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**TRAUMA  
CARE**

Expert Interventions

Donna Naydich

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**TRAUMA CARE**

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# Nurse to Nurse

# TRAUMA CARE

**Donna Naydich, RN, MSN, ACNP, CAISS**

*Trauma Consultant*

*Evans, Colorado*



New York Chicago San Francisco Lisbon London Madrid Mexico City  
Milan New Delhi San Juan Seoul Singapore Sydney Toronto

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*I dedicate this book to Michael J. Rhodes, MD, FACS, Chair, Department of Surgery, Christiana Care Health System, Wilmington, Delaware. He was my mentor in trauma care who spent endless nights with us in the shock trauma ICU in Allentown, Pennsylvania. His dedication and knowledge of trauma was the inspiration for me. Like a doting father, he sent me off to my first trauma coordinator position with confidence. The passion in this book mirrors the passion for the trauma patient that he demonstrated every day. It is that foundation upon which my trauma knowledge is built and for which I am forever grateful to him.*

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## Preface

When I was asked to write this book on trauma nursing, I found the opportunity not only exciting, but a chance to share 26 years of trauma nursing experience. As I have watched the staff and participated in the care of the trauma patient, I have wanted to produce a manual that would provide the information needed in a rapid, quick-find method. I have been a trauma nurse all of my career, from student nurse through trauma regional director positions. The faces, names, injuries, smells, and everything that comes with caring for trauma patients have remained embedded in memory all of my life. I can to this day name certain patients who had an impact on my career, knowledge, or for whom I have shed tears with the family. I have had the honor of saving lives and sitting with others as they make the transition. I have been a staff nurse, trauma nurse coordinator (as we were called back then), trauma registrar, trauma consultant/site surveyor, and trauma acute care nurse practitioner.

I was taught to be an active part of the trauma team, participating in patient assessment and identifying actions necessary to manage the patient. We were expected to interpret data and be ready to act without instructions. The team was completely collaborative and for that I am very grateful. Therefore you will find that this text is written with the understanding that the nurse is working side by side with the physicians and processing the same input. It is assumed that the nurse knows the limitations of his or her practice and will apply the knowledge in this book appropriately. There are occasions when the nurse will need to act independently and the goal of this book is to provide the information needed for the optimal care of the trauma patient.

In addition, I hope that the support services so necessary to the functional outcome of the trauma patient will also find this reference useful to their understanding of trauma care. To all those in the trauma nursing roles and all the staff supporting the trauma patient through to rehabilitation, I offer this text as your quick reference guide to rapid decision making and outstanding patient outcomes.

## x Preface

The book was extensively researched; however, due to the size, only references cited in the text will appear. All of the standard references including *Advanced Trauma Life Support (ATLS)*, *Trauma Nursing Core Course (TNCC)*, *McQuillan's Trauma Nursing from Resuscitation through Rehabilitation*, and the *Eastern Association for the Surgery of Trauma (EAST) Practice Management Guidelines* were used in every chapter. In addition, many other references provided insight and knowledge. Trust that these resources were exhausted in search of the most current and accurate data. I hope to find *Nurse to Nurse: Trauma Care* in many lab coat pockets as I round on trauma patients and survey trauma centers throughout the country.

To my colleagues who have been reading along with me throughout this year, I cannot express enough thanks for your time, expertise, gentle guidance, and friendship. To the friends and family who have patiently listened to me through this process and provided chocolate (and champagne when I was done), mahalo nui loa!

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Maggie Reynard, Illustrator/Artist, Half Moon Bay, California.

Heidi DeLeon, RN, BSN, Staff Nurse, St Joseph's Medical Center, Phoenix, Arizona.

Vicki Bennett, RN, MSN, Trauma Program Manager, Scottsdale Healthcare-Osborn, Scottsdale, Arizona.

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## List of Acronyms

ABC	Airway, breathing, circulation
ABG	Arterial blood gas
A/C	Assist-control (ventilation)
ACL	Anterior cruciate ligament
ACS	Abdominal compartment syndrome
ACS-COT	American College of Surgeons-Committee on Trauma
AD	Autonomic dysreflexia
ADH	Antidiuretic hormone
ADL	Activities of daily living
AHS	Autonomic hyperexcitability/dysfunction syndrome
AIDS	Acquired immunodeficiency syndrome
AIS	Abbreviated injury scale
ALI	Acute lung injury
ALS	Advanced life support
AMS	Acute mountain sickness
A-O	Atlanto-occipital
A-P	Anteroposterior
APP	Abdominal perfusion pressure
aPTT	Activated partial thromboplastin time
ARDS	Acute respiratory distress syndrome
ARS	Acute radiation syndrome
ASIA	American Spinal Injury Association
ATA	Atmosphere absolute
ATLS	Advanced trauma life support
ATS	American Trauma Society
ATV	All-terrain vehicle
AVN	Avascular necrosis
BIS	Bispectral index
BMR	Basal metabolic rate
BP	Blood pressure
BSF	Basilar skull fracture

## xiv Acronyms

BUN	Blood urea nitrogen
CAVR	Continuous arteriovenous rewarming
CBC	Complete blood count
CCF	Carotid cavernous fistula
CDC	Centers for Disease Control and Prevention
CHF	Congestive heart failure
CISM	Critical incident stress management
CMV	Controlled mechanical ventilation
CO	Carbon monoxide
COPD	Chronic obstructive pulmonary disease
CPAP	Continuous positive airway pressure
CPK	Creatine phosphokinase
CPP	Cerebral perfusion pressure
CPR	Cardiopulmonary resuscitation
CRIF	Closed reduction with internal fixation
CRRT	Continuous renal replacement therapy
CSF	Cerebrospinal fluid
CSW	Cerebral salt wasting
CT	Computed tomography
CVA	Costovertebral angle
CVP	Central venous pressure
CVVR	Continuous venovenous rewarming
CXR	Chest x-ray
DAI	Diffuse axonal injury
DI	Diabetes insipidus
DIC	Disseminated intravascular coagulation
DNR	Do not resuscitate
DPL	Diagnostic peritoneal lavage
DVT	Deep vein thrombosis
EAC	External auditory canal
ECA	External carotid artery
ECG	Electrocardiogram
ED	Emergency department
EDH	Epidural hematoma
EEG	Electroencephalogram

EMS	Emergency medical services
EOC	Emergency operations center
EOP	Emergency operations plan
ERCP	Endoscopic retrograde cholangiopancreatography
ETT	Endotracheal tube
FAST	Focused assessment with sonography for trauma
FES	Fat embolism syndrome
FFP	Fresh frozen plasma
FHT	Fetal heart tone
FTSG	Full thickness skin graft
FWB	Full weight bearing
GCS	Glasgow coma scale
GI	Gastrointestinal
GLF	Ground level fall
GOS	Glasgow outcome score
GSW	Gunshot wound
HACE	High-altitude cerebral edema
HAPE	High-altitude pulmonary edema
HBO	Hyperbaric oxygen
HBOC	Hemoglobin-based oxygen carrier
HIT	Heparin-induced thrombocytopenia
HIV	Human immunodeficiency virus
HO	Heterotrophic ossification
HR	Heart rate
ICA	Internal carotid artery
ICBG	Iliac crest bone graft
ICP	Intracranial pressure
ICS	Incident command system
ICU	Intensive care unit
I:E ratio	Inspiratory/expiratory ratio
IED	Improvised explosive device
IICP	Increased intracranial pressure
IMN	Intramedullary nail
INR	International normalized ratio
IO	Intraosseous line

## xvi Acronyms

IS	Incentive spirometry
ISS	Injury severity score
IV	Intravenous
IVC	Inferior vena cava
IVC-F	Inferior vena cava filter
LCL	Lateral collateral ligament
LLE	Left lower extremity
LMA	Laryngeal mask airway
LMP	Last menstrual period
LMWH	Low molecular weight heparin
LOC	Loss of consciousness
LR	Lactated ringer [solution]
LUE	Left upper extremity
MAP	Mean arterial pressure
MASH	Mobile Army surgical hospital
MAST	Military antishock trousers
MCI	Mass casualty incident
MCL	Medial collateral ligament
MI	Myocardial infarction
MMF	Maxillomandibular fixation
MODS	Multiple organ dysfunction syndrome
MOI	Mechanism of injury
MRI	Magnetic resonance imaging
MSOF	Multisystem organ failure
MVC	Motor vehicle collision
NCIPC	National Center for Injury Prevention and Control
NDMS	National Disaster Medical System
N/G	Nasogastric
NHTSA	National Highway Traffic Safety Administration
NIMS	National Incident Management System
NPO	Nothing by mouth
NSAID	Nonsteroidal anti-inflammatory drug
NSS	Normal saline solution
NTDS	National Trauma Data Standard
NWB	Nonweight bearing
OB	Obstetrics

OFR	Oxygen free radical
OOB (fall)	Out of bed
OR	Operating room
ORIF	Open reduction with internal fixation
OT	Occupational therapist/therapy
OU	Both eyes
PASG	Pneumatic antishock garment
PCWP	Pulmonary capillary wedge pressure
PE	Pulmonary embolism
PEEP	Positive end-expiratory pressure
PERRLA	Pupils equal, round, and reactive to light and accommodation
PI	Performance improvement
PICC	Percutaneously introduced central catheter
PMH	Past medical history
PPE	Personal protection equipment
PPI	Proton pump inhibitor
PPN	Peripheral parenteral nutrition
PPV	Positive pressure ventilation
PRBC	Packed red blood cells
PT	Physical therapist/therapy
PT	Prothrombin time
PTSD	Posttraumatic stress disorder
PTT	Partial thromboplastin time
PWB	Partial weight bearing
RBC	Red blood [cell] count
RLE	Right lower extremity
ROM	Range of motion
RR	Respiratory rate
RRT	Renal replacement therapy
RSI	Rapid sequence intubation
RTS	Revised trauma score
RUE	Right upper extremity
RUG	Retrograde urethrogram
SAH	Subarachnoid hemorrhage
SARS	Severe acute respiratory syndrome

## xviii Acronyms

SBIR	Screening, brief intervention, and referral
SCD	Sequential compression device
SCI	Spinal cord injury
SCIWORA	Spinal cord injury without radiographic abnormality
SDH	Subdural hematoma
SIADH	Syndrome of inappropriate secretion of antidiuretic hormone
SIRS	Systemic inflammatory response syndrome
SMA	Superior mesenteric artery
STSG	Split thickness skin graft
SVR	Systemic vascular resistance
SVT	Supraventricular tachycardia
TBI	Traumatic brain injury
TBSA	Total burn surface area
TDWB	Touchdown weight bearing
TENS	Transcutaneous electrical nerve stimulation
TLSO	Thoracolumbosacral orthosis
TM	Tympanic membrane
TMJ	Temporomandibular joint
TPN	Total parenteral nutrition
TRISS	Trauma and injury severity score
TTWB	Toe touch weight bearing
U/S	Ultrasound
V fib	Ventricular fibrillation
VAC	Vacuum-assisted closure (device)
VAP	Ventilator-associated pneumonia
VATS	Video-assisted thoracoscopy
$\dot{V}/\dot{Q}$	Ventilation-perfusion
VTE	Venous thromboembolism
WBAT	Weight bearing as tolerated
WBC	White blood [cell] count
WMD	Weapons of mass destruction



## Chapter I

# MECHANISMS OF INJURY

## INTRODUCTION

Trauma starts with the transfer of energy to the body from an outside force. The transfer of kinetic energy may be blunt or sharp in nature. In addition to blunt and sharp mechanisms, there is the situation of thermal energy in the form of heat, cold, or chemical agent, which generates the heat or cold. With the event of more frequent war-like situations, blast injuries and other mass casualty events are more common from improvised explosive devices (IED) or other mass disasters and are discussed in Chapter 15. Because the mechanism drives the injury sustained, injury prevention goes hand in hand. Table 1-1 identifies common mechanisms and the appropriate e-code for each (ICD9-CM 2008).

Trauma remains the leading cause of death in individuals aged 1 to 44 years, with the majority of injuries preventable ([www.cdc.gov/ncipc/osp/data.htm](http://www.cdc.gov/ncipc/osp/data.htm)). Motor vehicle collisions are the leading cause of trauma death in all age groups between 1 to 65 years. In individuals over 65 years, falls become the leading cause of death. The most common causes of nonfatal injuries as reported by the Centers for Disease Control and Prevention (CDC) are the following:

- Falls: 0 to 14 years and 25 years and older
- Unintentionally struck: leading cause of injury 15 to 24 years
- Motor vehicle collisions: second leading cause of injury 15 to 24 years.

**Table 1-1** E-codes for Common Mechanisms of Injury (ICD9-CM 2008)

<b>MOI</b>	<b>E-code (ICD9-CM)</b>	<b>Comments</b>
<b>MVC</b>		
x represents the fourth digit, meaning occupant position		
MV to MV	E812.x	Any two motorized vehicles involved in the collision, even if one is stationary or parked
MV to object in road	E815.x	Any motorized vehicle impact with an on-the-road object, such as an animal, road sign, median, overpass; not an off-road stationary object, such as a tree
MV to object off road	E816.x	See loss of control
MV loss of control	E816.x	Any loss of control on the road including leaving the road and ultimately crashing into an off-road object; rollover
Car surfing	E818.1	Standing on vehicle while moving
MVs to MV off-road	E821.x	MVC in vehicle traveling wholly off streets/roads, ATV
Off-road snow vehicle	E820.x	Snowmobiles
Pedestrian struck	E814.7	Pedestrian struck by any motorized vehicle on the road
Bicycle struck	E813.6	Any pedal cycle struck by any motorized vehicle on the road
<b>Falls</b>		
GLF	E888.8	General GLF without other specifics
GLF struck sharp object	E888.0	GLF in which a sharp object is struck en route to ground

(Continued)

**Table 1-1** E-codes for Common Mechanisms of Injury (ICD9-CM 2008) (Continued)

<b>MOI</b>	<b>E-code (ICD9-CM)</b>	<b>Comments</b>
<b>Falls</b>		
GLF struck blunt object	E888.1	GLF in which a blunt object is struck en route to ground
Slip, trip fall	E885.9	GLF from slipping, tripping and then falling
Fall from bike	E826.1	Riding bike, then collision on own, fall off
Fall OOB	E884.4	Fall from bed
Fall from chair	E884.2	Fall from chair
Fall while skiing	E885.3	Fall while skiing
Fall from snowboard	E885.4	Fall while snowboarding
Fall from skateboard	E885.2	Fall off roller skates, ice skates, in-line skates
Trip over curb	E880.1	Fall from tripping over a curb
Fall from toilet	E884.6	Fall from toilet
Fall from ladder	E881.0	Fall from ladder any height
Fall from building	E882	Fall from roof, other building, balcony
Fall in sports	E886.0	Collision or other cause of a fall during sports activities
Fall into hole	E883.9	Fall into a hole
Fall down steps	E880.9	Fall down any number of stairs
Fall from other	E884.9	Fall from height other object not found in the list
<b>Struck—unintentional</b>		
Without fall	E917.x	Struck unintentionally by object or persons without a fall

(Continued)

**Table 1-1** E-codes for Common Mechanisms of Injury (ICD9-CM 2008) (*Continued*)

<b>MOI</b>	<b>E-code (ICD9-CM)</b>	<b>Comments</b>
<b>Struck—unintentional</b>		
In sports, no fall	E917.0	Struck unintentionally in sports activities without subsequent fall
Crushed between objects	E918	Caught between two objects, crushed objects
By falling object	E916.0	Struck by any falling object
<b>Others</b>		
Lawnmower	E920.0	Injury while using a lawnmower, powered or not
Cut by glass	E920.8	Unintentional cut by glass
Unintentional GSW	E922.x	Gunshot, unintentional
Unintentional stab	E920.3	Injury caused by sharp implement, unintentional
<b>Homicide</b>		
Assault	E960.0	Struck by fists, kicked, assaulted
Assault with object	E968.2	Struck by object during assault, pistol-whipped, baseball bat, concrete block, etc
Assault with vehicle	E968.5	Intentionally struck by vehicle
Rape	E960.1	Rape
GSW	E965.x	Intentional gunshot; fourth digit represents weapon
Stab	E966	Intentional stab with implement
Abuse	E967.x	Abuse of child, adult, elderly; inflicted by another
Set on fire	E968.0	Intentional burning by fire

*(Continued)*

**Table 1-1** E-codes for Common Mechanisms of Injury (ICD9-CM 2008) (*Continued*)

<b>MOI</b>	<b>E-code (ICD9-CM)</b>	<b>Comments</b>
<b>Suicide</b>		
Hanging	E953.0	Intentional self-inflicted hanging, suffocation, asphyxiation, not caused by chemicals
GSW	E955.x	Intentional self-inflicted gunshot
Stabbing/cutting	E956	Intentional self-inflicted stab/cutting
Vehicle	E958.5	Intentional injury to self with a vehicle
<b>Burn</b>		
Conflagration	E890.x	Housefire or fire in a building
Conflagration—bed	E898.0	Housefire started in bed occupied by the injured
Jump burning building	E890.8	Jumping from a burning building
Hot water scald	E924.2	Burn from hot water—tap Burn from hot water—heated
Hot substance/liquid scald	E924.0	Burn from other hot substance
Hot object	E924.8	Burn from touching hot object
Frostbite	E901.x	Burn from cold exposure, causing frostbite
Chemical	E924.1	Burn from chemical—acid Burn from chemical—alkali
Electrical	E925.x	Burn from electrical source

*(Continued)*

**Table 1-1** E-codes for Common Mechanisms of Injury (ICD9-CM 2008) (*Continued*)

<b>MOI</b>	<b>E-code (ICD9-CM)</b>	<b>Comments</b>
<b>Bites/Animal</b>		
Dog	E906.0	Bite from dog
Kicked by animal	E906.8	Other injury inflicted by animals, such as gored, kicked, fallen upon
Fall off horse	E828.2	Fall off horse being ridden
Venomous snake	E905.0	Bite from venomous snake
Human	E968.7	Bite from human, intentionally inflicted
	E928.3	Bite from human, unintentional

The word “accident” will not be used in this text because of the preventable nature of trauma and the need for professionals to address trauma as a preventable disease, not happenstance, acts of god, and so on (Sisley 2007). Injury prevention activities by healthcare staff are hindered by time, education, and resources (Wilding et al. 2008), although hospital providers have the prime opportunity for these efforts. Every patient presents an injury prevention teaching opportunity. Natural disasters are some of the few “accidental” situations. Trauma is referred to as intentional versus unintentional in order to address the more appropriate nature of the event. For example, drunk driving is preventable, yet the injuries are usually unintentional. C. Everett Koop, former U.S. Surgeon General, made a profound statement regarding trauma: “If a disease were killing our children in the proportions that injuries are, people would be outraged and demand that this killer be stopped.”