

Musculo-skeletal System INJURY

An Overview Of The Global Burden Of Injury

Introduction:

- ✓ Injuries have traditionally been regarded as **random, unavoidable** “accidents”.
- ✓ Today both unintentional and intentional injuries are viewed as largely **preventable events**.
- ✓ Acceptance of injuries as a preventable public health problem over the past decade has led to the development of **preventative strategies** and, consequently, a decrease in the human death toll due to injuries

- ✓ Injuries, unintentional or intentional, constitute a **major public health problem**, **killing more than 5 million people worldwide each year** and causing many more cases of **disability**.
- ✓ People from all economic groups suffer fatal injuries, but death rates due to injury tend to be higher in those in the lower income groups.
- ✓ The poor are also less likely to make a full recovery following an injury.

Definition

- An injury is defined as "a bodily lesion at the organic level, resulting from acute exposure to energy___(mechanical, thermal, electrical, chemical or radiant) in amounts that exceed the threshold of physiological tolerance."
- In some cases (e.g. drowning, strangulation, freezing), the injury results from an insufficiency of a vital element".

Magnitude Of The Problem Of Injuries:

- While mortality is an important indicator of the magnitude of a health problem, it is important to realize that **for each injury death, there are several thousand injury survivors who are left with permanent disabling sequelae.**
- These non-fatal outcomes must also be measured in order to describe accurately the burden of disease due to injury.
- The indicator used to **quantify the loss of healthy life due to disease** is the disability-adjusted life year or **DALY**, a measure that accounts not only for the years of life lost from **premature death** but also for the years of life lived with disability.

Causes Of Injuries:

❑ Abnormal energy transfer:

1. Mechanical energy (moving objects)
2. Thermal
3. Electric
4. Chemical
5. Radiation

- All injuries can be characterized from the perspective of **an abnormal transfer of energy**.
- **For example**, the catastrophic injuries arising from the transfer of energy between the victim **and a stationary object** (the ground) or a **moving object-mobile** (another vehicle), which lead to trauma and possibly death.

Energy Forces And Injuries:

- If the energy transfer is **localized** in one area, the likely outcome may be a penetrating injury. If the energy transfer is **dispersed** over a broad area, The result will often be a non-penetrating injury (blunt).
- In situations involving thermal energy transfer, the result will be a burn. And so on, depending upon the mode of energy involved.

So injuries may be:

1. Blunt (compression)
2. Penetrating
3. Others:
 - Deceleration / Acceleration
 - Shear (shave or cut off)
 - Blast (explosion)
 - Thermal / Chemical

Injuries Are Not Accidents:

- **Accidents:** an unexpected occurrence happening by chance.... Implies **a random and uncontrollable event**.
- **Injuries:** a definable correctable event with specific risks for occurrence....implies something amenable to intervention.
- Nearly **all injuries** are not the result of random events.
- There are **distinct patterns and circumstances** that characterize their occurrence.
- Injuries most often occur to **certain risk groups** and are **fairly predictable** (whether it be to certain persons, at certain times, or in common locations)

□ Example: road traffic injuries.

1. Driving under influence of alcohol
2. Speeding
3. Under-utilization of seat belts and child restraints
4. Poor road design and roadway environment
5. Unsafe vehicle design
6. Under-implementation of road safety standards

Types Of Injuries:

There are several different types of injuries, though, which may occur from abnormal energy transfer.

The two main injury categories:

A. Unintentional injuries: Are subdivided into:

1. Road traffic injuries, poisoning, falls, fires, drowning
2. “Other unintentional injuries”:
 - I. Exposure to animate and inanimate mechanical forces (including firearms)
 - II. Exposure to electric current, radiation and extreme ambient temperature and pressure, and to forces of nature; and contact with heat and hot substances, and venomous plants and animals.

B. Intentional injuries: are subdivided into:

1. Self-inflicted injuries (i.e. suicide),
2. Interpersonal violence (e.g. homicide)
3. War-related injuries
4. “Other intentional injuries”. includes injuries due to legal intervention.

Injuries Of The Musculo-skeletal System:

- Injuries occur in particular **if the energy transfer** (mechanical workload) **is higher than the load-bearing capacity of the components of the musculo-skeletal system.**
- Injuries of muscles and tendons (e.g. strains, ruptures), ligaments (e.g. strains and ruptures) and bones (fractures, unnoticed micro-fractures and degenerative changes) are typical consequences.
- In addition irritation of the insertion points of the muscles and tendons and of tendon sheaths as well as functional restrictions and degeneration of bones and cartilage (e.g. menisci, vertebrae, inter-vertebral discs and articulations) may occur.

Two Fundamental Types Of Muscu-skeletal Injuries:

1. **Acute and painful injury**: Caused by strong and short-term energy transfer leading to sudden failure in structure and function e.g.:
 - ✓ Tearing of a muscle due to a heavy lift.
 - ✓ Fracture of a bone due to a fall.
 - ✓ Blocking of a vertebral joint due to vigorous movement.
2. **Chronic and persistent**: results from a permanent overload or energy transfer leading to continuously increasing pain and dysfunction (e.g. wear and tear of ligaments, tendinitis, muscle spasm and hardening)

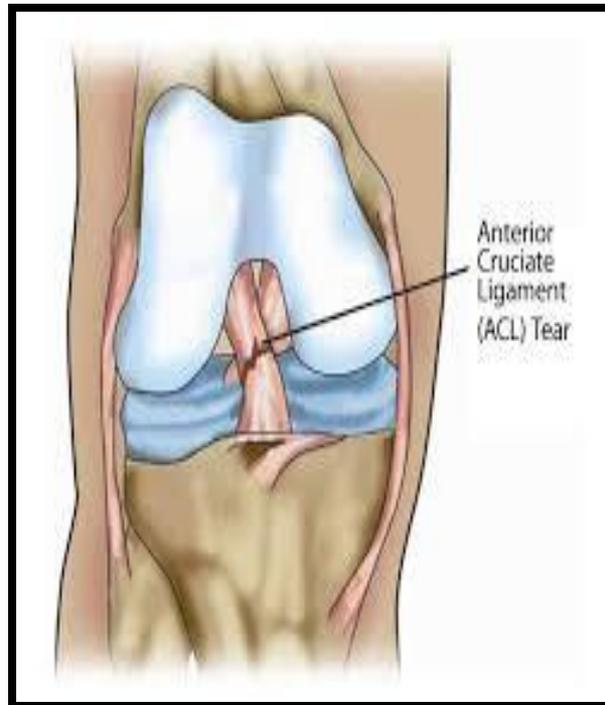
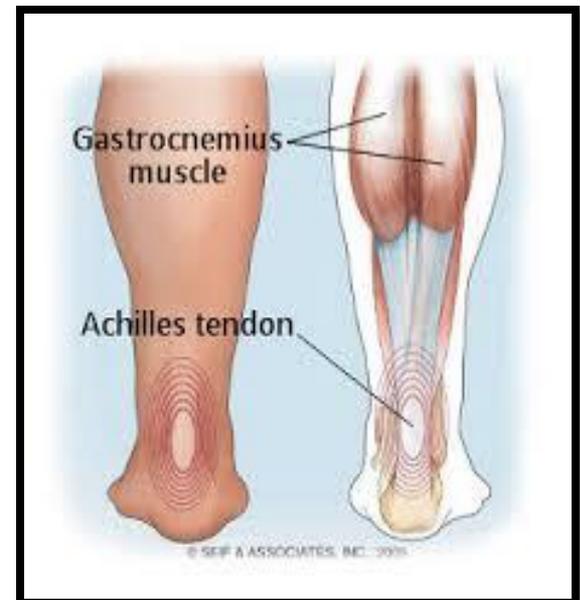


FIGURE 1. Anatomy of the tendocalcaneal joint with a ruptured Achilles tendon



BICEPS BRACHII

ORIGIN

Long head: supraglenoid tubercle of scapula.

Short head: coracoid process of scapula with coracobrachialis

INSERTION

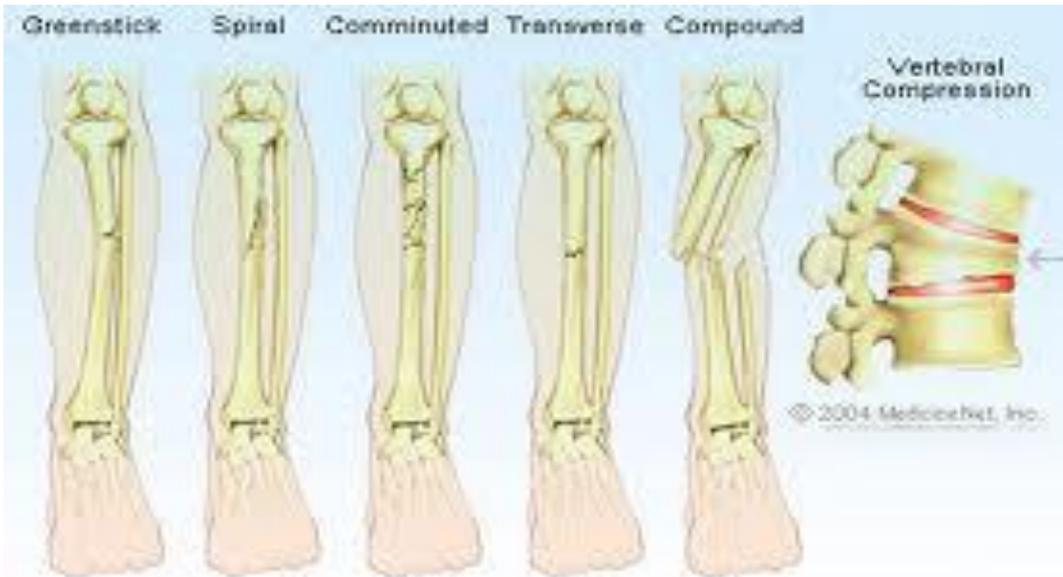
posterior border of bicipital tuberosity of radius (over bursa) and bicipital aponeurosis to deep fascia and subcutaneous ulna

ACTION

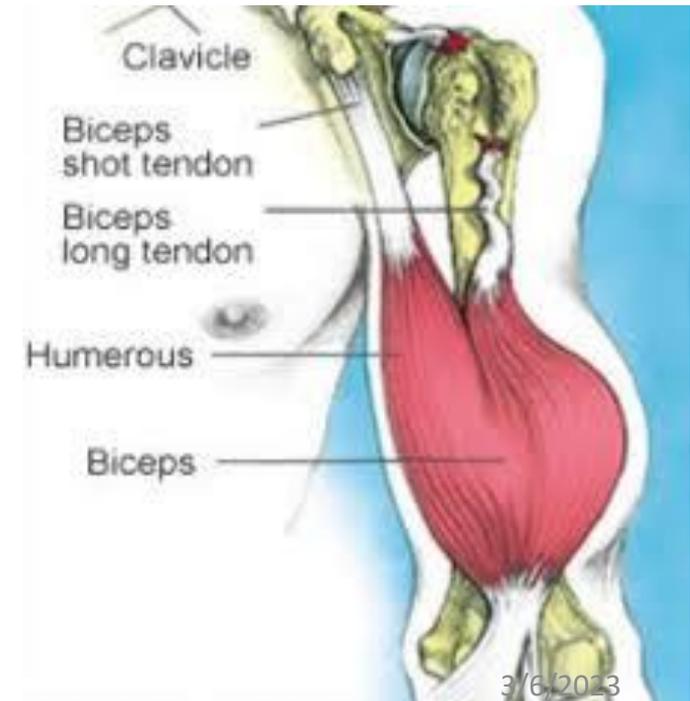
Supinates forearm, flexes elbow, weakly flexes shoulder

NERVE

Musculocutaneous nerve (C5, 6) (from lateral cord)



Typical Bone Fractures



3/6/2023

- **One disability-adjusted life year (DALY)** is defined as one lost year of healthy life, either due to premature death or disability.
- Although DALYs include premature death, injury and physical disability, **they do not, for example, account for:**
 - a. Mental health consequences of violence and war
 - b. Conditions such as sexually transmitted diseases resulting from rape
 - c. The effects of infectious diseases and malnutrition following war.

Global injury related mortality

- ✓ An estimated 5 million people worldwide died from injuries in 2000 — a mortality rate of 83.7 per 100 000 population.
- ✓ Injuries accounted for 9% of the world's deaths in 2000 and 12% of the world's burden of disease.
 - What is the global burden of injuries?
 - Injuries are recognized as a major concern in public health worldwide. Results of the Global Burden of Disease (GBD) study showed that globally in 2019, 8% of all deaths were due to injury
- ✓ The burden of disease related to injuries, particularly road traffic injuries, interpersonal violence, war and self-inflicted injuries is expected to rise dramatically by the year 2020.
- ✓ Road traffic injuries are the leading cause of injury-related deaths worldwide

World rankings of injury-related mortality and burden of disease (DALYs lost), 1990 and 2020

	No. of deaths		DALYs lost	
	1990	2020	1990	2020
Road traffic injuries	9	6	9	3
Self-inflicted injuries	12	10	17	14
Interpersonal violence	16	14	19	12
War	20	15	16	8

The table shows that if current trends continue, road traffic and intentional injuries (i.e. self-inflicted injuries, interpersonal violence and war-related injuries) will rank among the 15 leading causes of death and burden of disease.

Injuries Mortality By Region:

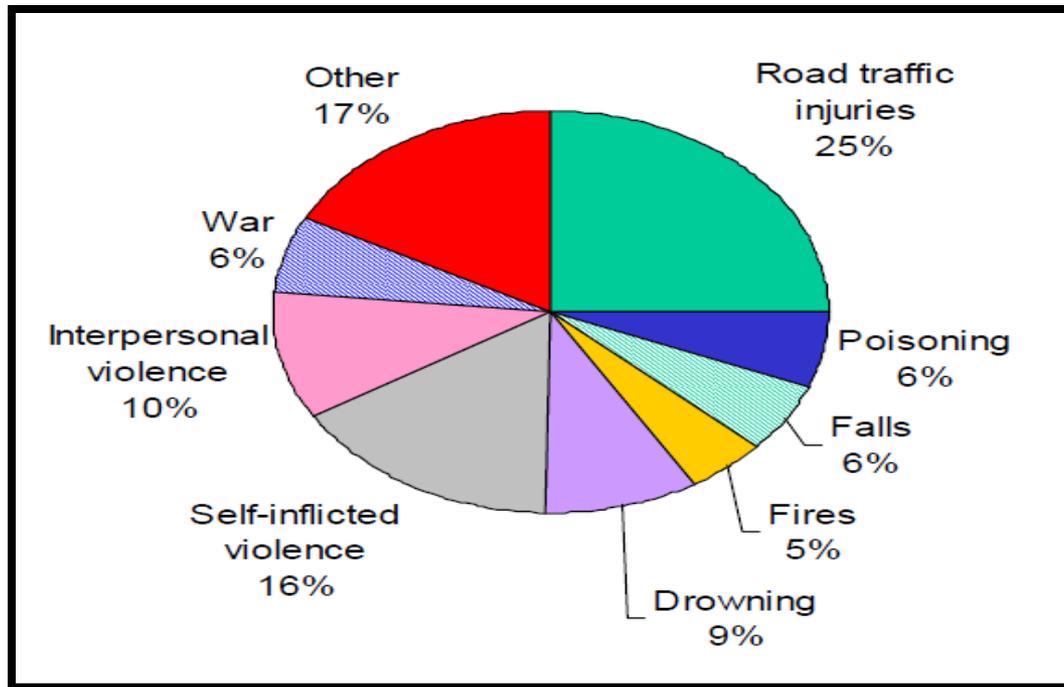
- ❑ More than 90% of the world's deaths from injuries occur in low- and middle-income countries.
- ❑ The low- and middle-income countries of Europe have the highest injury mortality rates.
- ❑ The South-East Asia and Western Pacific Regions account for the highest number of injury deaths worldwide.

Injuries Mortality By Sex And Age Group

- ❑ Globally, injury mortality among men is twice that among women. In some regions, however, mortality rates for **suicide and burns in females are as high or even higher than in males**.
- ❑ Males in Africa and Europe have the highest injury-related mortality rates.

- ✓ Young people between the ages of 15 and 44 years account for almost 50% of the world's injury-related mortality.
- ✓ Mortality **from road traffic injuries** and interpersonal violence in males is almost **3 times higher** than that in females.
- ✓ Children under 5 years of age account for approximately 25% of drowning deaths and a little over 15% of fire-related deaths worldwide.

Distribution of global injury mortality by cause, 2000



One quarter of all injury deaths are due to road traffic injuries; suicides and interpersonal violence combined account for another quarter of the global total

Magnitude Of Injury Mortality In Jordan:

- ❑ Accidents and injuries emerge as an increasingly significant problem. According to the **Jordan Traffic Institute**, there were **62115** road accidents in 2003 causing **832** deaths and **18368** injuries.
- ❑ According to the same source, **road traffic accidents** have been increasing over years and leading to more human and economic losses.
- ❑ **Occupational accidents** amounted to **15619** causing an estimate of **97522** work day's lost.

Prevention of injuries

- ❑ To date, injury prevention has tended to be an issue only in wealthier countries.

- ❑ The highest rates of death and permanent disability due to injury are, however, currently found in the poorer nations; It is these countries therefore that have the most urgent need for prevention strategies that are appropriate, cost-efficient and effective. In this context, **“appropriate”** means taking into account:
 - ✓ The complexities of the problem
 - ✓ The availability of resources and, furthermore,
 - ✓ What strategies have been shown to work elsewhere.

- ❑ To develop effective prevention strategies, most countries need better information.
- ❑ In particular, countries need to know about the numbers and types of injuries that occur and about the circumstances in which those injuries occur.
- ❑ Such information will indicate how serious the injury problem is, and where prevention measures are most urgently needed

Injury Control:

The primary focus of injury control is to:

- ✓ Identify **energy forces** which cause injury,
- ✓ Define mechanisms of **human exposure**,
- ✓ Identify precisely **where interventions can interrupt the causal pathway**.
- ✓ Unlike many chronic diseases, the **agent and time** of injury onset is almost **always known** and can be measured, the mechanism of energy transfer from reservoir to host can be described.
- ✓ With several exceptions, **injuries usually occur immediately after exposure** and rarely have the long incubation or latent periods of many infectious and chronic conditions

Primary Prevention

which occurs during **the pre-event phase**, prevents the injury event by eliminating the mechanisms of energy transfer or exposure: **examples:**

1. Traffic safety laws
2. Vehicle modifications which prevent automobile crashes,
3. fences around swimming pools which prevent submersion,
4. Trigger locks on guns,
5. Safety caps on poisonous substances

Secondary Prevention

which occurs during the **injury phase**, its goal is to **eliminate or reduce** injury severity once an energy transfer has occurred. **Examples:**

1. Motorcycle helmets,
2. seatbelts,
3. life vests,
4. Bullet proof vests

While measures on the secondary level do not prevent the event which causes injury, they do reduce the energy absorbed by the host.

It is important to note that some of the most effective secondary prevention strategies do not eliminate all injuries.

For example, the motorcycle helmet is very effective in reducing head trauma in motorcycle crashes, but is not effective in preventing trauma to other body regions

Tertiary Prevention:

- Which occurs in **the post injury phase**, aims to reduce the consequences of the injury once an injury-producing energy transfer has occurred.

Examples:

1. Emergency and trauma care, as well as rehabilitation efforts.
2. Some of the most important advances in injury control have been **improvements in the early response and treatment of serious injury.**

Specific Injury-prevention Strategies

can be divided into **two very broad groups based on need for host actions.**

- 1. Passive intervention** requires **no input or action by the host** and is usually accomplished by **modifying the agent, vehicle, vector, or environment**. Modifications in **car design** to improve brakes and increase the energy absorbed by vehicle components are two **examples**.
 - 2. Active intervention** requires that **the host take some type of action** for the intervention to work. Seatbelts and helmets are examples of active intervention
- ✓ Intervention strategies to be effective, they should incorporate both active and passive ones.
 - ✓ **Passive** intervention strategies are usually considered **more effective**, especially when compared with active interventions which require frequent or time-consuming action.
 - ✓ **Air bags**, for example, require no driver action, whereas **seatbelts** can only be effective when fastened by the occupant. However, the most effective crash **protection occurs when both are available**.

The Haddon Matrix, a model of the **agent–host relationship in injury causation**, was the foundation for the study of motor vehicle crashes and countermeasures for highway safety, and continues to be an applicable theoretical framework for injury prevention. **The Haddon Matrix divides the timing of the injury event into three phases**, these phases correspond to the three levels of prevention defined by public health:

- Pre-event,**
- Event,**
- Post event.**

Each of these phases is influenced by three factors:

- 1. The human (host),**
- 2. Vehicles or vectors,**
- 3. The environment,** which can be separated *into physical and social, with economic and cultural aspects.*

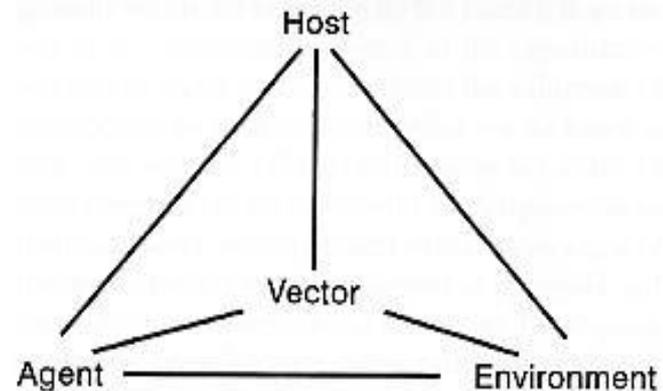


FIGURE 2-1. The epidemiologic triad of a disease.

These different 3 phases and 3 factors can be used to create a 3 by 3 matrix.

- In developing a program of injury control measures for a particular injury problem, we can **go systematically through each cell of the matrix** and **think up all possible countermeasures** applicable to that cell.
- The usefulness of the matrix is as a tool for generating ideas, at this stage **every possible strategy should be documented** and **nothing held back because of political or financial considerations.**

Factors	Human	Vehicle & Equipment	Environment
Phases			
Pre-event	1	2	3
event	4	5	6
Post-event	7	8	9

Phase	Human	Vehicles/Equipment	Environment
Pre Crash (Crash Prevention)	Information Attitude Impairment Police Enforcement	Roadworthiness Lighting Braking Handling Speed Management	Road Design and Road Layout Speed Limits Pedestrian facilities
Crash (Injury Prevention during the crash)	Use of Restraints Impairment	Occupant Restraints Other Safety Devices Crash Protective Design	Crash-protective Roadside objects
Post Crash	First-aid skills Access to Medics	Ease of Access Fire Risk	Rescue Facilities Congestion