other responders, and exposed, symptomatic public. • Diazepam is available in the CHEMPACK and may be deployed in the event of a nerve agent exposure. Paramedics may administer diazepam using the following dosages for the treatment of seizures: <ul style="list-style-type: none"> ○ Adult: 5 mg IM/IV/IO q 10 min titrated to effect (<i>max 30 mg</i>) ○ Pediatric: 0.1 mg/kg IV/IM/IO (max initial dose 5 mg) over 2-3 min q 10 min titrated to effect (<i>max total dose 10 mg</i>) • Mild exposure with symptoms: One dose of Duodote <ul style="list-style-type: none"> ○ Symptoms: Miosis, rhinorrhea, drooling, sweating, blurred vision, nausea, brady, or tachypnea ○ nervousness, fatigue, minor memory disturbances, irritability, unexplained tearing, wheezing, tachycardia, bradycardia • Moderate exposure with symptoms: One dose of Duodote followed by a second dose in 10 minutes <ul style="list-style-type: none"> ○ Symptoms: Miosis, rhinorrhea, SOB, wheezing, secretions, soft muscle weakness and fasciculations, GI effects • Severe exposure with symptoms: three doses of Duodote in rapid succession <ul style="list-style-type: none"> ○ Symptoms: Strange confused behavior, severe difficulty breathing, twitching, unconsciousness, seizing, flaccid, apnea 	

Effective Date: June 1, 2012
Next Review Date: June 30, 2014

Date Revised: November 10, 2011
Last Reviewed: November 10, 2011

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VCEMS Medical Director

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Draft March 2014.Docx



pinpoint pupils involuntary defecation, urination

Effective Date: June 1, 2012
Next Review Date: June 30, 2014
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Date Revised: November 10, 2011
Last Reviewed: November 10, 2011

VCEMS Medical Director

Admin\Committees\PSC\2014\13_Mar\0705_17_Nerve_Agent_Nov_2011 CR
Draft March 2014.Docx

COUNTY OF VENTURA PUBLIC HEALTH DEPARTMENT		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: EMT: Requirements To Staff An ALS Unit		Policy Number: 306	
APPROVED: Administration:	 Steven L. Carroil, EMT-P	Date: June 1, 2011	
APPROVED: Medical Director	 Angelo Salvucci, MD	Date: June 1, 2011	
Origination Date:	June 1, 1997	Effective Date: June 1, 2011	
Date Revised:	February, 2011		
Date Last Reviewed:	February, 2011		
Next Review Date:	February, 2014		

- I. PURPOSE: To define the requirements for an EMT to staff an ALS unit and assist a Paramedic in delivering ALS care.
- II. AUTHORITY: Health and Safety Code, Sections 1797.214, 1798.200.
- III. POLICY: EMTs who are scheduled to staff an ALS unit and assist a paramedic in ALS care shall meet the criteria outlined in this policy.
 - A. EMTs assigned to work with Paramedics shall:
 1. Successfully complete a comprehensive training module as described in Section III. B. below.
 2. Assist a paramedic with a minimum of 10 ALS contacts (a maximum of 5 may be simulated).
 3. Be evaluated and approved by the employer and Medical Director or designee. For agencies without a medical director, the BH PLP or PCC may evaluate and approve the EMT.
 - B. Training Module

This training module defines the minimum training needed for an EMT to be assigned to staff an ALS unit and assist a paramedic in ALS care shall:

 1. Be developed in conjunction with the Base Hospital.
 2. Include, at a minimum, the following topics and time intervals:
 - a. Airway Management
 - 1) General Assessment
 - 2) Endotracheal Intubation equipment set up
 - 3) VC EMS approved alternate airway equipment set up
 - 4) Bag-Valve-Mask/ET/alternate airway ventilation review
 - 5) Assembly of in line nebulizer
 - 6) Airway placement confirmation devices
 - 7) O₂ delivery devices

- 8) Suctioning
 - b. Trauma Skills
 - 1) Trauma Assessment Review
 - 2) C-Spine immobilization review
 - 3) Traction Splint review (e.g., Sager/Hare)
 - 4) Needle thoracostomy equipment
 - c. Medical Control
 - 1) VenturaCounty Policies 306 and 705
 - 2) Paramedic Scope of Practice
 - 3) EMT Scope of Practice
 - 4) EMT Base Hospital communications
 - d. IV and Medication Setup
 - 1) Aseptic Technique
 - 2) Assembly of preloaded medication containers
 - 3) Catheter taping
 - 4) Blood drawing
 - 5) Sharps precautions
 - e. Testing
- C. Duties and Responsibilities
- 1. The EMT shall perform only those patient-care items described in VCEMS Policy 300: EMT Scope of Practice.
 - 2. If necessary, the EMT may communicate with the Base Hospital on ALS calls as follows:
 - a. The EMT will clearly identify him/herself as an EMT.
 - b. The EMT can provide vital signs, vital sign updates, assessment information and initial scene information.
 - c. The EMT shall not ask for or pass on ALS orders.
- E. EMT AED
- EMTs trained to use an AED will successfully complete skills testing using the form in Appendix B.
- F. Documentation
- 1. Documentation of initial training, in the form of a VCEMS Attendance roster, shall be submitted to VCEMS.
 - 2. Documentation of testing of EMT shall be completed using the form in Appendix A and maintained by the provider agency.

4. Documentation of approvals shall be done using the form in Appendix C, and will be submitted to VCEMS.
6. In the event that an EMT has had to attend a retraining class, a letter stating that the individual has successfully completed the retraining and testing will be submitted to VCEMS.

APPENDIX A

Name: _____ Date: _____

EMTALS ASSIST SKILLS TESTING

TRAUMA SCENARIO	PASS	FAIL
Assess airway patency		
Administers high flow O ₂ via non-rebreather mask		
Completes spinal immobilization		
Demonstrates head-to-toe assessment		
Assembles IV bag and tubing		
Maintains sterility of IV		
Correctly immobilizes upper extremity		
Successful completion of this station _____ Evaluators Signature		

Cardiac Arrest Scenario	PASS	FAIL
Assesses ABC's		
Ensures compressions are being done		
Chooses correct size of oral airway		
Correctly inserts oral airway		
Adequately ventilates using bag-valve-mask		
Assembles intubation equipment		
Adequately ventilates using bag-valve-ET		
Verbalizes safety concerns for defibrillation		
Correctly places monitor patches and leads		
Assembles IV bag and tubing		
Assembles preload medications		
Verbalizes that paramedic must administer medications		
Verbalizes safety considerations for needles		
Successful completion of this station _____ Evaluators Signature		

LEGAL ISSUES STATION	PASS	FAIL
Identifies proper radio responsibilities		
Identifies limits of EMT scope of practice		
Discusses briefly prior to contact protocols		
Discusses briefly communication failure protocols		

Appendix B (1 page)

EMT ALS ASSIST
SKILLS EXAM
AUTOMATIC EXTERNAL DEFIBRILLATOR

NAME: _____
EMT# _____
DATE: _____

SKILLS AREAS	CRITERIA TO PASS	PASS	FAIL
Patient Assessment	<ol style="list-style-type: none"> 1. Confirms cardiopulmonary arrest. Unconscious, no breathing or agonal breathing, no pulse. 2. Patient 1 years or older and not a victim of major trauma. 		
Defibrillator Operation (must pass)	<ol style="list-style-type: none"> A. If collapse before dispatch, begin CPR (1.5 to 3 minutes CPR may be considered) <ol style="list-style-type: none"> 1. For defibrillators that analyze automatically when turned on: <ol style="list-style-type: none"> a. Attach pads in correct position (may be done during CPR if there are more than 2 rescuers) b. Turn on machine c. Clears patient and presses to analyze 2. For defibrillators that require the operator to press "Analyze" for first analysis: <ol style="list-style-type: none"> a. Turn on machine b. Attach pads in correct position. (may be done during CPR if there are 2 or more rescuers) c. Clears patient and presses analyze 		
Shockable Rhythms	<ol style="list-style-type: none"> 1. Delivers shock when prompted 2. Restart CPR for two minutes after shock. 3. Deliver additional shocks as needed. 		
No Shock Advised Rhythms.	<ol style="list-style-type: none"> 1. Checks pulse after analysis reveals "no shock advised". 2. If no pulse, restarts CPR for 2 minutes. 3. After 2 minutes, analyzes. 4. Checks pulse after analysis reveals "no shock advised". 5. If no pulse, restarts CPR for 2-3 minutes. 		
Patient Support/Assessment	<ol style="list-style-type: none"> 1. If pulse returns, monitors respiration and ventilates as needed. 2. If pulse, takes BP. 3. Continues to monitor for presence of pulse. 4. If pulse is less than 30, continues CPR. 		
Safety	<ol style="list-style-type: none"> 1. Clears prior to EVERY shock. 2. Checks for causes 		
Speed (must pass)	<ol style="list-style-type: none"> 1. Can hook up, assess, charge and deliver 1st shock for VF in no more than 90 seconds once AED sequence is initiated. 	Actual time (seconds) _____	
_____ Evaluator's Signature			

APPENDIX C

Employer: Please instruct the EMT to complete the requirements in the order listed.

_____, EMT has been evaluated and is approved to provide EMS Prehospital Care in the following instances. S/He has met all criteria as defined in VenturaCountyEMS policies. I have reviewed documentation of such and it is attached to this recommendation.

Please initial the appropriate box

<p>EMT ALS-Assist</p> <p><input type="checkbox"/> Employer Approval</p> <p><input type="checkbox"/> Completed appropriate EMT Training Module</p> <p><input type="checkbox"/> BH or Provider Medical Director or Designee Evaluation</p> <p><input type="checkbox"/> Notification to VC EMS</p> <p>Reference Policy 306</p>

Please sign and date below for approval.

Employer Signature	Date:
MD, PLP Provider MD or designee (EMT ALS-Assist authorization Only)	Date:

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: EMT/Paramedic/MICN Decertification and Discipline		Policy Number 330	
APPROVED: Administration: Steven L. Carroll, Paramedic		Date: June 1, 2009	
APPROVED: Medical Director: Angelo Salvucci, M.D.		Date: June 1, 2009	
Origination Date: April 9, 1985		Effective Date: June 1, 2009	
Date Revised: December 12, 2008			
Date Last Reviewed: April 9, 2012			
Review Date: April 30, 2014			

- I. PURPOSE: To provide disciplinary proceeding regarding prehospital emergency care certificates including provision of counseling, placing certificate holder on probation or suspension, revocation of certificate, denial of renewal of certificate, or denial of certification.
- II. AUTHORITY: California Health and Safety Code, Section 1798.200
- III. POLICY: The Ventura County Emergency Medical Services Director (VCEMSD) may provide counseling, place on probation, suspend from practice for a designated time period, deny or revoke certification or deliver reprimands to Ventura County Certified EMT-I, paramedic, or MICN if their actions, while providing prehospital care, constitutes a threat to public health and safety.

GROUND FOR DISCIPLINARY ACTION:

- A. Evidence that one or more of the following actions that constitute a threat to public health and safety has/have occurred:
 - 1. Fraud in the procurement of any certification, license or authorization.
 - 2. Gross negligence or repeated negligent acts
 - 3. Incompetence.
 - 4. Commission of any fraudulent, dishonest, or corrupt act, which is substantially related to the qualifications, functions, and duties of prehospital personnel.
 - 5. Conviction of any crime, which is substantially related to the qualifications, functions and duties of prehospital personnel. The record of conviction shall be considered conclusive evidence of conviction.
 - 6. Violation of or an attempt to violate or assistance in or abetting the violation of, or conspiring to violate, any provision of Division 2.5 of the Health and Safety Code, or of the regulations promulgated by the California State Emergency Medical

Services Authority, or the County of Ventura pertaining to prehospital care personnel.

7. Violation of or an attempt to violate any federal or state statute or regulation, which regulates narcotics, dangerous drugs or controlled substances.
8. Addiction to the excessive use of, or the misuse of, alcoholic beverages, narcotics, dangerous drugs or controlled substances.
9. Functioning as a Ventura County certified EMT-I, accredited paramedic, or authorized MICN while under the influence of alcoholic beverages, narcotics, dangerous drugs or controlled substances.
10. Functioning outside the scope of the held certificate or independent of medical controls in the local prehospital emergency medical care system except as authorized by other license or certification.
11. Unprofessional conduct exhibited by any of the following:
 - a. The mistreatment or physical abuse of any patient resulting from force in excess of what a reasonable and prudent person trained and acting in a similar capacity while engaged in the performance of his or her duties would use if confronted with a similar circumstance. Nothing in this section shall be deemed to prohibit an EMT-I or Paramedic from assisting a peace officer, or a peace officer that is acting in the dual capacity of peace officer and EMT-I or paramedic, from using that force that is reasonably necessary to affect a lawful arrest or detention.
 - b. The failure to maintain confidentiality of patient medical information, except, as disclosure is otherwise permitted or required by law in Section 56 to 56.6, inclusive, of the Civil Code.
 - c. The commission of any sexually related offense specified under Section 290 of the Penal Code.

- B. Failure to pass a certifying or recertifying examination shall be sufficient grounds for the denial of a certificate or the denial of the renewal of a certificate without a formal appeal process.

IV. PROCEDURE:

A. Submission of Claim.

When any of the Grounds for Disciplinary Action are exhibited by a certificate holder, any individual observing such grounds may submit a written claim relative to the infraction as well as any other supporting evidence to the VCEMSD. Discovery through medical audit shall be considered as a source of information for action.

B. Notification of Claim against Certificate Holder.

Before any formal investigation is undertaken, the VCEMSD shall evaluate the claim(s) relative to the potential threat to the public health and safety and determine if further action appears to be warranted.

When such a claim is submitted to the VCEMSD he/she shall notify the PCC and ED Medical Director at the appropriate Base Hospital, and the ALS provider management (if the certificate holder is an EMT-I or paramedic) of the claim. Notification of such a claim shall be given verbally within twenty-four (24) hours, or as soon as possible, followed by written notification within ten (10) days. The written notice shall include:

1. A statement of the claim(s) against the certificate holder.
2. A statement which explains that the claim(s), if found to be true, constitute a threat to the public health and safety and are cause for the VCEMSD to take disciplinary action pursuant to Section 1798.200 of the Health and Safety Code.
3. An explanation of the possible actions, which may be taken if the claims are found to be true.
4. A brief explanation of the formal investigation process.
5. A request for a written response to the claim(s) from the certificate holder.
6. A statement that the certificate holder may submit in writing any information, which she/he feels is pertinent to the investigation, including statements from other individuals, etc.
7. The date by which the information must be submitted.
8. A statement that if she/he so chooses, the certificate holder may designate another person, including legal counsel or the certificate holder's employer, to represent him/her during the investigation.

This notification may be combined with notification of disciplinary action if the certificate holder's certificate is being immediately suspended.

The claim shall be responded to by the appropriate individual(s) and relevant information shall be submitted to the VCEMSD within fifteen (15) days after receipt of written notification.

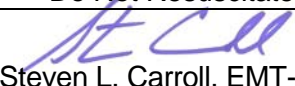

C. Review of Submitted Material.

The VCEMSD shall review the submitted material and determine the appropriate disciplinary action.

1. The nature of the disciplinary action shall be related to the severity of the risk to the public health and safety caused by the actions of the certificate holder or applicant for a prehospital care certificate.

2. The types of action, which may be taken prior to or subsequent to formal investigation, include:

Immediate suspension: The VCEMSD may immediately suspend a prehospital emergency medical care certificate at any point in the investigative or appeal process if there is evidence which indicates in the expert opinion of the VCEMSD that a continuing threat to the public health and safety will exist if the certificate is not suspended. The certificate holder's relevant employer shall be notified prior to or concurrent with initiation of the suspension. If the certificate is suspended prior to the initiation or completion of a review of the claims by an investigative review panel (IRP), an IRP shall not be required unless the certificate holder requests an IRP review, in writing, within fifteen (15) calendar days of the date that written notification is received. An expedited appeal hearing shall be convened if the certificate holder requests, in writing, such a hearing. Written notification shall be sent by certified mail.

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Do Not Resuscitate		Policy Number 613	
APPROVED: Administration:	 Steven L. Carroll, EMT-P	Date: June 1, 2011	
APPROVED: Medical Director:	 Angelo Salvucci, M.D.	Date: June 1, 2011	
Origination Date:	October 1, 1993	Effective Date:	June 1, 2011
Date Revised:	February 10, 2011		
Date Last Reviewed:	February 10, 2011		
Review Date:	February, 2014		

- I. PURPOSE: To establish criteria for a Do Not Resuscitate (DNR) Order, and to permit Emergency Medical Services personnel to withhold resuscitative measures from patients in accordance with their wishes.
- II. AUTHORITY: California Health and Safety Code, Sections 1798 and 7186. California Probate Code, Division 4.7 (Health Care Decisions Law). California Code of Regulations, Title 22, Sections 70707(6), & 72527(a),(4).
- III. DEFINITIONS:
 - A. "EMS Personnel": All EMTs, paramedics and RNs caring for prehospital or interfacility transfer patients as part of the Ventura County EMS system.
 - B. "Resuscitation": Medical interventions whose purpose is to restore cardiac or respiratory activity, and which are listed below:
 1. External cardiac compression (chest compressions).
 2. Defibrillation.*
 3. Tracheal Intubation or other advanced airway.*
 4. Assisted Ventilation for apneic patient.*
 5. Administration of cardiotoxic medications.*
 - C. "DNR Medallion": A permanently imprinted insignia, worn by a patient that has been manufactured and distributed by an organization approved by the California Emergency Medical Services Authority.
 - D. "DNR Order": An order to withhold resuscitation. A DNR Order shall be considered operative under any of the following circumstances. If there is a conflict between two DNR orders the one with the most recent date will be honored.
 1. A fully executed original or photocopy of the "Emergency Medical Services Prehospital DNR Form" has been read and reviewed on scene;
 2. The patient is wearing a DNR Medallion;

* - Defibrillation, advanced airway, assisted ventilation, and cardiotoxic medications may be permitted in certain patients using a POLST form. Refer to VCEMS Policy 625.

3. A fully executed California Durable Power of Attorney For Health Care (DPAHC) form is seen, a health care agent designated therein is present, and that agent requests that resuscitation not be done;
 4. A fully executed Natural Death Act Declaration has been read and reviewed on scene;
 5. A fully executed California Advance Health Care Directive (AHCD) has been read and reviewed on scene and:
 - a. a health care agent designated therein is present, and that agent requests that resuscitation not be done, or
 - b. there are written instructions in the AHCD stating that the patient does not wish resuscitation to be attempted;
 6. A completed and signed Physician Orders for Life-Sustaining Treatment (POLST) form has been read and reviewed on scene, and in Section A, "Do Not Attempt Resuscitation/DNR" is selected, or;
 7. For patients who are in a licensed health care facility, or who are being transferred between licensed health care facilities, a written document in the patient's permanent medical record containing the statement "Do Not Resuscitate", "No Code", or "No CPR," has been seen. A witness from the health care facility must verbally document the authenticity of this document.
- E. "California Advance Health Care Directive (AHCD)". As defined in California Probate Code, Sections 4600-4805.
- F. "California Durable Power of Attorney for Health Care (DPAHC)": As defined in California Civil Code, Sections 2410-2444.
- G. "Natural Death Act Declaration": As defined in the Natural Death Act of California, Health and Safety Code, Sections 7185-7195.
- H. "Physician Orders for Life-Sustaining Treatment (POLST)". As defined in California Probate Code, Division 4.7 (Health Care Decisions Law).
- IV. PROCEDURE:
- A. All patients require an immediate medical evaluation.
 - B. Correct identification of the patient is crucial in this process. If not wearing a DNR Medallion, the patient must be positively identified as the person named in the

DNR Order. This will normally require either the presence of a witness or an identification band.

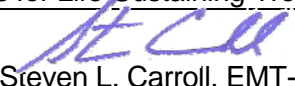
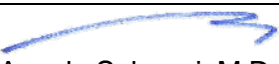
- C. When a DNR Order is operative:
1. If the patient has no palpable pulse and is apneic, resuscitation shall be withheld or discontinued.
 2. The patient is to receive full treatment other than resuscitation (e.g., for airway obstruction, pain, dyspnea, hemorrhage, etc.).
 3. If the patient is taking high doses of opioid medication and has decreased respiratory drive, early base hospital contact should be made before administering naloxone. If base hospital contact cannot be made, naloxone should be administered sparingly, in doses no more than 0.1 mg every 2-3 minutes.
- D. A DNR Order shall be considered null and void under any of the following circumstances:
1. The patient is conscious and states that he or she wishes resuscitation.
 2. In unusual cases where the validity of the request has been questioned (e.g., a family member disputes the DNR, the identity of the patient is in question, etc.), EMS prehospital personnel may temporarily disregard the DNR request and institute resuscitative measures while consulting the BH for assistance. Discussion with the family member, with explanation, reassurance, and emotional support may clarify any questions leading to validity of a DNR form.
The underlying principle is that the patient's wishes should be respected.
 3. There is question as to the validity of the DNR Order.
Should any of these circumstances occur, appropriate treatment should continue or immediately commence, including resuscitation if necessary. Base Hospital contact should be made when appropriate.
- E. Other advanced directives, such as informal "living wills" or written instructions without an agent in the California Durable Power of Attorney for Health Care, may be encountered. Should any of these occur, appropriate treatment will continue or immediately commence, including resuscitation if necessary. Base Hospital contact will be made as soon as practical.

- F. In case of cardiac arrest, if a DNR Order is operative, Base Hospital contact is not required and resuscitation should not be done. Immediate base hospital contact is strongly encouraged should there be any questions regarding any aspect of the care of the patient.
- G. If a DPAHC or AHCD agent requests that resuscitation not be done, the EMT shall inform the agent of the consequences of the request.
- H. DNR in a Public Place
Persons in cardiac arrest with an operative DNR Order should not be transported. The Medical Examiner's office should be notified by law enforcement or EMS personnel. If possible, an EMS representative should remain on scene until a representative from law enforcement or the Medical Examiner's office arrives.

V. DOCUMENTATION:

For all cases in which a patient has been treated under a DNR Order, the following documentation is required in the AVCDS report:

- A. Name of patient's physician signing the DNR Order.
- B. Type of DNR Order (DNR Medallion, Prehospital DNR Form, POLST Form, written order in a licensed health care facility, DPAHC, Natural Death Act Declaration).
- C. If the decision to withhold or terminate resuscitative measures was made by an EMT, his/her name and certificate number.
- D. For all cases which occur within a licensed health care facility, in addition to above, if the DNR Order was established by a written order in the patient's medical record, the name of the physician signing and the witness to that order.
- E. If resuscitation is not done because of the request of a healthcare agent designated in a DPACH or AHCD, the agent's name.

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Physician Orders for Life-Sustaining Treatment (POLST)		Policy Number 625	
APPROVED Administrator:	 Steven L. Carroll, EMT-P	Date: January 8, 2009	
APPROVED: Medical Director:	 Angelo Salvucci, M.D.	Date: January 8, 2009	
Origination Date:	January 7, 2009		
Date Revised:			
Date Last Reviewed:	February 10, 2011	Effective Date:	January 9, 2009
Review Date:	January, 2014		

- I. **PURPOSE:** To permit Ventura County Emergency Medical Services personnel to honor valid POLST forms and provide end-of-life care in accordance with a patient's wishes.
- II. **AUTHORITY:** California Health and Safety Code, Sections 1798 and 7186.
California Probate Code, Division 4.7 (Health Care Decisions Law).
- III. **DEFINITIONS:**
 - A. "EMS Personnel": All EMT-1s, EMT-Ps and RNs caring for prehospital or interfacility transfer patients as part of the Ventura County EMS system.
 - B. Valid Physician Orders for Life-Sustaining Treatment (POLST). A completed and signed physician order form, according to California Probate Code, Division 4.7 and approved by the California Emergency Medical Services Authority.
- IV. **POLICY:**
 - A. A POLST form must be signed by the patient or surrogate and physician to be valid.
 - B. Although an original POLST form is preferred, a copy or FAX is valid.
 - C. When a valid POLST form is presented, EMS personnel will follow the instructions according to the procedures below.
 - D. The POLST form is intended to supplement, not replace, an existing Advance Health Care Directive. If the POLST form conflicts with the Advance Health Care Directive, the most recent order or instruction of the patient's wishes governs.
- V. **PROCEDURE:**
 - A. Confirm that:
 1. The patient is the person named in the POLST.
 2. The POLST form, Section D, is signed by the patient and physician. The form is not valid if not signed by both.

- B. POLST form - Section A:
1. If the patient has no pulse and is not breathing AND “Do Not Attempt Resuscitation/DNR” is selected, refer to VC EMS Policy 613 – Do Not Resuscitate.
 2. If the patient has no pulse and is not breathing AND EITHER “Attempt Resuscitation/CPR” is selected OR neither option is selected then begin resuscitation.
- C. POLST Form – Section B: This section applies if the patient has a pulse and/or is breathing.
1. If “**Comfort Measures Only**” is selected, the following treatments may be done as indicated to relieve pain and suffering:
 - a. Patient positioning
 - b. Oxygen
 - c. Airway suctioning
 - d. Relief of airway obstruction (including Magill Forceps)
 - e. Pain control per VC EMS Policy 705
 2. If “**Limited Additional Interventions**” is selected, in addition to the above “Comfort Measures Only” items, the following treatments may be done as indicated:
 - a. IV fluids
 - b. bag-mask ventilation
 - c. CPAP
 - d. DO NOT INTUBATE

If the “Do Not Transfer to hospital for medical interventions” option is selected, contact the base hospital. Generally the patient will be transported.
 3. If “**Full Treatment**” is selected the patient will be treated with all medically indicated medications and/or procedures. If a patient has selected both “Do Not Attempt Resuscitation/DNR” in Section A and “Full Treatment” in Section B, if the patient is witnessed to go into a shockable rhythm and still has agonal respirations, defibrillate once and begin bag-mask ventilations, but do not begin chest compressions.

D. If there is any conflict between the written POLST orders and on-scene individuals, contact the base hospital.

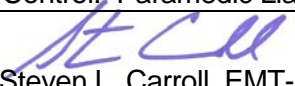
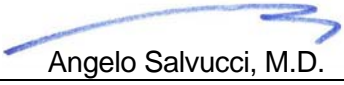
E. Take the POLST form with the patient.

VI. DOCUMENTATION:

For all cases in which a patient has been treated according to a POLST form, the following documentation is required in the narrative section of the AVCDS.:

A. A statement that the orders on a POLST form were followed..

B. The section of the POLST form that was applicable.

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Medical Control: Paramedic Liaison Physician		Policy Number 701	
APPROVED: Administration:  Steven L. Carroll, EMT-P		Date: June 1, 2013	
APPROVED: Medical Director:  Angelo Salvucci, M.D.		Date: June 1, 2013	
Origination Date: August 1, 1988		Effective Date: June 1, 2013	
Date Revised: December 13, 2012			
Date Last Reviewed: December 13, 2012			
Review Date: January 31, 2014			

- I. PURPOSE: To define the role and responsibility of the Paramedic Liaison Physician (PLP) with respect to EMS medical control.
- II. AUTHORITY: Health and Safety Code Sections 1707.90, 1798, 1798.2, 1798.102, and 1798.104. California Code of Regulations, Title 22, Sections 100147 and 100162
- III. POLICY: The Base Hospital shall implement the policies and procedures of VC EMS for medical direction of prehospital advanced life support personnel. The PLP shall administer the medical activities of licensed and accredited prehospital care personnel and ensure their compliance with the policies, procedures and protocols of VC EMS. This includes:
 - A. Medical direction and supervision of field care by:
 1. Ensuring the provision of medical direction and supervision of field care for Base Hospital physicians, MICNs, PCCs, and Paramedics.
 2. Ensuring that field medical care adheres to current established medical guidelines, and that ALS activities adhere to current policies, procedures and protocols of VC EMS.
 - B. Education by ensuring the development and institution of prehospital education programs for all EMS prehospital care personnel (MDs, MICNs, Paramedics).
 - C. Audit and evaluation by:
 1. Providing audit and evaluation of Base Hospital Physicians, MICNs, PCCs, and ALS field personnel. This audit and evaluation shall include, but not be limited to:
 - a. Clinical skills and supervisory activities pertaining to providing medical direction to ALS field personnel.

- b. Compliance with current policies, procedures and protocols of the local EMS agency.
 - c. Base Hospital voice communication skills.
 - d. Monthly review of all ALS documentation when the patient is not transported.
- D. Investigations according to VC EMS Policy 150.
- E. Recordkeeping by ensuring that proper accountability and records are maintained regarding:
 - 1. The activities of all Base Hospital physicians, MICNs and Paramedics.
 - 2. The education, audit, and evaluation of base hospital personnel
 - 3. Communications by base hospital personnel
- F. Communication equipment operation by ensuring that the base hospital ALS field personnel communication/ telemetry equipment is staffed and operated at all times by personnel who are properly trained and authorized in its use according to the policies, procedures and protocols of VC EMS.
- G. Base Hospital liaison by ensuring:
 - 1. Base Hospital physician and PCC representation at Prehospital Services Committee and other appropriate committee meetings
 - 2. Ongoing liaison with EMS provider agencies and the local medical community.
 - 3. On-going liaison with the local EMS agency.
- H. Ensuring compliance with Base Hospital Designation Agreement.

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Interfacility Transport Of Patients With IV Heparin & Nitroglycerin		Policy Number 722	
APPROVED: Administration: Steven L. Carroll, Paramedic		Date: January, 10, 2008	
APPROVED: Medical Director: Angelo Salvucci, M.D.		Date: January, 10, 2008	
Origination Date: June 15, 1998		Effective Date :January 10, 2008	
Date Revised: January 10, 2008			
Date Last Reviewed: February 9, 2012			
Review Date: January 31, 2014			

I. PURPOSE:

To provide a mechanism for paramedics to be permitted to monitor infusions of nitroglycerin and heparin during interfacility transfers.

II. POLICY:

- A. Paramedics: Only those Paramedics who have successfully completed a training program approved by the Ventura County EMS Medical Director on nitroglycerin and heparin infusions will be permitted to monitor them during interfacility transports.
- B. ALS Ambulance Providers: Only those ALS Ambulance providers approved by the Ventura County EMS Medical Director will be permitted to provide the service of monitoring nitroglycerin and/or heparin infusions during interfacility transports
- C. Patients: Patients that are candidates for paramedic transport will have pre-existing intravenous heparin and/or nitroglycerin drips. Pre-hospital personnel will not initiate heparin and nitroglycerin drips.

III. PROCEDURE:

- A. Medication Administration
 - 1. The paramedic shall receive a report from the nurse caring for the patient and continue the existing medication drip rate
 - 2. If medication administration is interrupted by infiltration or disconnection, the paramedic may restart or reconnect the IV line.
 - 3. All medication drips will be in the form of an IV piggyback monitored by a mechanical pump familiar to the Paramedic who has received training and is familiar with its use.
 - 4. In cases of pump malfunction that cannot be corrected, the medication drip will be discontinued and the receiving hospital notified.



- B. Nitroglycerin Drips: Paramedics are allowed to transport patients on nitroglycerin drips within the following parameters:
1. Infusion fluid will be D5W. Medication concentration will be either 25 mg/250ml or 50 mg/250ml.
 2. Drip rates will remain constant during transport. No regulation of the rate will be performed except to turn off the infusion completely.
 3. In cases of severe hypotension, the medication drip will be discontinued and the receiving hospital notified.
 4. Drip rates will not exceed 50 mcg/minute.
 5. Vital signs will be monitored and documented every 5 minutes.
- C. Heparin Drips: Paramedics are allowed to transport patients on heparin drips within the following parameters:
1. Infusion fluid will be D5W or NS. Medication concentration will be 100 units/ml of IV fluid (25,000 units/250ml or 50,000 units/500 ml).
 2. Drip rates will remain constant during transport. No regulation of the rate will be performed except to turn off the infusion completely.
 3. In cases of severe uncontrolled bleeding, the medication drip will be discontinued and the base hospital notified.
 4. Drip rates will not exceed 1600 units/hour.
 5. Vital signs will be monitored and documented every 10 minutes.
- D. QI: All calls will be audited by the service provider and by the transferring and receiving hospitals. Audits will assess compliance with VCEMS Policy, including base hospital contact in emergency situations. Reports will be sent to the EMS agency as requested.

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Emergency Medical Technician-I Automatic External Defibrillation (AED) Service Provider Medical Director		Policy Number: 802	
APPROVED: Administration: Steven L. Carroll, EMT-I-P		Date: 10/10/2002	
APPROVED: Medical Director: Angelo Salvucci, M.D.		Date: 10/10/2002	
Origination Date: November 1988		Effective Date: November 30, 2002	
Date Revised: June, 2002			
Date Last Reviewed: April 14, 2011			
Review Date: April 2014			

- I. PURPOSE: To define the qualifications and responsibilities of the EMT AED Medical Director.
- II. AUTHORITY: Health and Safety Code 1797.107, 1707.170, 1797.220, 1798 and California Code of Regulations, Title 22, Division 9, Sections 10063 and 100063.1.
- III. DEFINITION: "Defibrillation Medical Director" means a physician and surgeon licensed in the State of California who is certified by the American Board of Emergency Medicine and is designated by the local EMS medical director to be responsible for the EMT-I defibrillation program, including medical control, under his/her jurisdiction. Waiver of the board certified requirement may be granted by the local EMS medical director if such physicians are not available for designation. (22CCR100059.1)
- IV. POLICY: An EMT AED Service Provider Medical Director in Ventura County shall meet the qualifications and perform the functions defined in this policy.
- V. PROCEDURE: The EMT AED Medical Director shall:
 - A. Either:
 1. Be certified by the American Board of Emergency Medicine or
 2. Maintain current ACLS certification
 - B. Have skills in cardiac rhythm interpretation
 - C. Possess a working knowledge of the prehospital EMS system and EMT AED systems.
 - D. Make sufficient time commitment to actively participate in the review of individual cases and in the development and approval of all periodic reports.
 - E. Approve and monitor training programs, including refresher training

- F. Establish policies and procedures for demonstration of continued competency in defibrillation
- G. Require documented demonstration of skills proficiency
 - 1. Monthly for manual defibrillation
 - 2. At least every 6 months for automatic or semi-automatic defibrillation
- H. Rescind accreditation if an EMT fails to show continued competency
- I. Establish policies and procedures for temporary suspension, as needed, by EMS Medical Director, EMT AED medical director or Base Hospital medical director and submit these policies to the EMS Medical Director for approval.
- J. Submit reports to the EMS Medical Director according to policies and procedures established by the local EMS agency.

The EMT AED medical director may delegate specific field care audits, training and clinical experience/demonstration of competency to the medical director of a Base Hospital, physician, registered nurse, physician assistant or EMT-P licensed or certified in the State of California. An EMT may assist an instructor in demonstration of competency and training.

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Emergency Medical Technician (EMT) Automatic External Defibrillation (AED) Service Provider Program Standards		Policy Number: 803	
APPROVED: Administration:  Steven L. Canoin, EMT-P		Date: 04-24-06	
APPROVED: Medical Director:  Angelo Salvucci, M.D.		Date: 04-24-06	
Origination Date: November 1988		Effective Date: June 1, 2006	
Date Revised: March 2006			
Date Last Reviewed: April 14, 2011			
Review Date: April 30, 2014			

- I. PURPOSE: To establish criteria for approval and oversight of EMT AED Service Provider programs.
- II. AUTHORITY: Health and Safety Code 1797.107, 1797.170, 1798 and California Code of Regulations, Title 22, 10063.1.
- III. DEFINITION: An EMT AED service provider is an agency or organization that employs individuals as defined in Section 100060, and who obtain AEDs for the purpose of providing AED services to the general public.
- IV. POLICY:
 - A. An AED Service Provider shall be approved by Ventura County Emergency Medical Services (VC EMS) prior to beginning service. In order to receive and maintain EMT AED Service Provider approval, an EMT AED Services Provider shall comply with the requirements of this policy.
 - B. An EMT AED Service Provider shall:
 1. Have a written agreement with a physician who meets requirements in VCEMS Policy 802 to serve as Medical Director.
 2. Provide orientation of AED authorized personnel to the AED
 3. Ensure maintenance of AED equipment.
 4. Ensure continued competency of AED authorized personnel
 - a. Demonstration of skills competence at least every six months to the EMT Medical Director or his/her designee as identified to the EMS office.
 - b. Use of AEDs shall be incorporated into each fire station's quarterly drills.
 - c. Attendance records shall be maintained.
 - d. Continuing Education Lecture: The EMT (AED) shall attend one (1) hour lecture per six months to total four (4) per two year certification period with content in cardiac arrest management.
 5. Ensure that EMT personnel complete first responder BLS Prehospital Care Record (PCR) for all patient contacts and submit to VC EMS.
 6. Authorize personnel and maintain a current listing of all EMT AED Service



Provider authorized personnel and provide a listing upon request by the VC EMS Agency. Authorized personnel means EMT personnel trained to operate an AED and authorized by an approved EMT AED Service Provider.

7. Train all EMTs who have not already been trained in use of AED. Training shall include the following:
 - a. Perform emergency cardiac care in accordance with protocols developed and/or approved by the EMS Agency Medical Director.
 - b. Recognize that a patient is in cardiac arrest and that CPR and immediate application of the automated external defibrillator or manual defibrillator is required.
 - c. If collapse before call to 9-1-1, 2 minutes of CPR before first analysis.
 - d. Set up the automated defibrillator correctly.
 - e. Correctly apply the defibrillator pads.
 - f. Ensure that rescuers or bystanders are not in contact with the patient while the AED is analyzing or delivering a shock.
 - g. If collapse *after* call to 9-1-1, deliver shocks for ventricular fibrillation in the shortest time possible following their arrival at the patient side, ideally within 90 seconds.
 - h. Recognize that a shock was delivered to the patient.
 - i. Provide supportive care to a patient who has been successfully defibrillated.
 - j. Immediately recognize and respond to patients who rebrillate either at the scene or during transport, in accordance with protocols.
 - k. Deliver no more than the number of shocks allowed in the standing orders.
 - l. Record the pertinent events of the emergency response on a PCR.
 - m. Maintain the monitor/defibrillator and voice/ECG recorder or other documentation device in accordance with manufacturer's recommendations.
8. Develop and maintain a quality improvement program, approved by the VC EMS Medical Director that contains the following:
 - a. Assure timely and competent review of EMT managed cardiac arrest cases, accurate logging of required data, and timely, accurate and informative statistical summaries of system performance over time, as well as recommendations, as indicated, for modifications of system design, performance protocols, or training standards designed to improve patient outcome.

- b. Collect, store and analyze, at a minimum, the following data related to EMT management of cardiac arrest patients:
 - (1) Patient Data:
 - a) Age,
 - b) Sex,
 - c) Whether arrest was witnessed or unwitnessed,
 - d) Distance of collapse from EMT responding unit, and
 - e) Initial cardiac rhythm.
 - (2) EMS System Data:
 - a) Estimated time from collapse to call for help,
 - b) Estimated time from collapse to initiation of CPR,
 - c) EMT responding unit response time, and
 - d) Scene to hospital transport time.
 - (3) EMT Performance:
 - a) Accuracy of rhythm interpretation,
 - b) Time from arrival to actual defibrillation,
 - c) Time between defibrillation attempts,
 - d) Appropriateness of management for each rhythm encountered, and
 - e) General adherence to established protocol.
 - (4) Patient Outcome:
 - a) Rhythm after each shock.
 - b) Return of pulse and/or spontaneous respirations in the field.
- 7. EMT AED documentation submission
 - a. EMT documentation (incident printout and prehospital care record (PCR) shall be submitted to the receiving hospital as soon as possible (not more than two hours after patient arrival).
 - b. EMT documentation for all arrests (incident printout and PCR including times) shall be submitted by the provider to the involved base hospital within 30 days of the end of the calendar month of the occurrence.
 - c. EMT documentation (incident printout, PCR including times, and audio tape) shall be submitted to the EMT medical director or designee within 10 working days of the occurrence.
- 8. The EMT AED Service Provider, in conjunction with its medical director, shall submit an annual written report to the EMS Agency to include as a minimum the

following information.

- a. The total number of cases in which the AED was activated. The number of those cases where return of spontaneous circulation (ROSC) was achieved.
- b. The number of cases that presented in Ventricular Fibrillation (VF). The number of those cases where ROSC was achieved.
- c. The number of cases that presented in witnessed VF. The number of those cases where ROSC was achieved.
- d. The 90% fractile times from first notification to on-scene, to with patient and to first analysis, in case of secondary PSAP, time received.
- e. The number of cases of cardiac arrest responded to where the AED was not activated and the 90% fractile time from first notification to on-scene for those cases, in case of secondary PSAP, time received.

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Emergency Medical Technician (EMT) Medical Cardiac Arrest		Policy Number 805	
APPROVED Administrator	 Steven L. Carroll, EMT-P	Date: 04/24/2006	
APPROVED Medical Director:	 Angelo Salvucci, MD	Date: 04/24/2006	
Origination Date:	October 1, 1993	Effective Date: June 1, 2006	
Revised:	April 24, 2006		
Date Last Reviewed:	April 14, 2011		
Review Date:	April, 2014		

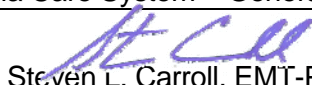

- I. PURPOSE: To define the protocol to be followed by non-transport unit EMT-Is during a response to a medical cardiac arrest.
- II. AUTHORITY: Health and Safety Code 1797.107, 1797.170, 1797.220, 1798 and California Code of Regulations, Title 22, Division 9, Section 100063 and 100063.1.
- III. POLICY: The following protocol shall be used by EMT-Is in a medical cardiac arrest.
- IV. PROCEDURE: EMT-Is shall:
 - A. CONFIRM: Patient is unconscious, non-breathing or has agonal respiration and pulseless.
 1. Arrest not secondary to trauma (if trauma, follow trauma protocol)
 2. If AED has demonstrated a high specificity for pediatric shockable rhythms, as determined by the service provider medical director, patient is 1 year of age or older. If the AED has not demonstrated a high specificity for pediatric shockable rhythms, as determined by the service provider medical director, patient is 8 years of age or older.
 - B. Initiate CPR/set up defibrillator.
 1. If collapse before call to 9-1-1, 2 minutes of CPR (1 or 2+ rescuers) before first analysis.
 2. If collapse after call to 9-1-1:
 - a. If alone, do not start CPR. Start defibrillator immediately and analyze.
 - b. For 2 or more rescuers, CPR while setting up defibrillator, then analyze immediately.
 - C. Clear personnel prior to analyzing rhythm. Re-clear and visually clear prior to administering shock.
 - D. Have machine analyze rhythm
 1. If the AED is not in compliance with the 2005 AHA Guidelines
 - a. If machine determines that a shock is necessary, press button to shock patient (360 J monophasic)*.
 - b. Analyze rhythm: If machine determines that a shock is necessary, press button to shock patient (360J monophasic)*.

* Or monophasic or biphasic energy level approved by service provider medical director.

- c. Analyze rhythm: If machine determines that a shock is necessary, press button to shock patient (360 J monophasic)*. Check carotid pulse.
 - d. If the patient remains unconscious and pulseless after the third shock, perform CPR for 1 minute and repeat the series of up to three shocks.
 - e. Continue cycles of CPR and assessment until turning over care to ALS responders or to the hospital.
 - f. If after any of the shocks, the rhythm has changed and there is a pulse, maintain the airway and breathing, monitor pulse, and check blood pressure. If pulse is less than 30 and patient remains unconscious, do CPR for 1 minute and reevaluate patient.
2. If the AED is compliant with the 2005 AHA Guidelines:
 - a. If machine determines that a shock is necessary, press button to shock patient (360 J)*, then immediately begin CPR.
 - b. Perform CPR for 2 minutes, reassess, and shock if necessary.
 - c. Continue cycles of CPR and assessment until turning over care to ALS responders or to the hospital.
- E. Patient Transportation
1. If the transport unit is an Advanced Life Support unit, the care of the patient will be turned over to the EMT-Ps. The EMT-I may accompany the patient to the hospital.
 2. If the transport unit is a Basic Life Support unit, CPR shall be continued and the patient transported to the nearest (in terms of time) hospital.
 - a. The EMT-I shall accompany the patient in the BLS unit.
 - b. If the patient transiently regains pulses as a result of previous defibrillation, and then patient loses pulses, the unit may pull over for machine evaluation of the patient's rhythm and deliver further shocks.
- F. If the initial rhythm is not shockable or any time that the machine indicates a non-shockable rhythm and patient remains pulseless:
1. Do CPR for two minutes
 2. Have machine analyze rhythm
 3. If unshockable rhythm remains, check pulse. If pulseless, do CPR for 2 minutes. If pulse is absent, reanalyze. Repeat cycle until transport unit arrives, patient resumes pulse, or a shockable rhythm presents.

* Or monophasic or biphasic energy level approved by service provider medical director.

4. If a shockable rhythm presents, follow shock series as above.
 5. If pulse returns, maintain airway and breathing, monitor pulse, and check blood pressure. Except in cases of hypothermia, if pulse is less than 30 and patient remains unconscious, do CPR for 2 minutes and reevaluate patient.
- F. When repeating shocks on a patient who has converted and then refribrillates, administer shocks at the level that conversion occurred (e.g., if the patient converted at 360 J, begin new series of shocks at 360 J) *¹.



COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Trauma Care System – General Provisions		Policy Number 1400	
APPROVED: Administration:	 Steven L. Carroll, EMT-P	Date: June 1, 2012	
APPROVED: Medical Director:	 Angelo Salvucci, M.D.	Date: June 1, 2012	
Origination Date:	July 1, 2010	Effective Date:	June 1, 2012
Date Revised:	April, 2012		
Date Last Reviewed:	April, 2012		
Review Date:	April, 2014		

- I. **PURPOSE:** To provide standards and guidelines for the Ventura County Trauma Care System. To provide all injured patients the accessibility to an organized, multi-disciplinary and inclusive system of trauma care. To ensure that all injured patients are taken to the time-closest and most appropriate medical facility.
- II. **AUTHORITY:** Health and Safety Code, §1797.160, §1797.161, and §1798, and California Code of Regulations, Title 22, §100255.
- III. **POLICY:**
 - A. **Multi-disciplinary Nature of Systematized Trauma Care**
The Ventura County EMS Agency (VCEMS) recognizes the multi-disciplinary nature of a systemized approach to trauma care. VCEMS has adopted policies, guidelines and triage criteria that provide for the coordination of all resources and ensure the accessibility to the time-closest and most appropriate medical facility for all injured patients.
 - B. **Public Information and Education**
 1. VCEMS is committed to the establishment of trauma system support and the promotion of injury prevention and safety education.
 2. VCEMS facilitates speakers to address public groups, and serves as a resource for trauma information/education.
 3. VCEMS assists community and professional groups in the development and dissemination of education to the public on such topics as injury prevention, safety education programs and access to the Trauma Care System.

4. Each designated facility must participate in the development of public awareness and education campaigns for their service area.
- C. Marketing and Advertising
1. In accordance with the Health and Safety Code, Division 2.5, no healthcare provider shall use the term "trauma facility," "trauma hospital," "trauma center," "trauma care provider," "trauma care vehicle," or similar terminology in its signs or advertisements or in printed materials and information it furnishes to the general public unless its use has been authorized by VCEMS.
 2. All marketing and promotional plans, with respect to trauma center designation shall be submitted to VCEMS for review and approval, prior to implementation. Such plans will be reviewed by VCEMS, with approval or denial issued within 10 days, based on the following guidelines:
 - a. Shall provide accurate information
 - b. Shall not include false claims
 - c. Shall not be critical of other providers
 - d. Shall not include financial inducements to any providers or third parties
- D. Service Areas for Hospitals
- Service areas for local trauma hospitals are determined by the VCEMS policy of transporting patients to the time-closest and appropriate facility.
- E. EMS Dispatching
- EMS dispatching for Ventura County is provided for and coordinated through the Ventura County Fire/EMS Communications Center, and, for Oxnard Fire, through the Oxnard PD center. The closest ALS transporting unit to an incident is dispatched, as well as BLS, and in some cases ALS, first responders.
- F. Training of EMS Personnel
1. Designated facilities will provide training to hospital staff on trauma system policies and procedures.
 2. Base Hospitals conduct periodic classes to orient prehospital providers to the local EMS system. Representatives from a designated trauma center may present the orientation to the Ventura County trauma system.
- G. Coordination and Mutual Aid between neighboring jurisdictions

1. VCEMS will establish and maintain reciprocity agreements with neighboring EMS jurisdictions that provide for the coordination of mutual aid within those jurisdictions.
 2. VCEMS works cooperatively and executes agreements, as necessary, in order to ensure that patients are transported to the time-closest and appropriate facility.
 3. VCEMS maintains contact with neighboring EMS agencies in order to monitor the status of trauma care systems in surrounding jurisdictions.
- H. Interfacility Transfers
1. As an inclusive trauma system, all hospitals have a role in providing trauma care to injured patients.
 2. Designated trauma centers are required to establish and maintain a transfer agreement with other trauma center(s) of higher designation for the transfer of patients that require a higher level of care.
 3. Transferring facilities, in conjunction with the higher-level facility, shall be responsible for obtaining the appropriate level of transportation when transferring trauma patients.
- I. Pediatric Trauma Care.
- Integration of pediatric hospital (s), when applicable, into the overall trauma care system to ensure that all trauma patients receive appropriate trauma care in the most expeditious manner possible
1. Designated trauma centers are required to maintain a transfer agreement with a pediatric trauma center.
 2. As with all specialties, pediatric consultation should be promptly available
 3. The transferring facility, in conjunction with the higher-level facility, shall be responsible for obtaining the appropriate level of care during transport.
- J. Coordinating and Integration of Trauma Care with Non-Medical Emergency Services
1. VCEMS ensures that all non-medical emergency service providers are apprised of trauma system activities, as it relates to their agency/organization.
 2. Non-medical emergency service providers are included in the VCEMS committee memberships, as appropriate.

3. VCEMS disseminates information to non-medical emergency service agencies through written communication, as necessary.
- K. Trauma Center Fees
- VCEMS has developed a fee structure that covers the direct cost of the designation process and to effectively monitor and evaluate the trauma care system. Fees are based on the direct VCEMS cost of administering the trauma care system.
- L. Medical Control and Accountability
1. Each designated trauma center shall:
 - a. Provide base hospital medical control for field prehospital care providers.
 - b. Provide base hospital service in accordance with California Code of Regulations, Title 22, as outlined in the VCEMS Base Hospital Agreements.
 - c. Participate in the VCEMS data collection system as defined by VCEMS, CEMSIS-Trauma and the National Trauma Database.
 - d. Participate in the VCEMS continuous quality improvement program.

COUNTY OF VENTURA HEALTH CARE AGENCY		EMERGENCY MEDICAL SERVICES POLICIES AND PROCEDURES	
Policy Title: Trauma Center Standards		Policy Number 1406	
APPROVED: Administration:	 Steven L. Carroll, EMT-P	Date: June 1, 2012	
APPROVED: Medical Director:	 Angelo Salvucci, M.D.	Date: June 1, 2012	
Origination Date:	July 1, 2010		
Date Revised:	February 9, 2012	Effective Date: June 1, 2012	
Date Last Reviewed:	February 9, 2012		
Review Date:	February 28, 2014		

- I. PURPOSE: To establish Ventura County Trauma Center facility and personnel standards for trauma patient care. To obtain and maintain designation as a Level II Trauma Center, the Trauma Center shall be in compliance with the standards contained in this policy.
- II. AUTHORITY: Health and Safety Code, § 1798, 1798.165 and 1798.170, California Code of Regulations, Title 22, Division 9, Chapter 7.
- III. DEFINITIONS:
 - A. “On-site” means being physically present within the patient treatment area at all times.
 - B. “In-house” means being physically present in the trauma center and responding immediately upon trauma team activation. Arrive to the patient treatment area within ten (10) minutes of placement of call with a minimum documented compliance rate of 80% for each calendar month, and in no case greater than fifteen (15) minutes from time call is placed.
 - C. “Immediately available” means: a) dedicated to the trauma center while on duty, b) unencumbered by conflicting duties or responsibilities; c) responding without delay when notified; and d) being physically present within the patient treatment area when the patient arrives or within fifteen (15) minutes of placement of call, whichever is later, and not to exceed fifteen (15) minutes from patient arrival, with a minimum documented compliance rate of 80% for each calendar month, and in no case greater than thirty (30) minutes from time call is placed.
 - D. “Promptly available” means arrival to the patient treatment area within thirty (30) minutes with a minimum documented compliance rate of 80% for each calendar month, and in no case greater than forty-five (45) minutes, from time call is placed.

- E. "On-call" requires the specified healthcare professional to be available to respond for trauma care in a defined manner and time period (i.e., immediately available, promptly available).

IV. POLICY:

A. General Provisions

1. California Statutes and Regulations: Trauma Centers will meet all applicable requirements set forth in California Health and Safety Code, Division 2.5, Chapter 6, Article 2.5 and California Code of Regulations, Title 22, Division 9, Chapter 7.
2. American College of Surgeons Committee on Trauma (ACS-COT) standards:
 - a. Trauma Centers will obtain within three (3) years of designation by VCEMS, and continuously maintain, ACS-COT Level II Trauma Center verification.
 - b. Trauma Centers are required to continuously comply with ACS-COT trauma center verification standards, as determined by VCEMS through the QI program and other oversight activities.
3. VCEMS may establish standards that exceed the requirements above.

B. Trauma System Activation

Trauma centers will accept all patients that meet trauma triage criteria, as described in VCEMS Policy 1405, except when on diversion per VCEMS Policy 402.

C Interfacility Transfers

1. As an inclusive trauma system, all hospitals will have a role in providing trauma care to injured patients. All Ventura County trauma centers are required to establish and maintain transfer agreements with each of the Ventura County hospitals.
2. The trauma center is obligated to immediately accept all patients who meet trauma transfer criteria from hospitals in Ventura County per VCEMS Policy 1404.
3. To initiate a transfer, a call shall be placed by the transferring hospital emergency physician or surgeon to the trauma center on-call trauma surgeon or designee. The verbal report for transfer shall be physician to physician.

4. The transferring hospital, in consultation with the trauma center, will be responsible for obtaining the appropriate level of transportation. Consideration of transport modality (e.g., ground vs. air) should be a collaborative decision between transferring hospital and the trauma center.

D. Response Requirements:

Staff response times will be documented in the patient care record and trauma registry for VCEMS review.

1. Surgical Service:

Availability: an operating suite is continuously available or being utilized for trauma patients and has operating staff who are on-call and promptly available unless operating on trauma patients.

2. General Surgeon:

- a. Availability: On-call and immediately available for highest level of trauma team activation, and available within one (1) hour of the time of call for other trauma team activations or consultation when requested by the emergency physician.
- b. Advised of all trauma patient admissions;
- c. Participate in major therapeutic decisions;
- d. Present in the emergency department for all major trauma resuscitations; and
- e. Present in the operating room for all procedures.

3. Emergency Medicine:

Availability: On-Site

4. Respiratory Therapist:

Availability: In House

5. Radiology Technician:

Availability: In House

6. CT Technician:

Availability: On call and immediately available

7. Radiologist:

Availability: On-call and promptly available

8. Interventional Radiology Service and Interventional Radiologist

- a. Includes diagnostic and therapeutic procedures
- b. Availability: On-call and promptly available
9. Ultrasound Service
Availability: On-call and promptly available
10. Anesthesiology:
Availability: On call and promptly available
11. Clinical Laboratory:
Availability: On-Site (within the lab)
12. Neurosurgery:
Availability: On-call and promptly available
13. OB/GYN Service:
Availability: On-call and promptly available
14. Orthopedics:
Availability: On-call and promptly available
15. Ophthalmologist:
Availability: On-call and promptly available
16. Oral or Maxillofacial, or Head and Neck Service:
Availability: On-call and promptly available
17. Plastic Surgery:
Availability: On-call and promptly available
18. Reimplantation/Microsurgery:
 - a. Availability: On-call and promptly available
 - b. If reimplantation/microsurgery is provided via a transfer agreement, the patient shall be transferred out within one (1) hour of arrival at that trauma center, unless other life threatening conditions take precedent as determined by the staff trauma surgeon. If transfer is delayed the reason(s) must be documented in the patient's chart.
19. Urologist
Availability: On-call and promptly available
20. Thoracic Surgery:
Availability: On-call and promptly available
21. Critical Care Services:
Availability: On-site within the critical care area

22. Critical Care Physician
Availability: On-call and promptly available
23. Cardiac Surgery:
 - a. Availability: On-call and promptly available if cardiac surgery is available at the trauma center
 - b. If cardiac surgery is provided via a transfer agreement, the patient shall be transferred out within one (1) hour of arrival at that trauma center, unless other life threatening conditions take precedent as determined by the staff trauma surgeon. If transfer is delayed, the reason(s) must be documented in the patient's chart.
24. Additional Specialty Services:
 - a. Burn Center. These services may be provided through a written transfer agreement with a burn center.
 - b. Acute hemodialysis capability.
 - c. Acute spinal cord injury management capability. This service may be provided through a written transfer agreement with a rehabilitation center.
 - d. A pediatric intensive care unit approved by the California State Department of Health Services' California Children Services (CCS); or a written transfer agreement with an approved pediatric intensive care unit. Hospitals without pediatric intensive care units shall establish and utilize written criteria for consultation and transfer of pediatric patients needing intensive care
25. Available Consultations:

The following specialist(s) or specialty service(s) will be available for consultation and respond by phone to a call within thirty (30) minutes.

 - a. Cardiology
 - b. Gastroenterology
 - c. Hand Surgery
 - d. Hematology
 - e. Infectious Diseases
 - f. Internal Medicine
 - g. Nephrology

- h. Neurology
 - i. Pathology
 - j. Pulmonary Medicine
- E. Heliport
Trauma Centers are required to operate and maintain a State-permitted heliport, on or immediately adjacent to the hospital, as described in California Code of Regulations Title 21, § 3554.
- F. Prehospital Personnel
 1. Trauma centers will have a written agreement with the Ventura College School of Prehospital and Emergency Medicine that allows paramedic students to schedule and experience their clinical rotations at the trauma center, as well as perform clinical procedures (e.g., endotracheal intubation, intravenous access) on patients.
 2. Trauma centers will allow EMT and paramedic personnel to perform clinical skills for continuing education and remediation purposes as directed by the VCEMS CQI program.
- G. Base Hospital
 1. Trauma Centers must be designated by VCEMS as a Base Hospital and comply with all requirements in VCEMS Policy 410.
 2. Trauma Centers must employ a minimum of one FTE Prehospital Care Coordinator.