

# San Diego County Trauma System

## CIREN Center

### CIREN Program Report



San Diego County  
Administration Center



Children's Hospital &  
Health Center



Scripps Mercy Hospital



Palomar Medical Center



Scripps Memorial – La Jolla



Sharp Memorial Hospital



UCSD Medical Center

## CIREN Center: Program Structure

The San Diego CIREN Center is a collaborative effort between the six regional Trauma Centers and the County of San Diego, Health & Human Services Agency, Division of Emergency Medical Services. The unique configuration of the San Diego CIREN program, incorporating six hospitals rather than one, presents logistical challenges for its participants but also offers research outcomes rich in rewards.

The CIREN Program was established in 1996 through the General Motors Corporation settlement agreement and is currently underwritten through a Cooperative Agreement with the NHTSA. The Principal Investigators for the project are:

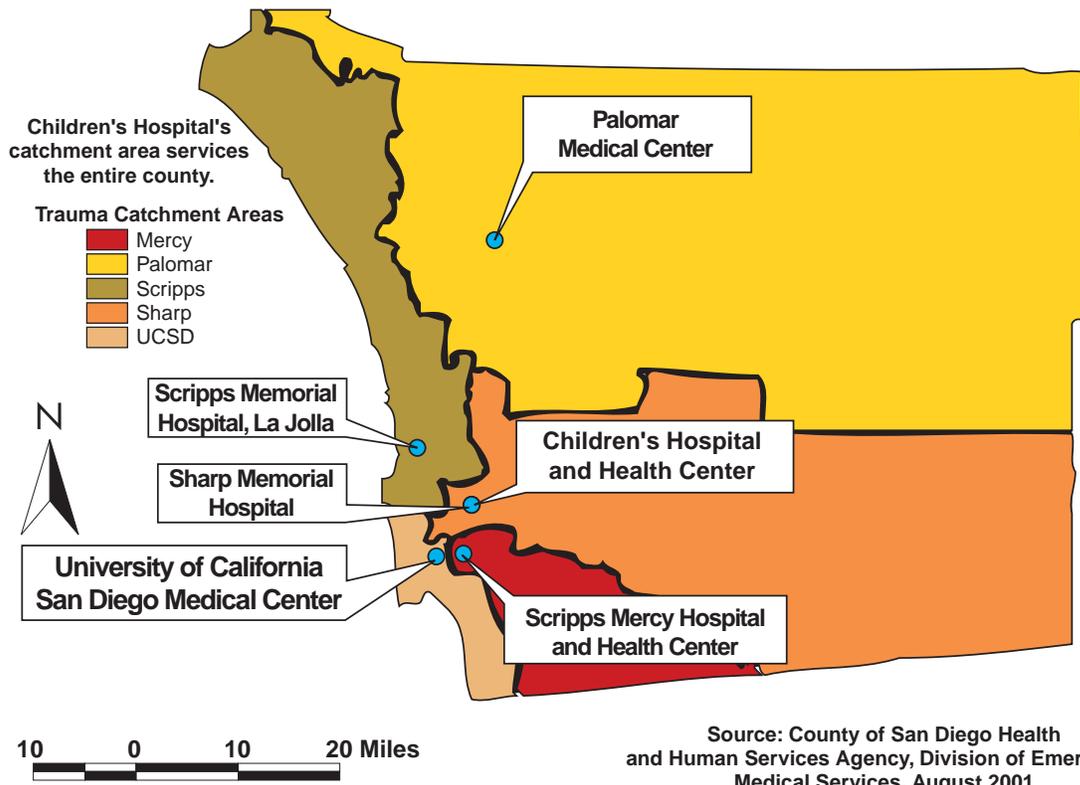
- **Gail F. Cooper, Administrator**, County of San Diego Office of Public Health
- **A. Brent Eastman, MD, Director**, Trauma Services at Scripps Memorial Hospital – La Jolla
- **David B. Hoyt, MD, Director**, Trauma Services at the University of California San Diego (UCSD) Medical Center

The Principal Investigators are supported by the Trauma Medical Directors and nurse administrators, researchers and case managers at the county's trauma centers. The participating Trauma Centers are:

- Children's Hospital and Health Center, San Diego
- Palomar Medical Center
- Scripps Mercy Hospital
- Scripps Memorial Hospital – La Jolla
- Sharp Memorial Hospital
- UCSD Medical Center

The San Diego region is rich in diversity. San Diego County, the fifth largest county in the United States, is home to 2.8 million residents and approximately 1.8 million licensed drivers. Covering 2.7 million acres, San Diego County has over 7,700 miles of roadways, 600 miles of which is made up of state highways. San Diego County is bordered by the Pacific Ocean to the west, Camp Pendleton to the north, the Anza-Borrego desert to the east, and the U.S.-Mexico border to the south. These

## Trauma Catchment Areas County of San Diego



boundaries insulate San Diego from adjacent regions, and in a sense, the County can be considered a natural laboratory for research.

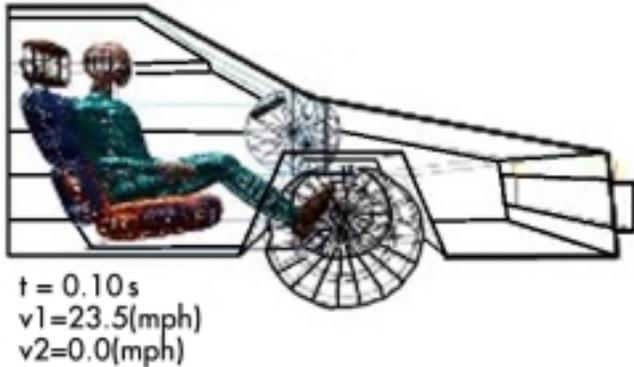
The San Diego CIREN Center draws project occupants from rural, suburban and urban regions. The crash scenarios, like the County's population, are varied and offer an array of research opportunities for the CIREN program. As evidenced from the following statistics, motor vehicle crashes continue to be a concern for the residents of San Diego. From July 1998 through June 1999, there were a total of 14,941 motor vehicle crashes in San Diego County, injuring 19,828 victims. Motor vehicle occupant (MVO) crashes were most common (82%), followed by pedestrians (7%), pedal cycle (5%), and motorcycles (4%). Almost 11 percent (10.9%) of victims were injured in Driving Under the Influence (DUI) crashes. Crashes involving unsafe speed made up 30.5% of the cases and sign/signal violations were associated with 9.8% of the crashes. Twenty percent of children under age 15 injured in DUI crashes were passengers of the DUI driver. Statistics indicate that nearly six percent (5.6%) of victims injured in MVO crashes were unrestrained (10.2% unknown restraint use). Child restraints were not used in less than 2%, however misuse rate is estimated at 96.4%. Of victims injured, 0.9% were killed, 3.3% suffered severe injury, 25.6% had other visible injuries, and 70.2% had a complaint of pain. These statis-

tics reflect the scope of the safety problem that motor vehicle crashes present in San Diego. The research efforts of the CIREN program have the potential to help mitigate the death, disability, and human suffering associated with

### Steve Erwin, CIREN San Diego Crash Investigator, During Case Review



### Animated Simulation of Frontal Offset Crash



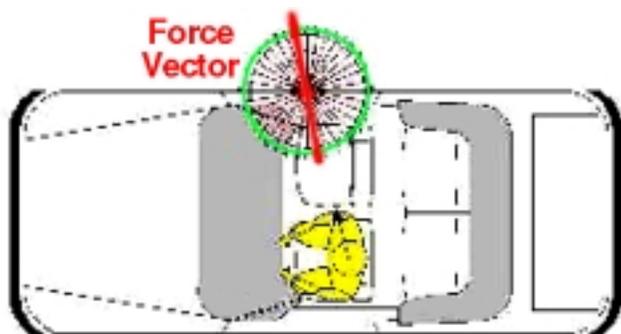
these crashes and to have repercussions nationally, as well as locally.

### Trauma System Participation

The San Diego CIREN program benefits from the seventeen-year working relationship of the San Diego Trauma System. The trauma system partners include the six Trauma Centers, the Division of Emergency Medical Services (EMS) and the Office of the Medical Examiner. Established in 1984, San Diego's trauma system is nationally recognized for its pioneering efforts, not only in patient care, but for its integration between EMS and Public Health and its strides in quality improvement activities. The trauma system participants have engaged in collaborative efforts to improve the triage, transport and treatment of injured patients, including motor vehicle crash occupants.

Since its inception, the trauma system has focused on the multidisciplinary system of care through an inclusive Medical Audit Committee (MAC) process which includes trauma physicians and nurses, other surgical specialties, the Medical Examiner, and prehospital and Emergency Department personnel. The MAC reviews trauma cases for prehospital and hospital delivery of care as a means to improve patient outcomes and ensure the provision of quality medical service.

### Principal Direction of Force for Far Side Crash



San Diego draws from the strength of the MAC multidisciplinary concept to provide a basis for the CIREN injury and crash analysis process. The MAC multidisciplinary approach has been enriched by the addition of crash reconstructionists, highway safety engineers, and prehospital providers. Collectively, the core participants have decades of experience in injury identification, injury causation, and crash dynamics. The CIREN process has fortified their understanding of occupant kinematics, vehicle design and biomechanics. As the case review system has matured the CIREN team has incorporated the use of crash video clips, simulations, and occupant motion vectors to assist with injury sourcing in challenging cases. Case analysis has provoked discussion regarding vehicle crashworthiness, injury patterns, and injury prevention opportunities.

### The People



**Ms. Gail F. Cooper**, has been instrumental in establishing Emergency Medical Service Systems, Trauma Systems, Injury Control programs, and Public Health policy at the local, state and national level for over 25 years. She has assisted state and local communities in further development and refinement of their respective EMS systems, strengthened data collection and evaluation components of EMS and Trauma systems, and formulated policies allowing for the integration of EMS, Trauma, and Injury programs.



**A. Brent Eastman, MD, FACS** is the N. Paul Whittier Chair of Trauma and Medical Director of Trauma Services at Scripps Memorial Hospital, La Jolla. Dr. Eastman served as Chairman of the Committee on Trauma for the American College of Surgeons from 1990 to 1994 and he has been a Co-Chair of the San Diego Trauma System Medical Audit Committee since its inception. The knowledge gained from these responsibilities, as well as his extensive clinical experience, ensure the CIREN program gets the benefit of Dr. Eastman's trauma background. Dr. Eastman has authored or co-authored more than 30 publications related to trauma care and trauma systems.



**Dr. David B. Hoyt, MD, FACS** is the Vice Chairman of the Surgical Department and Chief of the Division of Trauma, Burn, Surgical Critical Care. In 1996 he was awarded The Monroe E. Trout Professorship in Surgery at UCSD. He currently serves as Chairman of the UCSD Medical Group Board of Governors. Dr. Hoyt has distinguished himself in Traumatology having delivered numerous named lectures, received significant awards from his colleagues and scientific organizations while serving in positions of leadership. In addition to an active clinical schedule, he has been intense-

ly involved in both graduate and undergraduate teaching at UCSD. He is currently the President-elect of the American Association for the Surgery of Trauma, President of the Society of General Surgeons, Secretary of the Shock Society, and the Chairman of the American College of Surgeons Committee on Trauma. Dr. Hoyt has dedicated considerable time to research activities and is the author of over 300 publications.

**Ms. Sharon E. Pacyna, RN, BSN, MPH** has been the Project Manager for the San Diego CIREN Program since 1997. She has been active in nursing for almost 30 years, and has extensive experience in both the clinical and administrative aspects of trauma patient care. Her background has cultivated Ms. Pacyna's knowledge of injury mechanisms and injury diagnosis and treatment. She is responsible for coordinating CIREN activities on a day-to-day basis and overall program oversight. Additionally, Ms. Pacyna has delivered presentations locally and nationally, participated in the alpha testing of the CIREN database, and collaborated with other CIREN members to develop quality assurance processes and outreach programs.

**Mr. Steven M. Erwin** joined the San Diego CIREN Team in July 2000. He has over sixteen years of experience in Federal Department of Transportation motor vehicle related crash research, including six and a half years in quality assurance at the National Automotive Sampling System (NASS) Zone Center level, and ten years of NASS field data collection. This background provides Mr. Erwin with extensive knowledge, both historical and applicable, of NASS protocol and ground floor understanding and operation of the Electronic Data Collection System (EDCS).

As a CIREN Crash Investigator, he conducts all field data collection, crash dynamics reconstruction and synthesis of the data into the EDCS. He assists in the linking of injury to the mechanism injury and the propagation of technical and educational information through presentations to medical and industry audience. He formulates vehicle dynamics, occupant kinematics and injury analysis into detailed written reports.

**Ms. Teresa M. Vaughan, RN, BSN, CCRN** is the Assistant Project Manager for the San Diego CIREN program. Her extensive clinical experience with trauma patients has provided her with knowledge of crash injury patterns and mechanism of injury. Throughout her employment she has been responsible for AIS coding, data collection and entry into trauma registry databases. Her responsibilities for CIREN include conducting patient interviews, obtaining digital images of patient injuries, review of all NASS AIS coding, and CIREN database entry. Ms. Vaughan is an active participant in development of presentations for quarterly CIREN meetings in Washington DC, as well as monthly case reviews among the six trauma centers.

**Mary D. Kracun, RN, PhD, CCRN** is the Investigational Clinician for the Trauma Service at Scripps Memorial Hospital, La Jolla, California. Dr. Kracun has been involved in Critical Care, Emergency and Trauma Nursing for more than 25 years. She has been active with the American Association of Critical-Care Nurses, serving on both local and national Boards of Directors. Dr. Kracun has participated in the development of the CIREN computer database data elements and quality assurance activities related to the CIREN program. Additionally, she has played an active role in the development of presentations for the CIREN Quarterly Meetings as well as delivering CIREN educational programs at both local and regional conferences.

CIREN San Diego is fortunate to have the input from the Medical Directors and Nurse Managers from the six Trauma Centers. They identify potential candidates for the CIREN study and provide in-depth injury documentation and injury description, which are invaluable during the case analysis. These partners include:

#### **Children's Hospital, San Diego**

Barry E. LoSasso, MD, FACS, FAAP  
Trauma Medical Director

Susan A. Cox, RN, MS, CEN  
Trauma Services Director

Renee Douglas, RN  
Assistant Trauma Coordinator

#### **Scripps Memorial Hospital, La Jolla**

A. Brent Eastman, MD, FACS

N. Paul Whittier, Chair of Trauma

Mary D. Kracun, RN, PhD, CCRN  
Investigational Clinician, Trauma

Jackie Martinez, RN, BSN, CCRN  
Trauma Case Manager

Jennifer Wilson, RN, BSN, ONC  
Trauma Case Manager

Cheryl Wooten, RN, MSN, CNRN  
Trauma Program Manager

#### **Palomar Medical Center**

Thomas Velky, MD  
Medical Director Trauma Service

Patricia Renaldo, RN, BSN  
Trauma Clinician

Shannon Durbin-Yates, RN, BSN  
Trauma Clinician

#### **UCSD Medical Center**

David B. Hoyt, MD, FACS  
Director, Trauma Services

Linda Richards, RN, MN  
Study Coordinator

Beth Romeril, RN, MSC(A)  
Research Nurse

**Scripps Mercy Hospital**

Michael J. Sise, MD, FACS  
Medical Director, Trauma Services  
Dorothy M. Kelley, RN, MSN, CEN  
Trauma Program Manager

**Sharp Memorial Hospital**

Frank R. Kennedy, MD, FACS  
Director, Trauma Services  
Kathi Ayers, RN, MSN, CCRN, CFNP  
Trauma Program Manager  
Linnea Trageser, RN, MS, ANP  
Trauma Nurse Practitioner/CNS

**The Role of Emergency Medical Services**

Personnel from the County of San Diego, Emergency Medical Services provide administrative and managerial oversight to the CIREN project. In addition to their

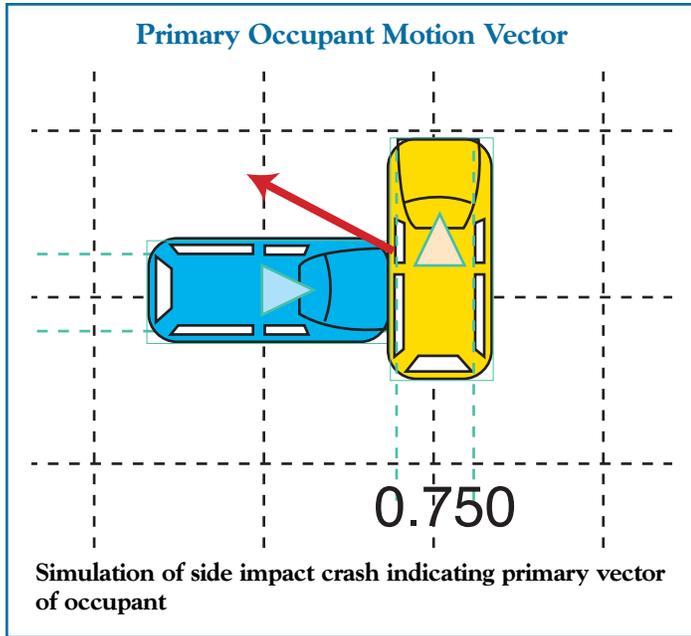
participation in the Trauma System, EMS has on-line access to all prehospital provider data. Housed in the office of EMS is a wide area network computer system, linking prehospital providers with Emergency Departments in a real time prehospital patient information system identified as the QA Net. The QA Net serves many purposes. It is a database for all prehospital patient information in which an EMT-P makes patient contact. It also provides current information on the resource status of all Emergency Departments and Trauma Centers. If a Trauma Center's on-call and back-up surgeons are all busy in the Operating Room due to multiple admissions, this information is entered into the QA Net so that triage/destination decisions can be based on resource availability.

CIREN utilizes the QA Net to assist in identifying potential crash study candidates. On a daily basis the QA Net is queried for all injury patients transported to the six Trauma Centers. EMS staff review these computerized prehospital records, deleting all but the motor vehicle crash victims. The information remaining in this dedicated CIREN database is printed and faxed to the Trauma Centers to serve as

**Example of San Diego County QA Net Hospital Status  
Emergency Receiving Status**

HOSPITAL NAME-CODE	TRAUMA	HOSPITAL	CT	ICU	OTHER	OTHER
ALVARADO	1	OPEN	OPEN	OPEN	OPEN	OPEN
CHILDRENS	56	OPEN	OPEN	OPEN	OPEN	OPEN
CORONADO	49	OPEN	OPEN	OPEN	L/D FULL	OPEN
FALLBROOK	38	OPEN	OPEN	OPEN	OPEN	OPEN
GROSSMONT	12	OPEN	OPEN	OPEN	OPEN	OPEN
KAISER	16	OPEN	OPEN	OPEN	NO TELE	OPEN
MERCY	19	BYPASS	OPEN	DOWN	OPEN	OR FULL
PALOMAR	22	OPEN	OPEN	OPEN	OPEN	OPEN
PARADISE VALLEY	24	OPEN	OPEN	OPEN	OPEN	OPEN
POMERADO	59	OPEN	OPEN	OPEN	OPEN	OPEN
SCRIPPS CV	2	ED SAT	OPEN	OPEN	OPEN	OPEN
SCRIPPS ENCINITAS	45	OPEN	OPEN	OPEN	OPEN	OPEN
SCRIPPS LJ	30	OPEN	OPEN	OPEN	OPEN	OPEN
SHARP	31	OPEN	OPEN	OPEN	OPEN	OPEN
SHARP CV	46	ED SAT	OPEN	OPEN	OPEN	OPEN
THORNTON	23	OPEN	OPEN	OPEN	OPEN	OPEN
TRI-CITY	32	OPEN	OPEN	FULL	OPEN	OPEN
UCSD	35	OPEN	OPEN	OPEN	OPEN	OPEN
VILLA VIEW	54	OPEN	OPEN	OPEN	OPEN	OPEN

a guide for identifying program candidates. Available data corresponds with many of the CIREN inclusion criteria such as occupant position, type of crash (frontal, side), seat belt use, child restraint system use, airbag deployment, extrication information, and names of the on-scene prehospital providers.



In calendar year 2000, CIREN screened 6,037 motor vehicle crash occupants transported to San Diego Trauma Centers. Forty-eight patients were enrolled in CIREN. At least one exclusion reason was documented for the remaining 5,989 patients. The most frequently cited exclusion reason was lack of severe injury (79.5%). The explanation for this high percentage is because injury severity, as opposed to year of vehicle for example, is readily available to medical personnel. The next highest exclusion categories were; inappropriate crash configurations - 5.9% (rear collisions, multiple rollovers), lack of active or passive restraints in frontal crashes - 5.5%, and vehicles that did not meet Late Model Year criteria - 3.3%.

The QA Net information not only assists CIREN personnel in identifying inclusion patients but also provides access to scene documentation and eyewitness accounts from scene personnel, which can be key to determining crash analysis.

EMS and the Trauma Centers enjoy a close and productive relationship with personnel from the County of San Diego, Medical Examiner's Office. In addition to providing detailed and descriptive autopsy reports, the Medical Examiner will call the CIREN Project Manager with crash scenarios appropriate for CIREN inclusion. The Medical Examiner also has a background in crash dynamics and provides insight into the biomechanics of injury.

## Research and Prevention

From August 1984 through June 1999, more than 93,000 patients were admitted to San Diego County's designated Trauma Centers and the leading cause of injury and death was motor vehicle crashes. In 1998/1999, among traumatic deaths, motor vehicle occupant crashes were the leading cause of death (210) and Years Potential Life Lost (8490.1). Years Potential Life Lost (YPLL) calculates the years of life lost due to a death using the average life expectancy as an estimate for the total length of life. These figures emphasize the need for prevention efforts related to motor vehicle crash injury.

CIREN focuses on research and prevention of injuries and death from motor vehicle crashes. San Diego is in a unique position to meet the mission and goals of CIREN due to the prior research efforts of the San Diego Trauma Centers. In addition to hospital-specific research the Trauma Centers have established the Trauma Research and Education Foundation (TREF), a non-profit organization to facilitate centralized prevention and education efforts. The past dedication to and experience in research, provides benefits to the CIREN program.

San Diego has made advances in the process for reviewing crash dynamics, occupant kinematics and injury causation. Case review participants include crash reconstructionists, highway safety engineers, and medical/nursing personnel knowledgeable in injury identification and injury mechanisms. Each case is analyzed in-depth to determine crash-worthiness, human tolerances and environmental factors as related to injury patterns. These reviews have led to several research questions and study options. One area investigated in-depth by San Diego was the biomechanics and crash factors responsible for mediastinal injuries. It discovered that restraint systems, although key in preventing a multitude of serious injuries, could result in blunt rupture of the heart and transection of the aorta. These findings were discussed at the Second Annual CIREN Conference and the audience was encouraged to design, test and develop alternate safety belt design systems to mitigate these injuries (please refer to abstract at the end of the San Diego chapter).

In addition to conducting case reviews independently, San Diego hosted the Michigan CIREN Center and conducted a joint case review session. San Diego also presented at a multi-CIREN Center review in Boston and participates in monthly CIREN Teleconference Case Review.

The County of San Diego provides procedures and protocols for prehospital personnel. This year the triage criteria for the County were revised and based, in part, on information provided by the CIREN Crash Investigator. Education regarding these criteria is being provided for paramedics and Emergency Department physicians and nurses.

San Diego CIREN staff have volunteered for several

CIREN subcommittees and projects including the Quality Assurance subcommittee, alpha testing for the CIREN database, CIREN Outreach subcommittee.

San Diego has promoted efforts to engage in community activities while enhancing its understanding of prehospital care. During a sister CIREN visit, San Diego arranged for the City of Santee Fire Department, a local county paramedic agency, to conduct an extrication demonstration. Maneuvers including dash roll-up, cutting A and B Pillars and use of the jaws-of-life were demonstrated.

## Financial Considerations

The following table uses a NHTSA formula to project motor vehicle crash costs for 1998/1999 San Diego CIREN patients. The NHTSA cost figures are based on a report entitled “The Economic Cost of Motor Vehicle Crashes, 1994”. Unit costs are sorted by the occupant’s highest Abbreviated Injury Score (AIS), which is an indicator of patient injury severity. Please note the NHTSA 1994 figures are national averages and do not reflect the actual costs in San Diego, nor have they been adjusted for 1998/1999 inflation. The NHTSA economic cost components are comprehensive and include productivity losses, property damage, medical costs, rehabilitation costs, travel delay, legal and court costs, emergency service costs, insurance administration costs, premature funeral costs and costs to employers. It is difficult to assign a monetary figure to the physical and emotional pain borne by patients and their families involved in motor vehicle crashes. However, these estimates delineate the devastating financial losses incurred from these injuries.

## A Case Study

The following is an example of how the CIREN multidisciplinary approach is incorporated into case analysis and how this can have branching impacts locally and nationally. San Diego Trauma Center researchers identified an interesting case in which two occupants in the same vehicle had identical aortic lacerations. Only one of the patients agreed to participate in the CIREN study but there was a discrepancy as to whether our study patient was the driver or the passenger. CIREN staff contacted the prehospital providers to get a first hand account of scene events including occupant positions. The paramedic information also helped the Crash Investigator pinpoint the scene location, which was difficult to determine because the vehicle went airborne from an Interstate cloverleaf and landed approximately 165 feet below. During the CIREN Case Review, crash dynamics, occupant kinematics, and the biomechanics of the aortic injury were analyzed and consensus was reached regarding the dynamics responsible for the injury. As part of CIREN’s educational objectives, patient outcome was shared with the prehospital personnel who were very interested in the case and appreciative of the feedback. Case

### Estimated Cost of Motor Vehicle Crashes

Severity per AIS	1998/99 CIREN Patients by MAIS	NHTSA Cost Formula per AIS	Estimated Costs for San Diego CIREN Patients
1	11*	\$3,777	\$41,547
2	8*	\$31,164	\$249,312
3	52	\$98,011	\$5,096,572
4	12	\$221,494	\$2,657,928
5	15	\$697,533	\$10,462,995
6	3	\$822,328	\$2,466,984
TOTAL			\$20,975,338

\* AIS 1 and 2 injuries are primarily pediatric patients

analysis was also discussed with the other CIREN Centers on a Grand Rounds Teleconference, where a spirited and educational discussion ensued.

Of special consequence in this case is the nature of the injury reviewed. Aortic injuries can be devastating and, depending on the extent of injury, many patients will die at the scene of the crash. Surviving patients are transported to the hospital but a significant percentage die if not diagnosed expediently. Therefore, identification of patients with a high risk for aortic injury presents a tremendous opportunity to save lives. To this end, CIREN Centers are analyzing crash configurations to determine if they can characterize factors that might provide a high index of suspicion for aortic injuries. This case highlights the importance how analysis of real life crashes, by a multidisciplinary team, can assist in the understanding of the mechanism and diagnosis of injuries.

## Outreach Efforts

San Diego recognizes the importance of providing education to the first responders and medical community regarding crash dynamics, occupant kinematics, and associated injury patterns to assist with the diagnosis and treatment of motor vehicle-related injuries. CIREN outreach efforts for law enforcement, prehospital providers, emergency department personnel (20 receiving hospitals) and trauma center personnel will enhance patient triage, transport, treatment, and outcome. Below is a list of local and national presentations provided by San Diego CIREN.

### Presentation Roster

#### National Presentations/Posters

**Oct. 18–20, 2001 Orthopedic Trauma Association  
17th Annual Meeting San Diego –  
Poster Session**

**Audience:** Over 600 orthopedic surgeons, nurse practitioners, and nurses attended the conference.

**Presenters:** Sharon E. Pacyna, BSN, MPH, Steven M. Erwin, Crash Investigator, Teresa M. Vaughan, RN, BSN, Mary Kracun, BSN, PhD

Presentation included a Poster Session with an overview of the national CIREN Program and a continuously playing PowerPoint™ presentation which depicted occupant kinematics, vehicle reconstruction, crash video clips and case presentations. Additionally, a crashed vehicle was displayed with contour gage and calibrated rods sticks demonstrating crush and deformation.

**June 21, 2001      Emergency Department Personnel  
– Piecing it Together**

**Audience:** CIREN Quarterly Meeting, Washington D.C. MD's, RN's, Engineers, Automotive Manufacturing Executives and Researchers

**Speakers:** Sharon E. Pacyna RN, MPH and Steve Erwin, Crash Investigator

San Diego CIREN's presentation developed for Emergency Department personnel includes CIREN overview, basic crash dynamics, and patient inclusion criteria. It emphasized the importance of injury documentation and crash details. Crash dynamics associated with injury patterns was discussed.

**Mar. 16, 2001      Real Life Injuries in Offset Frontal  
Crashes**

**Audience:** CIREN Quarterly Meeting, Washington D.C. MD's, RN's, Engineers, Automotive Manufacturing Executives and Researchers.

**Speakers:** A. Brent Eastman, MD and Steve Erwin, Crash Investigator

Review of San Diego CIREN incidence of FY offset frontal crashes including patient outcome. Presentation of two offset frontal crashes with vehicle and occupant simulations.

**Nov. 30, 2000      Diaphragm Injuries**

**Audience:** CIREN Quarterly Meeting, Washington D.C. MD's, RN's, Engineers, Automotive Manufacturing Executives and Researchers

**Speakers:** David B. Hoyt, MD and Steve Erwin, Crash Investigator

Incidence of diaphragm injuries in the CIREN database as related to crash type, patient outcome, and associated injuries. Discussion of mechanism of injury.

**Jul. 21, 2000      Side Impact – Case Presentation**

**Audience:** CIREN Quarterly Meeting, Washington D.C. MD's, RN's, Engineers, Automotive Manufacturing Executives and Researchers

**Speakers:** Sharon E. Pacyna, RN, MPH and Steve Erwin, Crash Investigator

The presentation provided an in-depth review of a side impact with air bag deployment. Detailed vehicle/occupant

photographs and a MSMAC simulation provided specific case information. CIREN and NASS query information was included for comparison. The format included audience participation.

**May 5, 2000      Lower Extremity Injuries**

**Audience:** CIREN Quarterly Meeting, Washington D.C. MD's, RN's, Engineers, Automotive Manufacturing Executives and Researchers

**Speaker:** A. Brent Eastman, MD

The presentation included lower extremity injury statistics from the San Diego County CIREN Program, two case presentations with injury/biomechanical analysis, and an occupant simulation depicting lower extremity kinematics with and without a seatbelt.

**Oct. 28, 1999      Aortic Injuries in Near-Side  
Collisions**

**Audience:** The Third Annual CIREN Conference. MD's, RN's, Engineers, Automotive Manufacturing Executives and Researchers

**Speakers:** David B. Hoyt, MD and Jeffrey Augenstein, MD.

Mechanisms of injuries for frontal and side impact collisions was reviewed. The importance of having a high index of suspicion was emphasized to ensure the institution of life saving measures.

**Sept. 15, 1998      Mediastinal Injuries**

**Audience:** Second Annual CIREN Conference, Ann Arbor Michigan. MD's, RN's, Engineers, Automotive Manufacturing Executives and Researchers.

**Speaker:** David B. Hoyt, M.D.

Dr. Hoyt presented historical and current research on mechanisms of aortic and blunt heart injuries. Research of multi-center CIREN cases were analyzed for crash type, association of chest injuries, and of specific injury mechanisms.

**May 20, 1998      Correlating Crash Injuries: People  
and Vehicles**

**Audience:** 18th Annual Conference of the National Association of Orthopedic Nurses, San Francisco California. RN's, PT's, OT's. Attendance ~75; 1,800 registrants at conference.

**Speaker:** Mary Kracun, RN, PhD, CCRN

Presentation included vehicle safety features, real and potential injuries expected in crashes and the importance of knowing specifics of the crash and how this information is beneficial in caring for patients injured in vehicle crashes.

**Regional/Local**

Oct. 22, 2001      Vehicle Intrusion And Crush As  
Indicators For Trauma Triage

Sep. 3, 2001	CIREN Update: Side Impact Case Presentations
Jun. 15, 2001	The Case of the Human Crash Dummies
Mar. 6, 2001	What Really Happens to You When You're in a Crash!
Feb. 13, 2001	Vehicle Intrusion and Crush as Indicators for Trauma Triage
Aug. 11, 2000	Safety Facts You Should Know
Jul. 13, 2000	CIREN Update: Lower Extremity Injuries
June 2000	Trauma Research: Making it Real
Jan. 15, 2000	The CIREN Project – New Dimensions in Prevention
Jan. 12, 2000	Biomechanics and Injury. Analysis of the Motor Vehicle Crash Victim
Sep. 25, 1998	Overview of CIREN & Vehicle Reconstruction
Jan. 9, 1998	Crash research and the Pediatric Patient
Dec. 2, 1997	CIREN: New Technologies and the Research Connection
Nov. 13, 1997	Injury Mechanisms and Car Crashes
Sep. 16, 1997	Correlating Crash Injuries: People and Vehicles
Jun. 13, 1997	The Biomechanics of Crash Injuries
May 1997	CIREN Case Presentation and the Methods/Benefits of Linking Data
Apr. 17, 1997	A Study to Correlate Crash Data: Matching Human Injuries with Vehicular Damage
Feb. 19, 1997	CIREN: Motor Vehicle Injury Research in San Diego
Feb. 12, 1997	CIREN: Motor Vehicle Injury Research in San Diego
1997 – 2001 Monthly	CIREN Research: UCSD residents and medical students

## **CIREN 1998 Mediastinal Injuries**

David B. Hoyt, M.D., A. Brent Eastman, M.D., Gail F. Cooper, Sharon Pacyna, R.N., M.P.H., David Guillen, B.A. and the San Diego County Trauma System

Severe mediastinal injuries of the heart and aorta remain a significant problem. They have been of interest historically for the last 500 years. Definitive repair with surgical treatment has only been accomplished in the last 40 years.

The incidence of these injuries clinically or on autopsy is highly variable depending on the presence of chest trauma, but at-scene mortality in recent autopsy series continues to account for between 30% and 50% of scene deaths. Although some of these injuries reach the hospital, their time-to-death is early if untreated and the diagnosis despite newer modalities remains challenging. Overall survival of heart injuries presenting to trauma centers with vital signs is approximately 50%. Twenty to thirty percent of transected aortic injuries still die in trauma centers prior to diagnosis.

Because they are a common cause of scene death and continue to be a diagnostic challenge with a narrow window for intervention and high surgical mortality, mediastinal injuries remain an ideal opportunity for effective prevention.

Review of San Diego CIREN cases revealed an 11% incidence of injuries to the heart and aorta with blunt rupture of the heart and aortic transection being most common. Similar cases were searched for in the CIREN database. They were compiled and analyzed for crash type, association of chest injuries and evidence of specific injury mechanisms.

Multiple mechanisms for blunt heart injury have been postulated. Review of the current data suggests that at high velocity with frontal crashes, restraint devices themselves, or the overpowering of restraint devices, continue to produce these devastating injuries. Redistribution of the load of restraints more laterally may possibly lead to a change in the frequency of these injuries.

Similar to heart injuries, multiple mechanisms have been invoked to explain aortic transection. Review of current cases suggests that during high-energy transfer, chest wall compression, either by restraints or overpowering of restraints, continues to lead to higher chest loading and injury. Redirection of energy transfer to lateral loading may potentially lead to a different incidence of these injuries.

With drivers increasingly traveling at higher speeds, reconsideration of more effective restraints may be necessary to prevent these injuries.

