THE Fracture Classification MANUAL

Ramon B. Gustilo

THE FRACTURE CLASSIFICATION MANUAL

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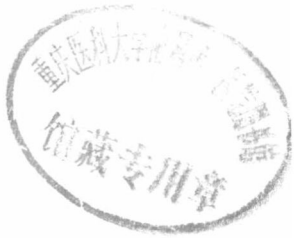
To the charter members of the Orthopaedic Trauma Association.

FOREWORD



New treatment options for musculoskeletal injuries are developing with increasing frequency. If we consider just external fixation, there are presently advocates for unilateral frames with stout half-pins vs. circular frames with flexible transfixion pins; and those for early fixator removal vs. external fixation until early fracture union. Proponents of each school cite improved healing times and/or fewer complications. Yet, we have learned that healing times and complications are determined more by the pattern and severity of injury than by the means of fixation. Thus, unless injury patterns are defined, meaningful comparisons between alternative treatment methods are impossible.

In the early 1980s Ramon Gustilo identified the need for a comprehensive musculoskeletal injury classification, and set the process in motion. He was well suited for the task. Dr. Gustilo was already well established as a leading investigator and educator in the field of orthopaedic traumatology. He had authored several large multi-center studies and devised the standard classification for open fractures.

The injury classification/codification project coincided with the mission of the Orthopaedic Trauma Hospital Association, the forerunner of today's Orthopaedic Trauma Association (OTA). The Association consisted of the representatives from each of the major trauma centers in America. It was in need of a comprehensive classification to conduct multi-center studies, and it could provide the broad base of input from experienced surgeons that would be necessary to compile a workable classification system with general acceptance from the orthopaedic community.

It was clear from the start that *no classification could please everyone. It would be too detailed* for some and too general for others; too anatomic or too mechanistic. Yet, all believed that a comprehensive classification amenable to computerization was badly needed to facilitate communication now, and provide a vehicle for orderly change in the future. The process formally began in 1983. A 3-day OTHA workshop established the basic format for the classification. Specialty committees then reviewed existing classifications for various anatomic regions and recommended logical, well accepted classifications for inclusion into the master classification whenever possible. After much editing and revision, the classification was then adopted by the Orthopaedic Trauma Association. The coding system and publication was prepared through the diligence of Dr. Gustilo and his staff at Hennepin County Medical Center.

The result of this combined effort is the first comprehensive classification of orthopaedic injuries, and only integrated codification of injury patterns, treatments, complications. It presents a trauma registry coding system designed for computerized tracking of patients, and integrates these with the Expanded ICD-9 codes to assist with patient billing. The book includes a simplified injury severity score (ISS) score sheet and an excellent clinical assessment form for rating the clinical outcome of injured patients during follow-up visits.

The Registry successfully incorporates time-honored classification for specific injuries into a consistent and logical format. There is no attempt to introduce change when well accepted classifications already exist. There is no bias toward any particular school of thought or type of instrumentation. For example, the classification incorporates the central themes of Garden, Letournel, Salter, Tile, and Weber, to name a few. These specialized classifications are logically woven into a consistent pattern for describing long bone fractures and soft tissue injuries. To simplify usage, each injury pattern is depicted by a clear line drawing and accompanied by ICD-9 codes.

*This classification of injuries, procedures, and com*plications is of great value for the present. Taken together, it provides a "trauma registry" for tracking cases and conducting studies for clinical practices, institutions, or multi-center studies. It should advance our care of injury patients by permitting more accurate comparisons of treatment methods. The wide-spread use of logical injury and treatment codes should facilitate communication between surgeons and third party pay-

ers. Finally, the presentation of musculoskeletal injuries in an atlas format should simplify fracture pattern recognition and orthopaedic trauma education for students of all ages.

For the future, the trauma registry provides the working document, and the Orthopaedic Trauma Association the scientific forum for orderly change by consensus. Hopefully, the partnership will continue and the Registry will evolve through future editions as our knowledge of musculoskeletal injury continues to grow.

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1987-1988
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University of Maryland
Baltimore, Maryland

INTRODUCTION

The primary goals in establishing a fracture classification system is to provide the following: (1) a standard basis for treatment evaluation, relative to indications, results, and complications; (2) a basis for evaluating expense relative to type of fracture, severity, and mechanism of injury; (3) an educational tool in which reports and publications are taken from the same database, thus rendering analysis meaningful; (4) a fracture classification using Expanded ICD-9 codes plus variable terminal codes for specific diagnosis, i.e., type 9 open fracture and fracture configuration adaptable to computer technology for expedient and accurate data retrieval.

A logical and systematic method of classifying fractures is presented, based on published results from well established journals and the past experiences of recognized orthopaedic and trauma surgeons. Members of the Orthopaedic Trauma Association and the Committee on Injuries of the American Academy of Orthopaedic Surgeons worked on this project 10 years ago, recognizing the difficulties and controversies in arriving at a fracture classification system. Fracture classification must be easy to learn, logical, and have clinical relevance and application to orthopaedic practice and clinical research. The members also recognized two problems. First, there are existing fracture classifications of individual bones that are currently used based on sound principles with several years of clinical experience which must be preserved. Second, a fracture classification system should lend itself to easy adaptation by the modern technology of computer science. With the computerization of fracture, treatment, and results based on standardized fracture classification we can critically analyze and compare the various methods of treatment, results, complications, and expense of each fracture.

In our first meeting 10 years ago, members of 12 major orthopaedic trauma institutions gathered for 3 consecutive days, reviewed every fracture, and organized a system of classifying fractures. We reviewed the fracture classification used currently and in the past as a reference point for our discussion. Uniformity in classifying shaft and articular fractures was easily recognized as the basis for classifying fractures. All long bones were classified according to: (a) articular; (b) extra-articular.

Articular fractures are classified as: (1) linear, (2) impacted, (3) comminuted, or (4) bone loss.

The extra-articular is divided into two major portions: (1) the upper or lower end (metaphyseal); (2) shaft portion—upper, middle, or lower third. The extra-articular fractures are subclassified into (a) displaced and nondisplaced; (b) open or closed; (c) fracture configuration—transverse, oblique, spiral, comminuted, segmental, or bone loss.

Dislocations are classified as either open or closed, and direction of dislocation such as lateral, medial, anterior, and posterior. Associated soft tissue injuries in both shaft fractures and joint injuries are included.

Other existing classification systems for spine (Denis), humeral head and neck (Neer), pelvis (Tile), acetabulum (Judet and Letournel), open fractures (Gustilo), femoral shaft fractures (Winquist et al), and many others have been incorporated into the system because of common usage, and more importantly because it is logical, anatomical, and etiological in nature. Fracture classification is a dynamic and evolving process and, therefore, requires reevaluation every 2 to 3 years. Review every 2 to 3 years is essential to update the classification based on previous experience and recent developments related to fracture type, treatment results, or better understanding of etiology and pathogenesis.

Every injury carries the ICD-9 Expanded Codes and its modifications. Every treatment carries a ICD-9 code and HCMC orthopaedic treatment code. We developed specific treatment codes applicable to our institution as we found the ICD-9 treatment code cumbersome and not specific enough for easy retrieval and analysis.

The application of the fracture classification and treatment to computerization is largely due to the work of John Sitton who developed the computerization of the discharge summary, incorporating it for database

management for every fracture. Ms. Lynda Dent and Ms. Deidre Dietz are credited for their meticulous and accurate work on the actual coding of each diagnosis, its procedures, and complications.

The software development is the result of a cooperative effort between Mr. John Sitton, Professor Arora, and his coworkers from the Industrial Engineering Division, University of Minnesota; Carol Valentine and Lynda Dent, HCMC Medical Records Service Manager; Lincoln Fletcher, Management Information Services; and the HCMC Orthopaedic Department. Together they integrated the discharge summary with database management and clinical reporting and research. The painstaking and accurate drawing of all fracture types and the organization of the entire text is credited to Melissa Hanson, our Medical Illustrator and Clinical Research Coordinator. Ms. Tracy Davis developed the treatment and complication codes for the orthopaedic department which are adaptable for computerization. Dr. Stephen Kuslich is recognized for his development of the structured discharge summary interview system, which makes the medical record complete, accurate, and satisfies the requirement of multiple medical users. We appreciate Drs. Leo deSouza, Charles Edwards, and the late Robert Merkow for helping with several sections of the Fracture Classification, particularly the ankle, spine, wrist, and hand.

We hope this book will serve to stimulate a nationwide organized trauma registry and workers in this field to actively participate and assess the classification of fractures and dislocations.

RAMON B. GUSTILO, M.D.

CONTENTS

BRIEF DESCRIPTION OF THE TRAUMA REGISTRY

The Trauma Registry is based on the following classification of skeletal injury:

1. Injuries are identified according to a consistent, organized classification system.
2. Diagnosis of each injury is classified and coded according to Expanded ICD-9. Treatment codes have Expanded ICD-9 and HCMC trauma TTT registry code.
3. Complications for each injury are classified and coded.
4. For detailed description of fracture configuration a terminal digit is added to the Expanded ICD-9 code when applicable.
5. There are two codes in each fracture illustration-the first one is closed fracture and the second one is open fracture.
6. Follow-up outpatient evaluation systems have been developed and computerized on time oriented basis.

FRACTURE CLASSIFICATION

The basic concepts of fracture classification and the trauma registry are based on the following categories (Figs 1 to 7):

1. Two types of bones
   A. Long bone, i.e., femur, tibia
   B. Flat bone, i.e., scapula, vertebrae
2. Long bones are divided into subdivisions
   A. Intra-articular
   B. Extra-articular
3. The extra-articular portion is divided into three main portions
   A. Proximal end—metaphysis and neck
   B. Distal end—metaphyseal portion
   C. Shaft—divided into proximal, middle, and distal one third.
4. Flat bone is divided into
   A. Articular
   B. Body (extra-articular)
5. Fracture configuration
   A. For shaft fractures, there are four categories
      a. Linear
      b. Comminuted
      c. Segmental
      d. Bone loss
   B. For linear fractures there are three subtypes
      a. Transverse
      b. Oblique
      c. Spiral
   C. For comminuted fractures, there are four subtypes
      a. Butterfly fragments less than 50% of shaft diameter
      b. Butterfly fragments, 50% or more of shaft diameter
      c. Comminuted, less than 50% of shaft diameter
      d. Comminuted, 50% or more of transverse diameter
   D. Segmental fractures are divided into
      a. Two levels
      b. Three or more levels
      c. Intramedullary fragment split
      d. Intramedullary fragment comminuted
   E. Bone loss
      a. <50% of shaft diameter
      b. >50% of shaft diameter
      c. Segmental loss
   F. For articular fracture, there are four types
      a. Linear
      b. Comminuted
      c. Impacted
      d. Bone loss

TREATMENTS ARE CLASSIFIED AND CODED

Each injured entity, per admission or clinic visit, is assigned a series of treatment codes. Treatments are coded according to ICD9-CM and our Trauma Registry treatment codes. The Trauma Registry treatment code is more specific than ICD-9 treatment code. Dates of treatment are also included in collected information for time-oriented analysis.

INJURY SEVERITY SCORE

For the multiple trauma patient, an injury severity score is recorded using the Abbreviated Injury Scale 1985 Revision, American Association for Automotive Medicine (Table 1).

COMPLICATIONS ARE CLASSIFIED AND CODED

Each injured entity, per admission or clinic visit, is assigned appropriate complications codes. Dates of complication onset and resolution are noted for time-oriented analysis. (Some complications are assigned as "Systemic.")

A FOLLOW-UP EVALUATION DATA SHEET IS INCLUDED (pages 153–168)

Each injured entity is periodically assigned numeric evaluation scores on five scale. Dates of evaluation are noted for time-oriented analysis. Every patient visit is recorded and fracture status is evaluated every 6, 12, and 24 weeks and every 6 months thereafter until a final evaluation can be determined.

ORTHOPEDIC DATA PROCESSING SYSTEM

INTRODUCTION

The Orthopedic Data Processing System is an IBM Personal Computer-based data base system that provides patient record management and access capabilities specifically oriented to Orthopedic Departments. The system was developed in a major research hospital by an Orthopedic Surgeon and his associates and is intended to provide an easily installed and maintained method of accessing patient clinical data.

DESIGNED USES

The system is designed to be used primarily for the following functions:

1. Provide access to summary medical records of individual patients.
2. Provide a research data base that is directly linked to statistical reporting software.
3. Assist in the preparation of structured discharge summaries.
4. Provide data to support the analysis of quality of care issues.
5. Provide patient clinical summaries that link inpatient and outpatient care.

MAJOR CLINICAL FEATURES

The system is designed specifically for orthopedic departments and has provisions for the following types of clinical information. Coding of information in the data bases permits a wide variety of research uses of patient clinical data.

1. Patient demographic information and information specific to a trauma event is available.
2. Diagnosis coding is based on the American Academy of Orthopedic Surgeons ICD-9-CM Expanded codes with extensions that permit classification by type of open fracture and more specificity than provided by the ICD-9-CM Expanded codes.
3. Dates and treatment codes are included for time oriented analysis of treatments.
4. Coded information is available for complications, use of antibiotics and anticoagulants, and injury severity scores.

SOFTWARE DESCRIPTION

The Orthopedic Data Processing System has been designed to be easy to use and one that the department staff can adapt to easily. It is implemented in the Ashton-Tate dBaseiv file format, so that files can be readily used by other hospital data base systems. The system supports networking so that multiple workstations can simultaneously access the data base. The system does require an IBM-XT or compatible computer with 640K of RAM and a 20MB hard disk drive.

The system is menu-driven, so that no programming experience is required to operate the system. On-line help is available to assist the operator in coding clinical information.

Data is indexed by medical record number as well as patient name, and by system-assigned trauma event numbers and case numbers. Multiple admissions and multiple trauma events are easily handled by the system.

The major modules of the system provide for entering new patient data, editing existing data, displaying summary clinical records, reporting patient summary data, and accessing a statistical reporting package directly from the data base system. A major feature is a module that assists the operator in preparing a structured discharge summary report from the existing data base and adding text with the operator's choice of word processors.

INJURY SEVERITY SCORE

Purpose

The injury severity score represents the severity of injuries caused by an event of trauma. This includes the defined body areas of Soft Tissue, Head and Neck, Chest, Abdomen, Extremity and/or Pelvis.

Severity Code on Injury Severity Score Table

1. Minor
2. Moderate
3. Severe (Non-Life Threatening)
4. Severe (Life Threatening)
5. Critical (Survival Uncertain)
6. Fatal (Dead on Arrival)

Injury Severity Score Equation

The sum of the squares of the highest severity code in each of the three most severely injured areas of six body regions (Table 1).

$$A^2 + B^2 + C^2 = \text{Injury Severity Score}$$

Directions

1. Choose the three most severely injured areas.
2. Using the Injury Severity Score Table, assign the appropriate Severity Codes.
3. Using the Injury Severity Score Equation, sum the total of the squared Severity Codes.
4. The summed total equals the Injury Severity Score.

TABLE 1.
THE ABBREVIATED INJURY SCALE

EXTERNAL	
Abrasion OR	
Contusion OR	
Laceration	1
superficial	1
major	2
Avulsion	2
superficial	2
major	3
Penetrating	1
no tiss loss	1
tiss loss	2
Degloving inj.	
1,2,3,4,5,6	
Burn	1
1st degree	1
2 < 10%	1
3 < 10%	2
10-19%	2
20-29%	3
30-39%	4
40-89%	5
> 90%	6
HEAD OR NECK	
HEAD	
BRAIN	
Penetrating	5
Crush	6
Cranial nerv	2
ANATOMIC	
Brain sterm	5
compress	5
contusion	5
crush	6
hemorrhage	6
laceration	6
penetrating	6
Cerebellum	3
contusion	3
laceration	4
hematoma	4
epidural	4
< 100 cc	4
> 100 cc	5
subdural	4
< 100 cc	4
> 100 cc	5
intracereb	4
axonal inj	5
penetrating	5
misc	3
Cerebrum	3
contusion	3
laceration	4
hematoma	4
epidural	4
< 100 cc	4
> 100 cc	5
subdural	4
< 100 cc	4
> 100 cc	5
intrcereb	4
axonal inj	5
penetrating	5
misc	3
LEVEL OF CONSC	
Awake on adm	
no LOC	1
LOC ? time	2
w deficit	3
amnesia	2
w deficit	3
coma < 1 h	2
w deficit	3
coma 1-6 h	3
w deficit	4
Lethargic	
no coma	2
w deficit	3
coma < 1 h	2
w deficit	3
coma 1-6 h	3
w deficit	4
coma ? time	3
w deficit	4
LOC ?	3
w deficit	4
Unconscious	
? time	3
w deficit	4
coma < 1 h	3
w deficit	4
coma 1-6 h	3
w deficit	4
coma 6-24 h	4
w deficit	5
coma > 24 h	5
6 CS motor	
> 3	4
< 4	5
LENGTH OF COMA	
< 1 h	2
w deficit	3
1-6 h	3
w deficit	4
6-24 h	4
w deficit	5
> 24 h	5
concussion	2
SKULL	
Base fx	3
complex	4
vault fx	2
closed	2
compound	3
depressed	3
complex	4
massive dep	4
EAR	1
ear canal	1
inner ear	2
middle ear	2
ossicles	2
1 M rupture	2
NECK	
Decapitation	6
Penetrating	2
no organ inj	2
complex	3
Vagus inj	2
Phrenic inj	2
Carotid art	3
laceration OR	
puncture	3
minor	3
w deficit	4
major	4
tiss loss	5
w thromb	3
w deficit	4
thrombosis	3
w deficit	4
Jug vein ext	1
laceration OR	
puncture	1
minor	1
major	2
w loss	2
Jug vein int	1
laceration OR	
puncture	3
minor	3
major	4
w loss	4
Vertebral art	3
intimal tear	3
w deficit	4
laceration OR	
puncture	
minor	3
w deficit	4
major	4
w deficit	5
w loss	5
w thromb	4
Larynx	3
contusion	3
laceration OR	
puncture	3
no perf	3
perf	4
tiss loss	5
crush	4
Pharynx	3
contusion	3
laceration OR	
puncture	3
no perf	3
perforation	4
tiss loss	5
Thyroid gld	2
contusion	2
laceration	3
Vocal cord	2
w resp prob	5
Hyoid fx	2
w resp prob	5
CERVICAL SPINE	
Strain	1
Cord Contusion	3
w/wo fx/disl	3
temp deficit	3
incomplete	4
complete	5
below C3	5
above C4	6
Cord lacerat	5
w/wo fx/disl	5
incomplete	5
complete	5
below C3	5
above C4	6
Disc herniat	3
Dislocation wo	2
cord damage	2
spinous pr	2
transv pr	2

Continued.

Table 1 continued.

facet, pedic	3
lamina	3
odontoid	3
occip-C1	3
vert body	3
Fracture wo	2
cord damage	2
sp/trnsv pr	2
facet, lam	3
pedic/odont	3
vert body	2
minor	2
major	3
mult	3
Nerve root	2
laceration	2
avulsion	2

FACE

penetrating	1
no tiss loss	1
minor loss	2
major loss	3
EYE	1
conjunctiva	1
cornea	1
laceration	2
avulsion	3
optic nerve	2
laceration	3
avulsion	3
retina lac	1
detachment	2
sclera lac	2
all other	1
MOUTH	
gingiva	1
contusion	1
laceration	1
avulsion	2
tongue	1
minor lac	1
deep lac	2
SKELETAL	
alveolar	2
mandible fx	1
closed	1
body	2
subcondyl	2
open	2
body	3
subcond	3
maxilla fx	2
lefort I	2
lefort II	3
lefort III	4
nasal	1
contusion	1
closed fx	1
open fx	2
orbit fx	2
closed	2
open	3
teeth	1
loose	1
fx	1
avulsion	1
TMJ	1
sprain	1
dislocat	2
zygoma fx	2

CHEST

Crush-massive	6
Penetrating	1
simple	1
complex	3
Inhalation inj	3
minor	3
major	5
VESSELS	
Aorta-thor	4
intimal tear	4
laceration OR	
puncture	4
minor	4
major	5
w loss	6
w thromb	5
thrombosis	3
Innomin art	3
intimal tear	3
laceration OR	
puncture	3
minor	3
major	4
w loss	6
w thromb	4
thrombosis	3
Innomin vein	3
laceration OR	
puncture	3
minor	3
major	4
w loss	5
Pulmonary art	3
intimal tear	3
laceration OR	
puncture	3
minor	3
major	4
w loss	6
w thromb	4
thrombosis	3
Pulm vein	3
laceration OR	
puncture	3
minor	3
major	4
w loss	5
Subclav art	3
intimal tear	3
laceration OR	
puncture	3
minor	3
major	4
w loss	6
w thromb	4
thrombosis	3
Subclav vein	3
laceration or	
puncture	3
minor	3
major	4
w loss	4
Vena cava sup	3
laceration OR	
puncture	3
minor	3
major	4
w loss	5
Other art	3
intimal tear	3
laceration OR	
puncture	3
minor	3
major	4
w loss	5
w thromb	3
thrombosis	3
Other veins	3
laceration OR	
puncture	3
minor	3
major	4
w loss	4
ORGANS	
Trachea	3
contusion	3
laceration OR	
puncture	3
no perf	3
perforation	4
w loss	5
fracture	4
simple	4
major	5
Bronchi-major	3
contusion	2
laceration OR	
puncture	3
no perf	3
perforation	4
w loss	5
fracture	4
simple	4
major	5
Lung	
contusion	3
segmental	3
lobar	3
> 1 lobes	4
lacetation	3
segmental or	
lobar	3
w HIX	4
w tens PIX	4
w PMS-HMS	4
> 1 lobes	4
w HIX	5
w tens PIX	5
w HMS-PMS	5
Esophagus	3
contusion	3
laceration	3
no perf	3
perforat	4
w loss	5
Diaphragm lac	3
Myocardium	4
contusion	4
laceration	5
simple	5
complex	6
Pericardium	3
contusion	3
w unilat HIX	
+/or HPIX	3
w bilat HIX	
+/or PIX	4
w tamponade	4
laceration OR	
puncture	4
w HIX. PIX	5
w HMS-PMS	5
Heart valve	5

Continued.

Table 1 continued.

Corda tend	5
Cardiac sept	5
Pleura lac	2
Thoracic	
cavity inj	3
w unilat HIX	
or PIX	3
w bilat HIX	
or PIX	4
w HMS/PMS	4
w tens PIX	5
> 1000 cc HIX	5
Thoracic duct	2
SKELETAL	
Rib cage	1
contusion	1
fracture	1
1 rib	1
w PIX/HIX	2
w PMS-HMS	2
> 1 rib	2
2-3 ribs	2
w PIX-HIX	3
w PMS-HMS	3
mult/1 rib	2
w PIX HIX	3
w PMS-HMS	3
> 3 ribs	3
w PIX HIX	4
w PMS-HMS	4
open/displ	3
w PIX HIX	4
w PMS-HMS	4
flail	4
severe	
Sternum	
contusion	
fracture	
THORACIC SPINE	
Strain	
Cord Contusion	
w/wo fx/disl	
temp deficit	
incomplete	
complete	
Cord lacerat	
w/wo fx/dist	
incomplete	
complete	
Disc herniat	
Dislocation wo	
cord deficit	
sp/trnsv pr	
facet. lam	
pedicle	
vert body	
Fracture wo	
cord deficit	
sp/trnsv pr	
facet/lam	
pedicle	
vert body	
minor	
major	
multiple	
Nerve root	
laceration	
avulsion	

ABDOMEN	
Abd wall	
laceration	1
thru perit	1
simple	2
tiss loss	3
penetrating	1
not to perit	
simple	1
mild loss	2
tiss loss	3
VESSELS	
Aorta. abd	4
intimal tear	4
laceration OR	
puncture	4
minor	4
major	5
tiss loss	6
w thromb	5
thrombosis	3
Iliac art	3
intimal tear	3
laceration OR	
puncture	3
minor	3
major	4
tiss loss	5
w thromb	4
thrombosis	3
Iliac vein	3
laceration OR	
puncture	3
minor	3
major	4
tiss loss	4
Vena cava/inf	3
laceration OR	
puncture	3
minor	3
major	4
tiss loss	5
Other art	3
intimal tear	3
laceration OR	
puncture	3
minor	3
major	4
tiss loss	5
w thromb	4
thrombosis	3
Other veins	3
laceration OR	
puncture	3
minor	3
major	4
tiss loss	4
ORGANS	
Abd inj	1
w hematuria	1
w hemoperit	2
Retroper hem	3
GI TRACT	
Stomach	2
contusion	2
laceration	2
no perf	2
perforation	4
tiss loss	4
Duodenum	2
contusion	2
laceration	3
no perf	3
perforation	4
tiss loss	5
Gallbladder	2
contusion	2
perforation	3
w duct inj	4
laceration	2
minor	2
w duct inj	3
tiss loss	3
Colon	2
contusion	2
laceration	3
no perf	3
perforation	4
tiss loss	5
Mesentery	2
contusion	2
laceration	2
minor	2
major	3
tiss loss	4
Iejun-Ileum	2
contusion	2
laceration	2
no perf	2
perforation	3
tiss loss	4
Rectum	2
contusion	2
laceration	3
no perf	3
perforation	4
tiss loss	5
Anus	2
contusion	2
laceration	2
no perf	2
perforation	3
tiss loss	4
Kidney	2
contusion	2
minor	2
major	3
laceration	2
minor	2
major	3
tiss loss	5
Liver	2
contusion	2
minor	2
major	3
laceration	2
minor	2
w hemoper	3
vssl/duct	3
major	4
tiss loss	5
Spleen	2
contusion	2
minor	2
major	3
lac/rupture	2
minor	2
w hemoper	3
w vessels	3
major	3
tiss loss	5
Pancreas	2
contusion	2
minor	2
major	3
laceration	2
minor	2

Continued.

Table 1 continued.

w hemoper	3
vssl/duct	3
major	3
tiss loss	5
GU	
Bladder	2
contusion	2
laceration	2
no perf	2
perf	3
tiss loss	4
Ureter	2
contusion	2
laceration	2
no perf	2
perf	3
tiss loss	4
Urethra	2
contusion	2
laceration	2
no perf	2
perf	3
tiss loss	4
Fallopian lac	4
Ovary	1
contusion	1
laceration OR	
perforation	2
minor	2
major	3
complex	4
Placenta abrp	4
Uterus	1
contusion	2
laceration OR	
puncture	2
minor	2
2nd tri	3
3rd tri	4
major	3
2nd tri	4
3rd tri	5
complex	3
2nd tri	4
3rd tri	5
Vagina	1
abrasion	1
contusion	1
laceration OR	
perforation	1
minor	1
major	3
complex	3
Vulva	1
abrasion	1
contusion	1
laceration OR	
perforation	1
minor	1
major	3
complex	5
Penis	1
contusion	1
laceration OR	
perforation	2
minor	2
major	3
complex	4
Testis	1
contusion	1
laceration OR	
perforation	2
minor	2
major	3
complex	4
Scrotum	1
abrasion	1
contusion	1
laceration OR	
perforation	1
minor	1
major	2
complex	3
Perineum	1
abrasion	1
contusion	1
laceration OR	
perforation	1
minor	1
major	3
complex	3
LUMBAR SPINE	
Strain	1
Cauda equina	
contusion	3
w/wo fx/disl	3
temp deficit	3
incomplete	4
complete	5
Cord Contusion	3
w/wo fx/disl	3
temp deficit	3
incomplete	4
complete	5
Cord lacerat	5
w/wo fx/disl	5
incomplete	5
complete	5
Disc herniat	3
Dislocation wo	2
cord deficit	2
sp/trnsv pr	2
facet. lam	3
pedicle	3
vert body	3
Fracture wo	2
cord deficit	2
sp/trnsv pr	2
facet/lam	3
pedicle	3
vert body	2
minor	2
major	3
multiple	3
Nerve root	2
lacteration	2
avulsion	2
EXTREMITIES	
UPPER EXTREM	
Amputation	3
Crush	3
Penetrating	1
simple	2
complex	3
VESSELS	
Axill art	2
int tear	2
laceration OR	
puncture	2
minor	2
major	3
tiss loss	4
w thromb	3
thrombosis	3
Axill vein	2
laceration OR	
puncture	2
minor	2
major	3
tiss loss	3
w thromb	3
Brachial a	2
intimal tear	2
laceration OR	
puncture	3
minor	3
major	4
w thromb	3
thrombosis	2
Brachial v	1
laceration OR	
puncture	1
minor	2
major	2
tiss loss	2
Other art	1
intimal tear	1
laceration OR	
puncture	1
minor	1
major	2
tiss loss	2
w thromb	2
thrombosis	2
Other veins	1
laceration OR	
puncture	1
minor	1
major	2
tiss loss	2
NERVES	
Median/ulnar	
OR radial n	
laceration	2
> 1 n lac	3
MUSC/TEND/LIG	
Musc lac	2
tiss loss	3
Tendon lac	2
> 1 tendon	3
JOINTS	
Joint capsule	
laceration	2
Acromioclav J	1
contus/spr	1
crush	3
disloc/lac	2
Elbow J	1
contus/spr	1
crush	3
dislocation	2
lac into J	2
w lig	2
> 1 nerv lac	3
IP dislocat	1
MC/MP disloc	2
Shoulder J	1
contus/spr	1
crush	3
lac/disloc	2
Sternoclav J	1
contus/spr	1
disloc/lac	2
crush	3
Wrist J	1

Continued.

Table 1 continued.

contus/spr	1
laceration	2
dislocation	3
crush	3
SKELETAL	
Extrem fx	2
Carpal/MC	2
Finger	1
fx	1
crush/amput	2
Radius fx	2
closed	2
open	3
Ulna fx	2
closed	2
open	3
Humerus fx	2
closed	2
open	3
Clavicle fx	2
Acromion fx	2
Scapula fx	2
LOWER EXTREM	
Amputation	3
below knee	3
above knee	4
Crush	3
below knee	3
above knee	4
Penetrating	1
simple	2
complex	3
VESSELS	
Femoral A.	3
intimal tear	3
laceration OR	
puncture	3
minor	3
major	4
tiss loss	5
w thromb	3
thrombosis	3
Femoral V.	2
laceration OR	
puncture	3
minor	2
major	3
tiss loss	3
Popliteal A.	2
intimal tear	2
laceration OR	
puncture	2
minor	2
major	3
tiss loss	4
w thromb	3
thrombosis	3
Popliteal V.	2
laceration OR	
puncture	2
minor	2
major	3
tiss loss	3
Other A.	1
intimal tear	1
laceration OR	
puncture	1
minor	1
major	2
tiss loss	2
w thromb	2
thrombosis	2
Other V.	1
laceration OR	
puncture	1
minor	1
major	2
tiss loss	2
NERVES	
Sciatic lac	3
Femoral/tibial	
OR peroneal	2
> 1 M. lac	3
MUSC/TEND/LIG	
Achilles lac	2
Collat/cruciat	
lac	2
ankle	2
knee	3
Musc lac	2
Tend lac	2
> 1 tend lac	3
Patella lac	2
total trans	3
JOINTS	
Foot J	1
disloc	1
sprain	2
Talar J's	1
spr/disloc	1
Ankle J	1
contus/spr	1
laceration	2
disloc/crush	3
Knee J	1
contusion	1
sprain	2
lac/disloc	2
crush	3
Hip J	1
sprain	1
dislocation	2
SKELETAL	
Foot fx	2
Tarsal/MT fx	2
Calcaneus fx	2
Toe	1
fx	1
crush/amp	2
Tibia	2
fx	2
closed	2
open	3
Fibula	
contusion	1
w nerv inj	2
fx	1
bi/trimall	2
closed	2
open	3
Femur fx	3
Patella fx	2
Pelvis	
fx	2
closed	2
open	3
crush	4
closed	4
open	5
Sacroiliac fx	3
Pubic symp fx	3

ABBREVIATIONS:

A. art: artery
dep: depressed
disl: dislocation
fx: fracture
HMS: Hemomediastinum
HIX: hemothorax
HPIX: hemopneuothorax
IM: Inner or middle ear
IP: interphalangeal
J: joint
MC: metacarpal
MP: metaphalangeal
N: nerve
per, perit: peritoneum
perf: perforation
pr: process
PMS: pneumomediastinum
PIX: pneumothorax
temp: temporary
tri: trimester
V: vein
w: with
wo: without
misc: other head injuries subarachnoid hemorrhage, edema, brain swelling, subpial hemorrhage, hygroma, ischemia, infarction

*For details of the Trauma Registry Code and Software write: Hennepin County Medical Center, Department of Orthopaedic Surgery, 701 Park Avenue South, Minneapolis, MN 55415.

ISS CALCULATION:

Body region	Highest AIS	AIS Squared
External	_____	_____
Head or Neck	_____	_____
Face	_____	_____
Chest	_____	_____
Abdomen	_____	_____
Extremities	_____	_____
Total	= ISS =	_____

EXAMPLES OF ISS

C.T., 36-year-old female, jumped off from a 3 story building. Presenting problems were:

1. Severe chest contusion
2. Malgaigne fracture
3. Bilateral femur fracture
4. Fracture dislocation talus
5. Marked obesity (> 300 lb)

$A^2 + B^2 + C^2 =$
$2^2 + 4^2 + 4^2 = 36$ ISS

D.M., 18-year-old motor bike accident victim. Presenting problems were:

1. Transected aorta
2. Acute abdomen (liver and spleen)
3. Bilateral hemothorax
4. Closed fractures humerus and femur
5. Renal contusion

$5^2 + 5^2 + 4^2 = 66$ ISS.