SAPIENZA
UNIVERSITÀ DI ROMA

TRAUMATIC INJURIES AFTER ROAD ACCIDENTS

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Temporal Trend Analysis- 1

- Every day in Italy → 598 road accidents
- Deaths after road accident → 13
- Injured in road accidents → 849

Temporal Trend Analysis- 2

- In 2008 → 218.963 road accidents
- Deaths → 4.731
- Injured → 310.739 (1,4 road accidents)

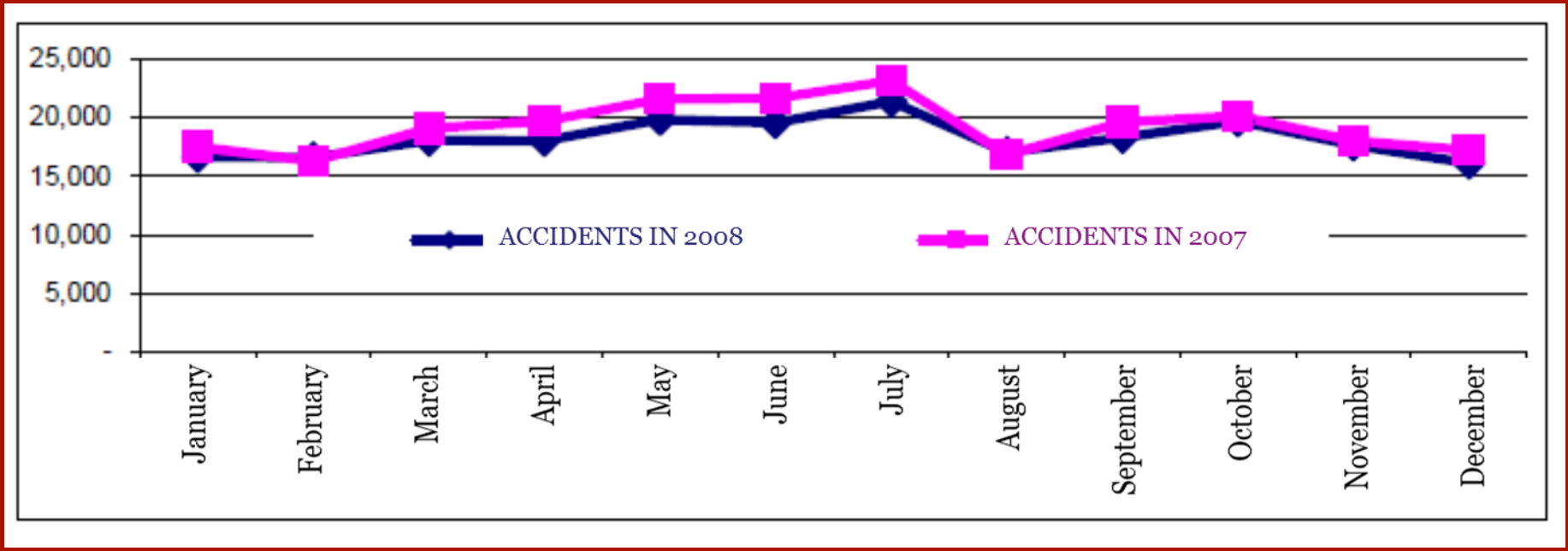
	ABSOLUTE VALUES		PERCENTAGE CHANGES
	2007	2008	2007/2008
ACCIDENTS	230.871	218.963	-5,2
DEATHS	5.131	4.731	-7,8
INJURED	325.850	310.739	-4,6

Temporal Trend Analysis-3

Age	Accidents	Deaths	Injured	Mortality rate	Severity index
2000	256.546	7.061	360.013	2,8	1,9
2001	263.100	7.096	373.286	2,7	1,9
2002	265.402	6.980	378.492	2,6	1,8
2003	252.271	6.563	356.475	2,6	1,8
2004	243.490	6.122	343.179	2,5	1,8
2005	240.011	5.818	334.858	2,4	1,7
2006	238.124	5.669	332.955	2,4	1,7
2007	230.871	5.131	325.850	2,2	1,6
2008	218.963	4.731	310.739	2,2	1,5

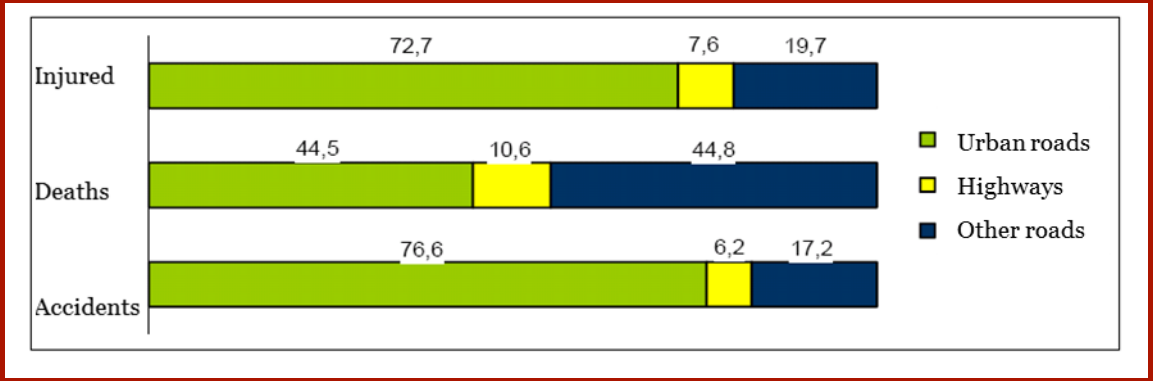
Index of Mortality and Severity

When?


25,000
20,000
15,000
10,000
5,000
-
ACCIDENTS IN 2008
ACCIDENTS IN 2007
January
February
March
April
May
June
July
August
September
October
November
December

Where?

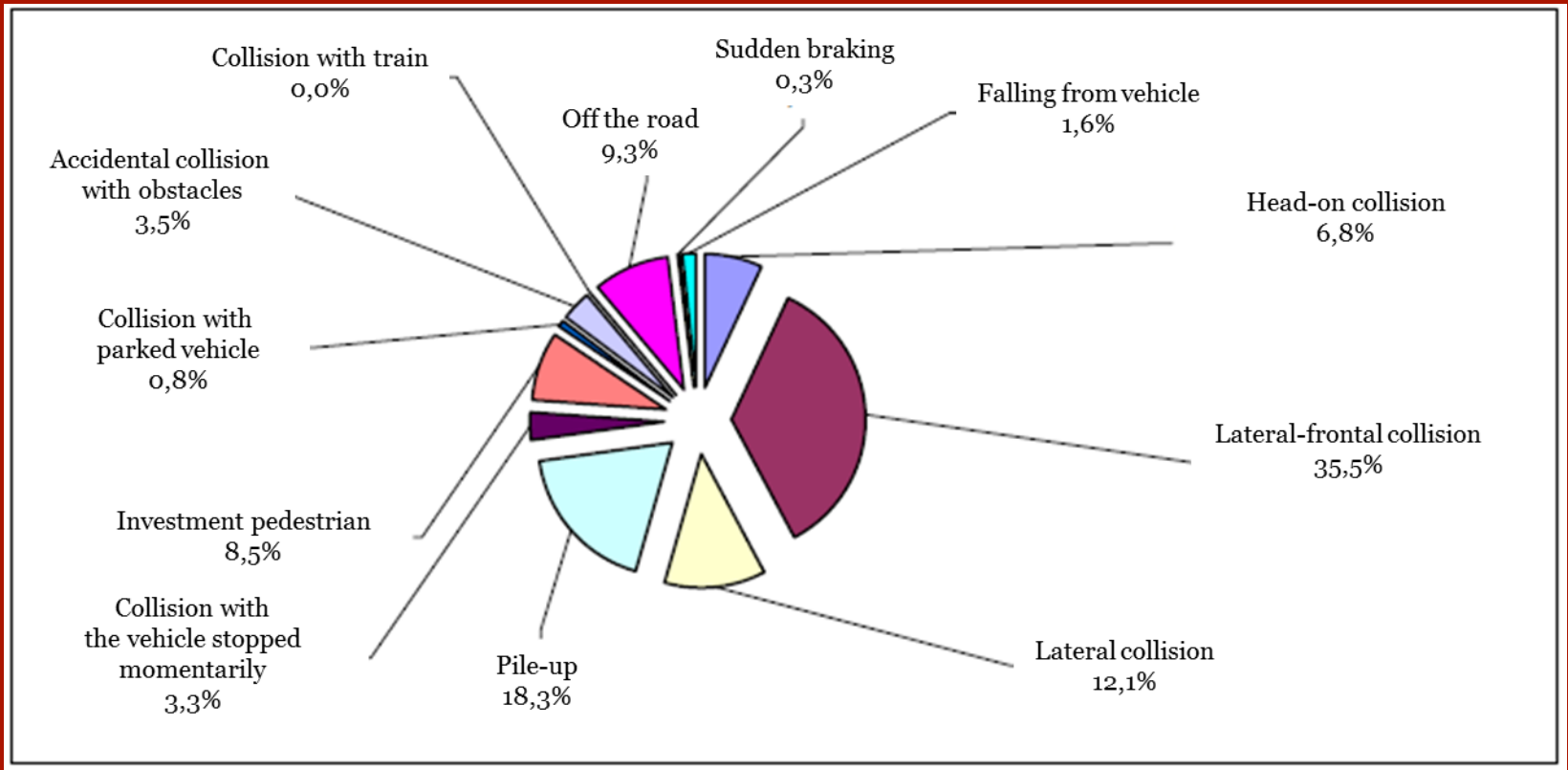
ROADS	Accidents	Deaths	Injured	Mortality rate	Severity index
Urban roads	168.088	2.076	228.325	1,2	135,8
Highways	12.372	452	20.631	3,7	166,8
Other roads	38.503	2.203	61.783	5,7	160,5
Total	**218.963**	**4.731**	**310.739**	**2.2**	**141.9**



- **76,7 % of road accidents occur in urban roads;**

- **Injury and mortality rates of accidents in urban roads are about 1/3 compared to those in highways.**

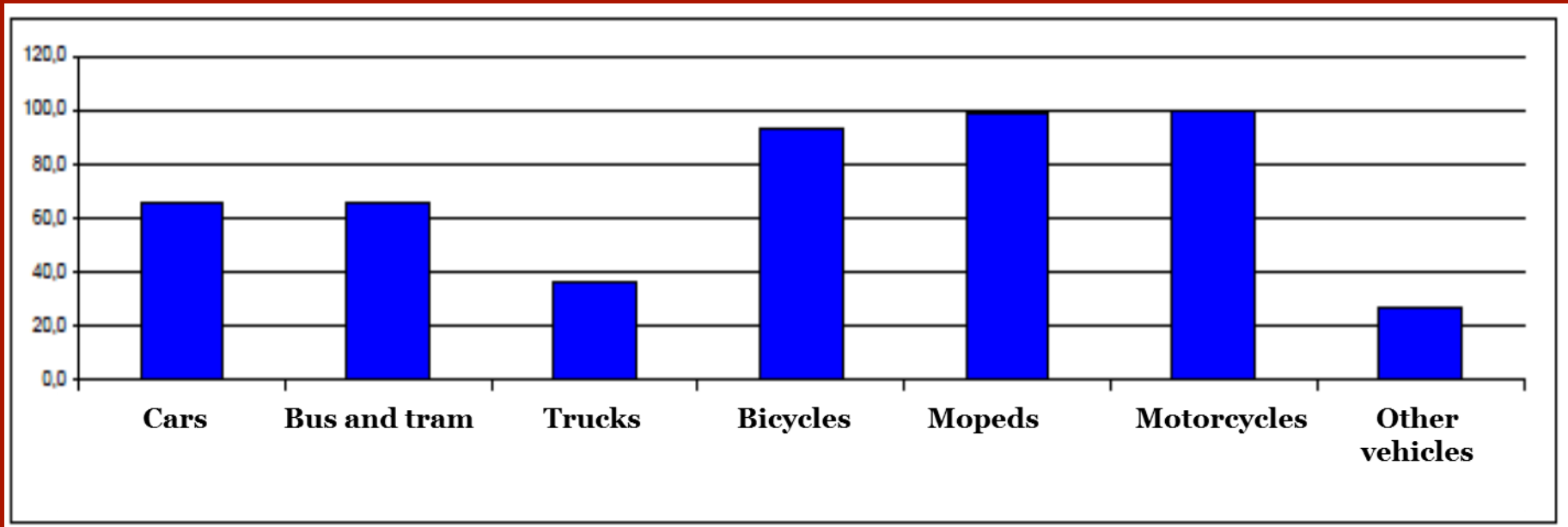
Dynamic accident



Lateral-frontal collision

53.8% of the causes of road accidents in urban areas

Vehicles involved



Who is involved?

PEOPLE INVOLVED	Deaths		Injuries		Severity index
	Number	Percentage	Number	Percentage	
Drivers	3.303	69,8	215.156	69,2	1,6
Passengers	780	16,5	74.943	24,1	1,1
Pedestrians	648	13,7	20.640	6,6	3,0
Total	**4.731**	**100,0**	**310.739**	**100,0**	**1,6**

- **The injury and mortality rate of the driver is higher than the injury and mortality rate of passengers.**

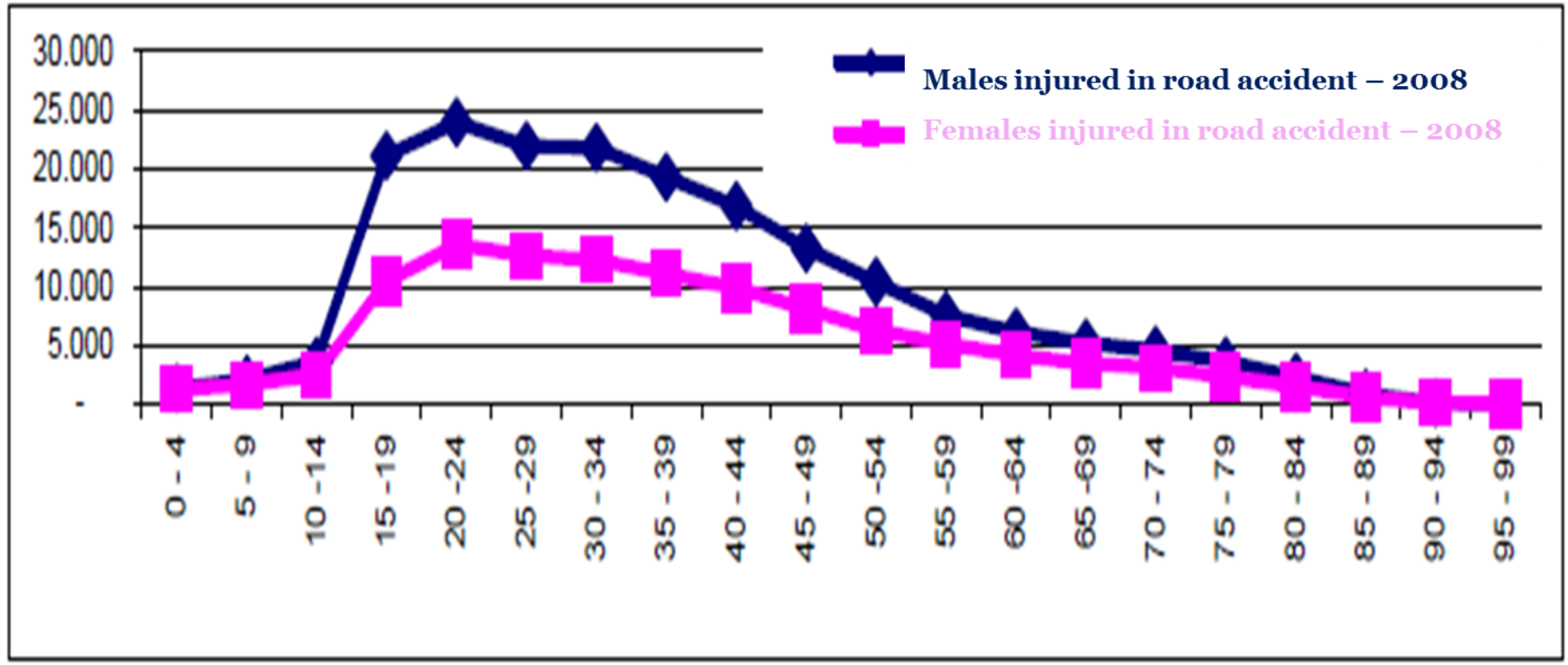
- **On average the severity index of pedestrians is double compared to the severity index of passengers.**

Vehicles involved

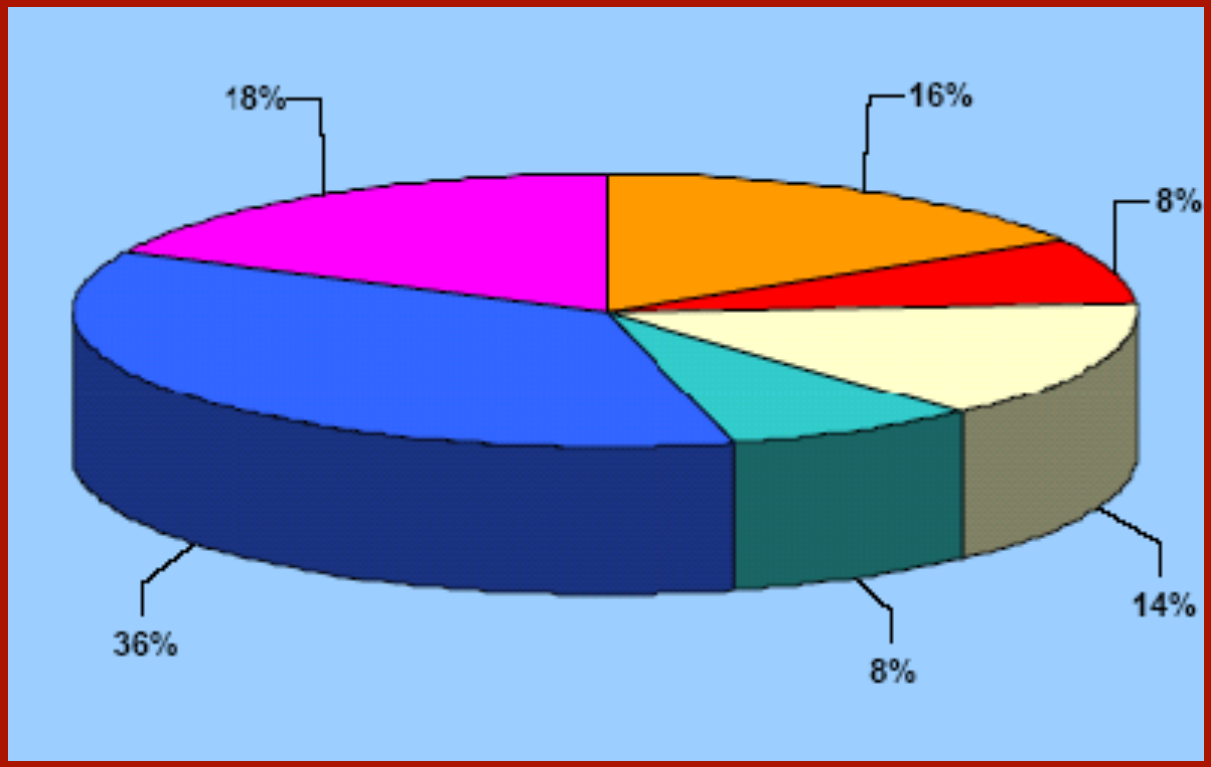
Dead and injured for vehicle

VEHICLES	Absolute values			Percentages		
	Vehicles	Dead	Injured	Vehicles	Dead	Injured
Cars	272.832	2.116	177.698	66,4	51,8	61,3
Bus and tram	3.516	13	2.314	0,9	0,3	0,8
Trucks	29.913	252	10.859	7,3	6,2	3,7
Bicycles	15.636	288	14.533	3,8	7,1	5,0
Mopeds	28.665	294	28.216	7,0	7,2	9,7
Motorcycles	55.320	1.086	55.086	13,5	26,6	19,0
Other Vehicles	5.278	34	1.393	1,3	0,8	0,5
Total	**411.160**	**4.083**	**290.099**	**100,0**	**100,0**	**100,0**

Age affected



Parts of the body affected



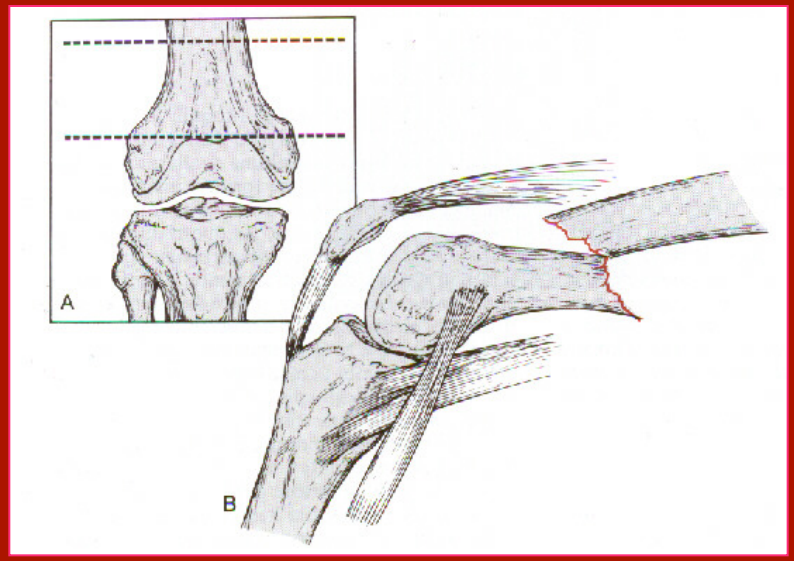
Head
Neck
Chest
Abdomen
Legs
Superficial injuries

Frequency of fractures

	Upper Extremity	Lower Extremity	Spine
The driver of vehicles	42.4%	48.5%	9.1%
Bikers	65.8%	32.9%	1.3%
Pedestrians	34.3%	55.5%	10.1%

Distribution of the 3 most common types of fracture

	Age 12-39	Age 40-59	Age 60-99
The driver and passengers of vehicles	Femur shaft (13.8%) Distal radius (12.3%) Metatarsals (9.3%)	Distal femur (11.1%) Proximal tibia (11.%) Ankle (11.1%)	Distal radius (21.1%) Spine (10%) Ankle (10.5%)

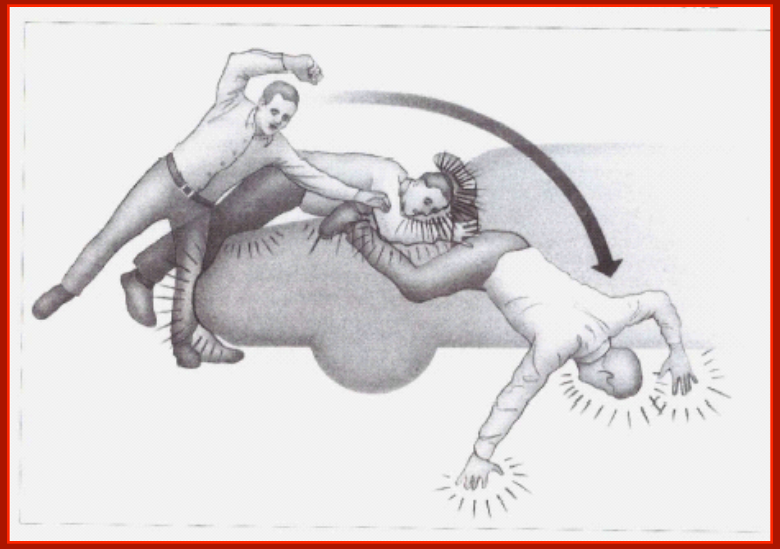


Distribution of the 3 most common types of fracture

	Age 12-39	Age 40-59	Age 60-99
Bikers	Proximal humerus (20.6%) Clavicle (14.3%) Metacarpals (11.1%)	Phalanges (40%) Distal radius (20%) Tibia shaft (6.6%)	

Distribution of the 3 most common types of fracture

	Age 12-39	Age 40-59	Age 60-99
Pedestrians	Tibia shaft (28.6%) Ankle(9.5%) Spine (9.5%)	Tibia shaft (19%) Proximal tibia (14.3%) Ankle (14.3%)	Proximal tibia (21.1%) Metatarsals (15.8%) Tibia shaft (10,5%)



Traffic accident

- Road accidents often cause polytrauma;
- The polytrauma patient is very often in debilitated conditions;
- The fractures often need surgery;

- Targets to pursue for ideal osteosynthesis:
  1. **Stable**
  2. **Fast execution**
  3. **Minimally invasive**

PROXIMAL HUMERUS FRACTURES

- They represent 20% of fractures in patient bikers between 12 and 39 years;

- In most cases they occur after a fall on the shoulder;

- People who do not wear appropriate clothing (jackets with adequate protection in Kevlar or titanium) have a greater frequency compared to those who wear them (23%).

Classification

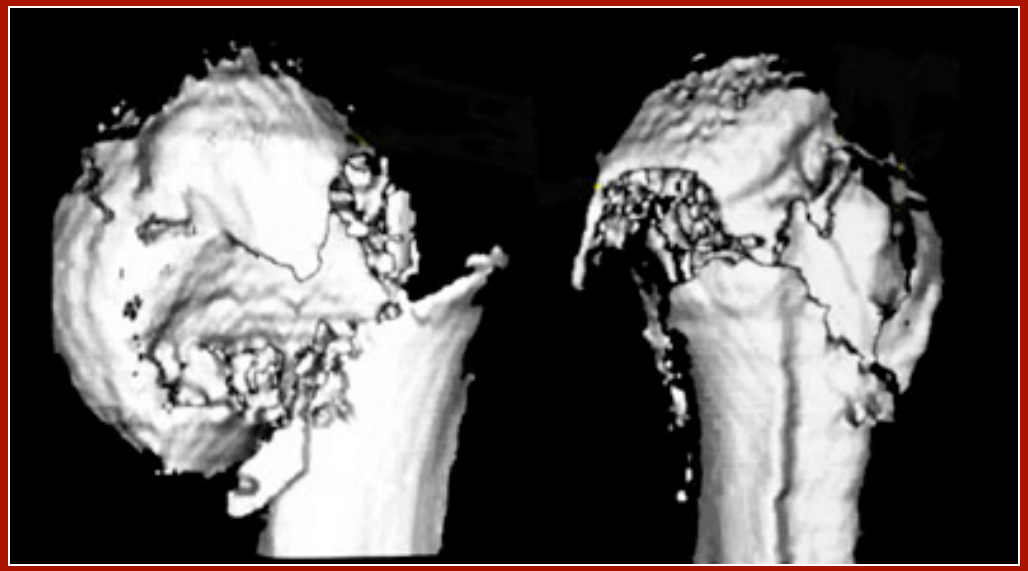
- EXTRA-ARTICULAR FRACTURES

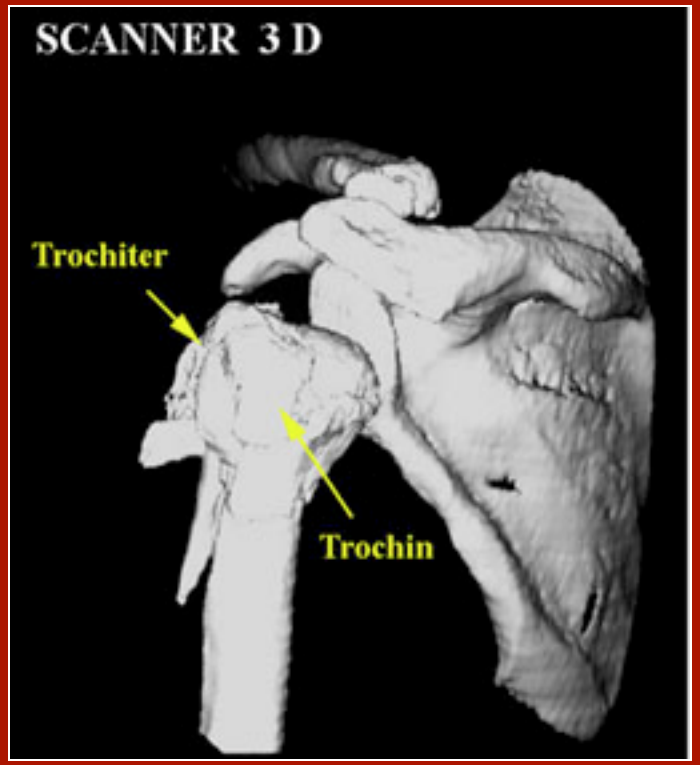
1. Fractures involving the greater tuberosity.
2. Impacted metaphyseal fractures (neck fractures).

- ARTICULAR FRACTURES

1. Fracture of the anatomic neck with a slight displacement.
2. Cephalotubercular fractures with marked displacement.
3. Fractures with glenohumeral dislocation.

CT-scan for a preoperative planning





Fractures of the greater tuberosity

1. **Nonoperative treatment**: impacted greater tuberosity fractures. → Shoulder abduction cushion

2. **Operative treatment**: nonimpacted greater tuberosity fracture. → Screw fixation

Fractures of the surgical neck - 1

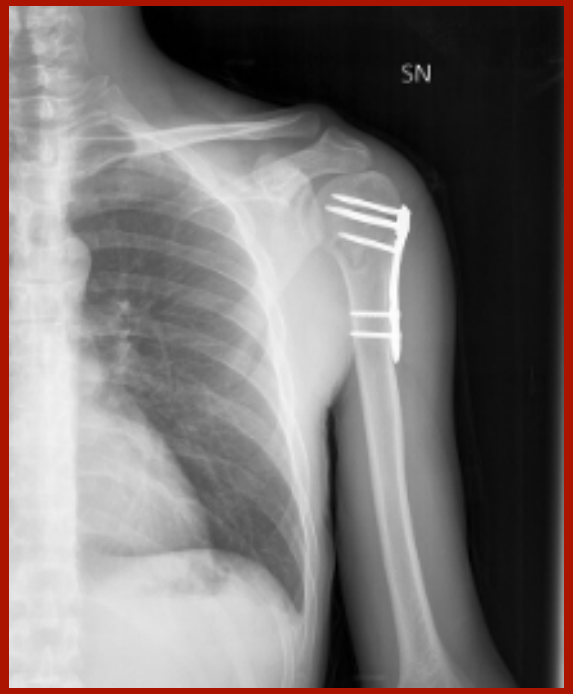
Nonoperative treatment: acceptable deformity

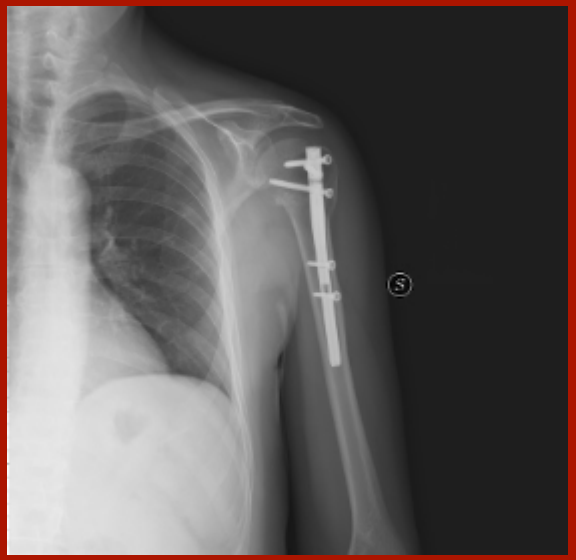
- Sling and swath
- Arm sling
- Collar and cuff
- Shoulder immobilization

Fractures of the surgical neck - 2

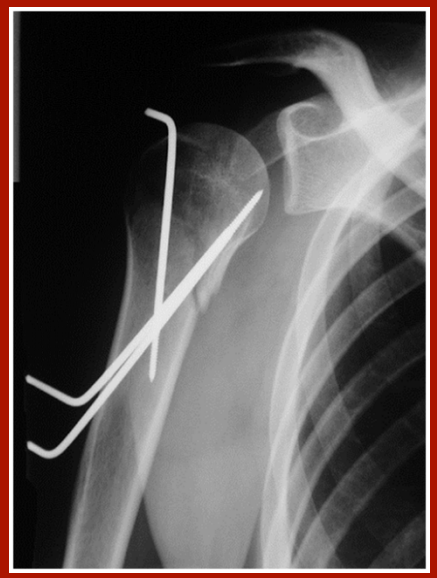
Operative treatment: unacceptable deformity and/or risk of displacement

- K-wire fixation
- Screw fixation
- Plate fixation
- Nail fixation





Meta-epiphyseal fractures



K-wire fixation

Screw fixation

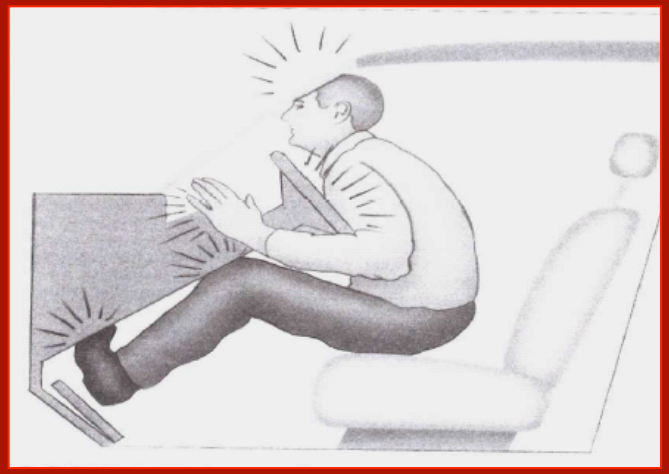
Nail fixation

Plate fixation

Fractures with cephalotubercular fragmentation

DISTAL FEMUR FRACTURES

- They usually occur as a result of direct trauma (impact of the knee on the dashboard);
- They represent 11% of the fractures in drivers and passengers of vehicles who do not wear seat belts;
- After an impact the fractures may be exposed.



Distal Femur Fractures - 2

A: Extraarticular fracture (45%)

-A1 simple

-A2 metaphyseal wedge and/or fragmented wedge

-A3 metaphyseal complex

B: Partial articular fracture (20%)

-B1 lateral condyle, sagittal

-B2 medial condyle, sagittal

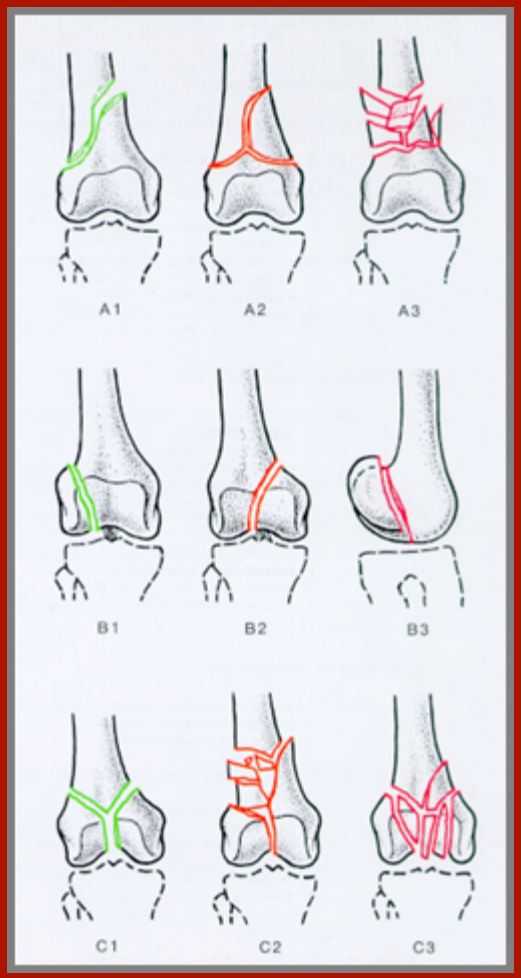
-B3 coronal

C: Complete articular fracture (35%)

-C1 articular simple, metaphyseal simple

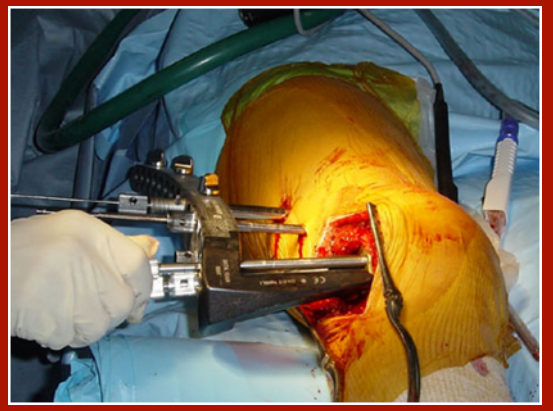
-C2 articular simple, metaphyseal multifragmentary

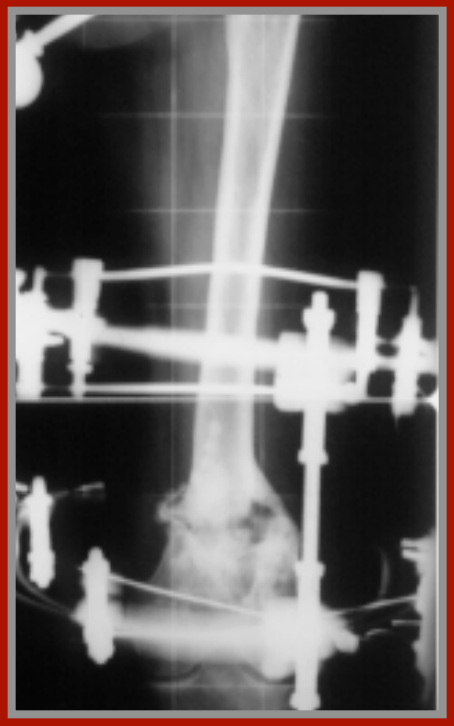
-C3 articular multifragmentary



Treatment options

- Lag screw
- Condylar locking compression plate
- Retrograde nailing
- External fixator (open fractures)

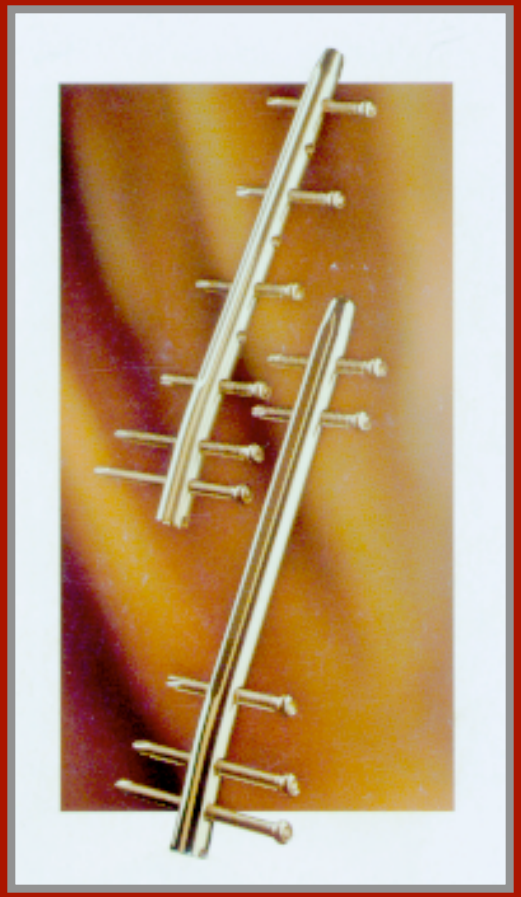




Retrograde Nailing

Advantages

- Allows indirect reduction
- Good biomechanical properties
- Definitive procedure
- Rapid mobilization postoperatively

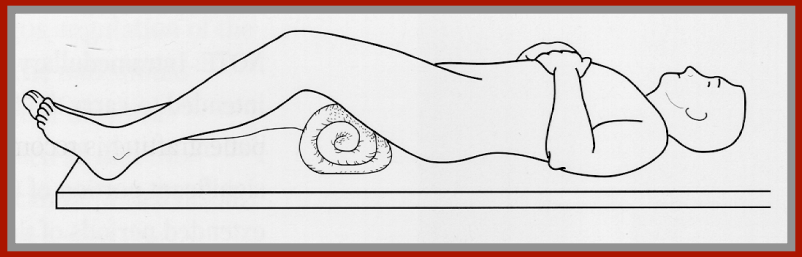


Disadvantages

- Risk of secondary displacement of the reconstructed condyles
- Risk of iatrogenic intraarticular damage to the knee joint
- Risk of damage to the posterior cruciate ligament
- Risk of malrotation and/or angular deformity
- Risk of damage to the patellar tendon
- Risk of chronic knee pain
- Risk of retropatellar damage (nail too long)

SURGICAL TECHNIQUE

Position the patient supine on a radiolucent table with the knee in 30° flexion.



Make a longitudinal, slightly oblique medial parapatellar incision along a line starting 5 cm above the superior pole of the patella to the tibial tubercle.

After the tissue protector has been introduced, the reamer shaft, fitted with the initial reamer head is inserted over the guide wire

Screw insertion

A: Extraarticular fracture

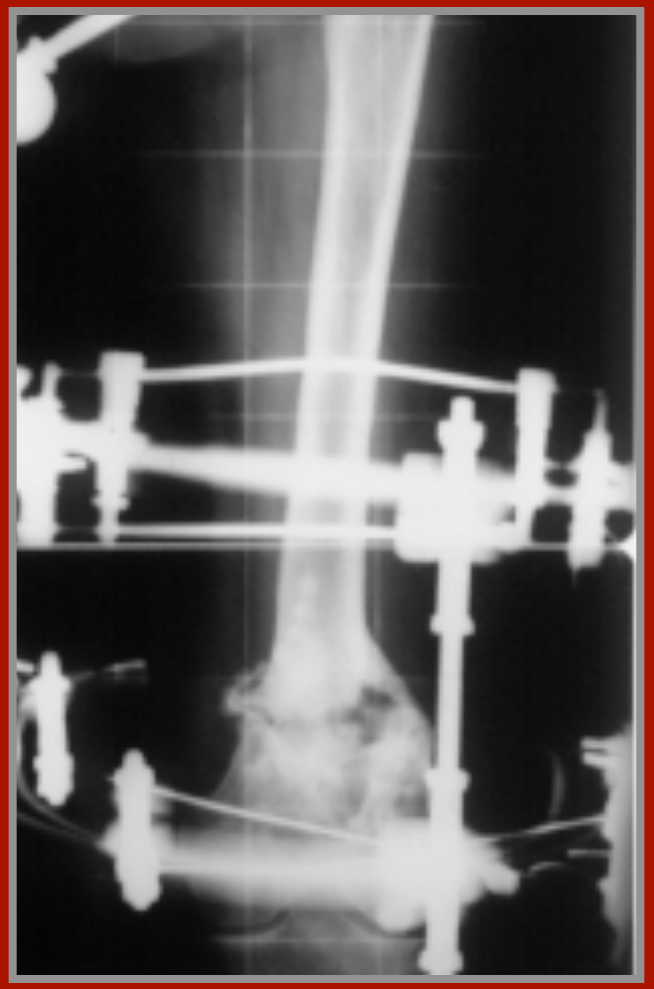
Type A fractures treated with retrograde nailing

C: Articular fracture

Type C fractures treated with screws and retrograde nailing

External fixation

- **Open fractures;**
- **Temporary treatment until the stabilization of the patient's clinical condition.**



PROXIMAL TIBIAL ARTICULAR FRACTURES

- **Mechanism of lateral compression (lateral plateau fractures 50%, medial plateau fractures 10%).**
- **Mechanism of vertical axial compression.**

Typical fracture that occurs during the attempt to rest the foot on the ground to prevent bike falls or after an impact pedestrian-vehicle.

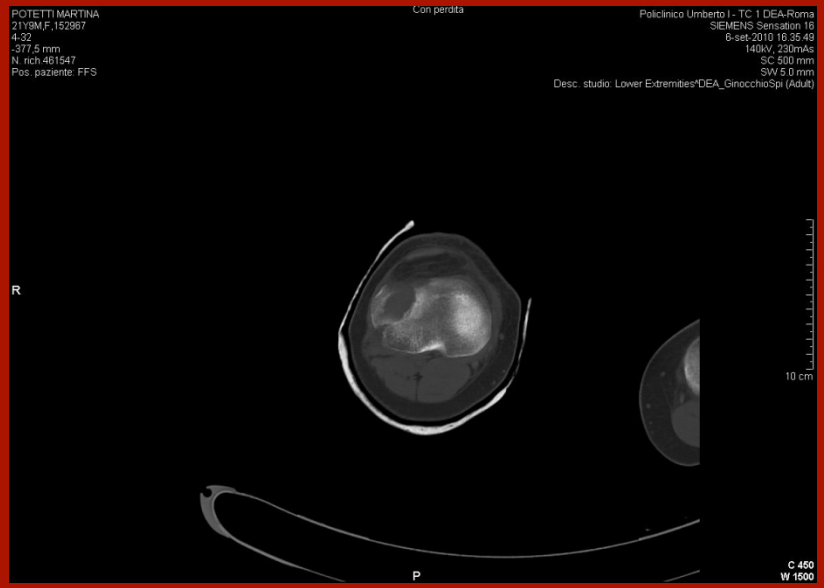
Proximal tibial articular fractures

- **Fractures with a condylar split**
- Anatomical reduction of the articular fracture component and fixation with lag screws.

- **Fractures with a condylar depression**
- Reduction of the impacted fragment(s);
- The defect which is created once the impacted articular fragments are reduced must be filled with an autologous cancellous autograft;
- Plate osteosynthesis.

- **Fractures with a split-depression**
- Plate osteosynthesis.

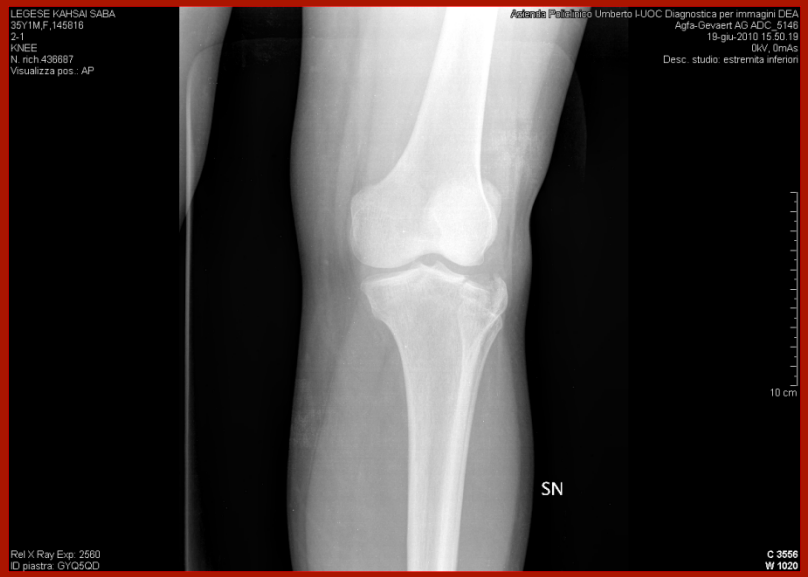
CT-scans


POTETTI MARTINA
21Y9M,F,152967
4-32
-377.5 mm
N. rich.461547
Pos. paziente: FFS
Con perdita
Policlinico Umberto I - TC 1 DEA-Roma
SIEMENS Sensation 16
8-set-2010 16:35:49
140kV, 230mAs
SC 500 mm
SW 5.0 mm
Desc. studio: Lower Extremities^DEA_GinocchioSpi (Adult)
R
10 cm
P
C 450
W 1500


POTETTI MARTINA
21Y9M,F,152967
5-1
N. rich.461547
Pos. paziente: FFS
Con perdita
Policlinico Umberto I - TC 1 DEA-Roma
SIEMENS Sensation 16
8-set-2010 16:35:32
Desc. studio: Lower Extremities^DEA_GinocchioSpi (Adult)
R
20 cm
F
C 450
W 1500

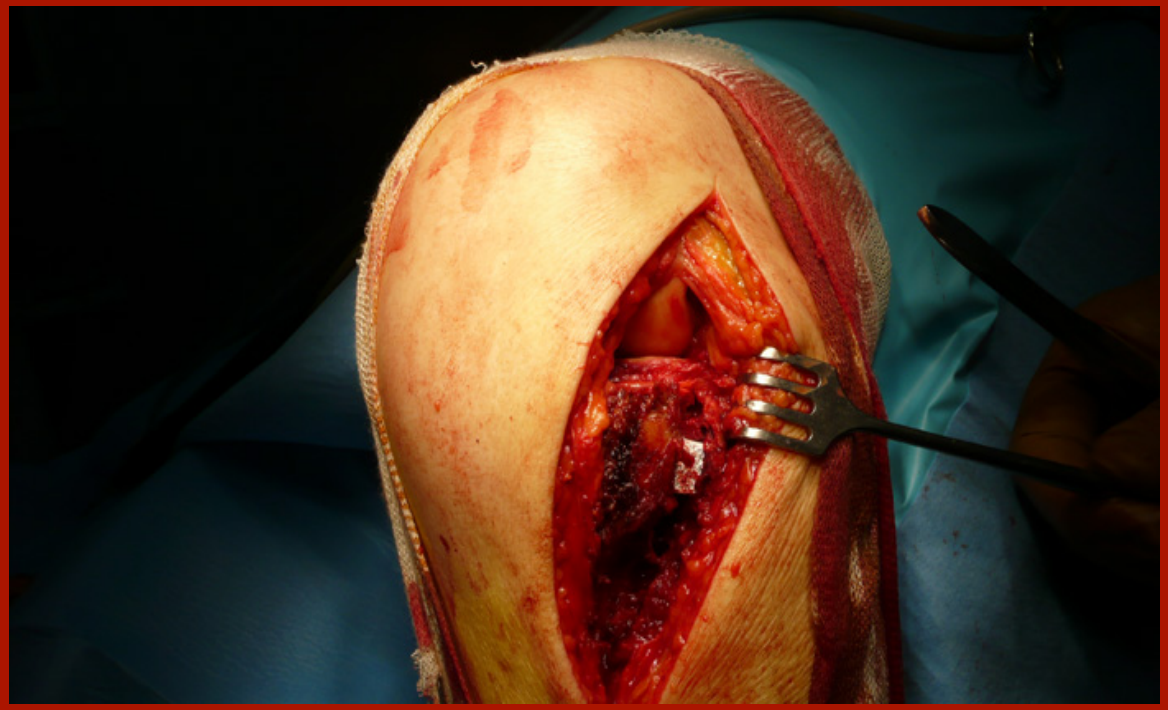

POTETTI MARTINA
21Y9M,F,152967
8-84
N. rich.461547
Pos. paziente: FFS
Policlinico Umberto I - TC 1 DEA-Roma
SIEMENS Sensation 16
8-set-2010 16:35:35
140kV, 230mAs
SC 500 mm
SW 1.0 mm
Desc. studio: Lower Extremities^DEA_GinocchioSpi (Adult)
R
10 cm
F
C 450
W 1500

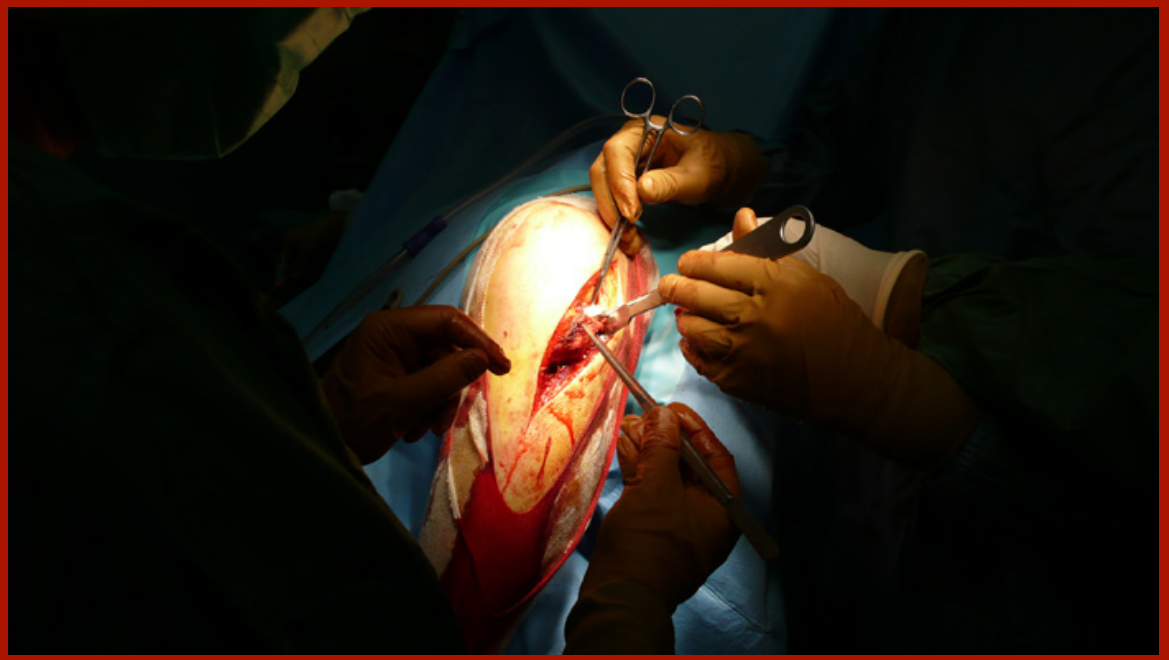
Fractures with depression - 1

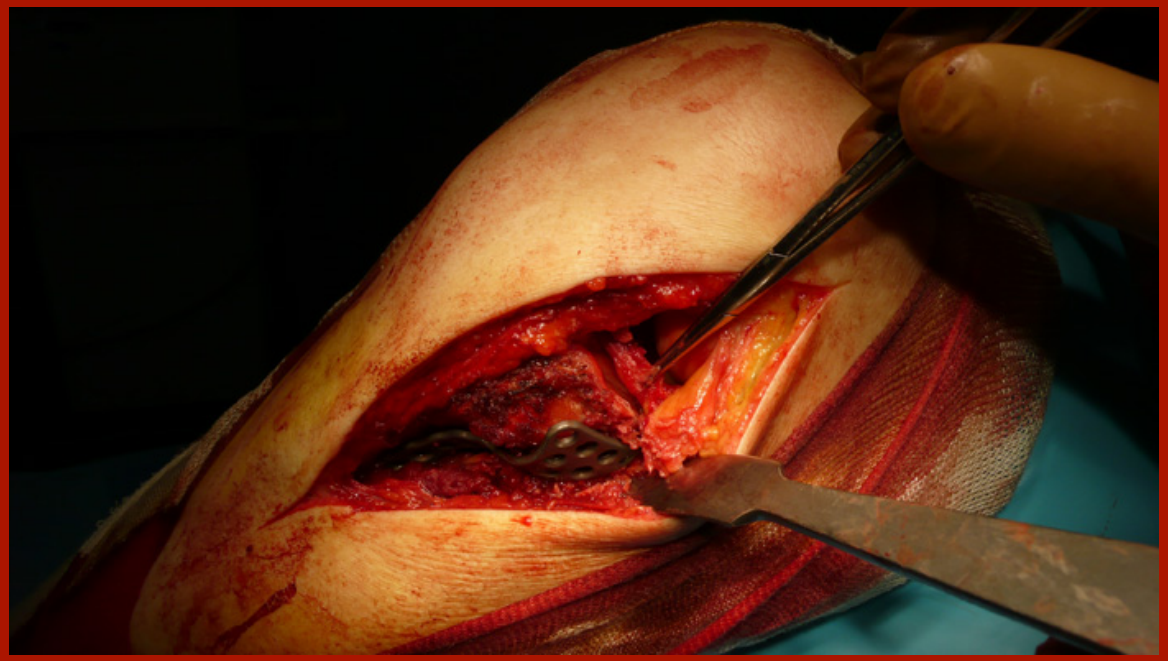


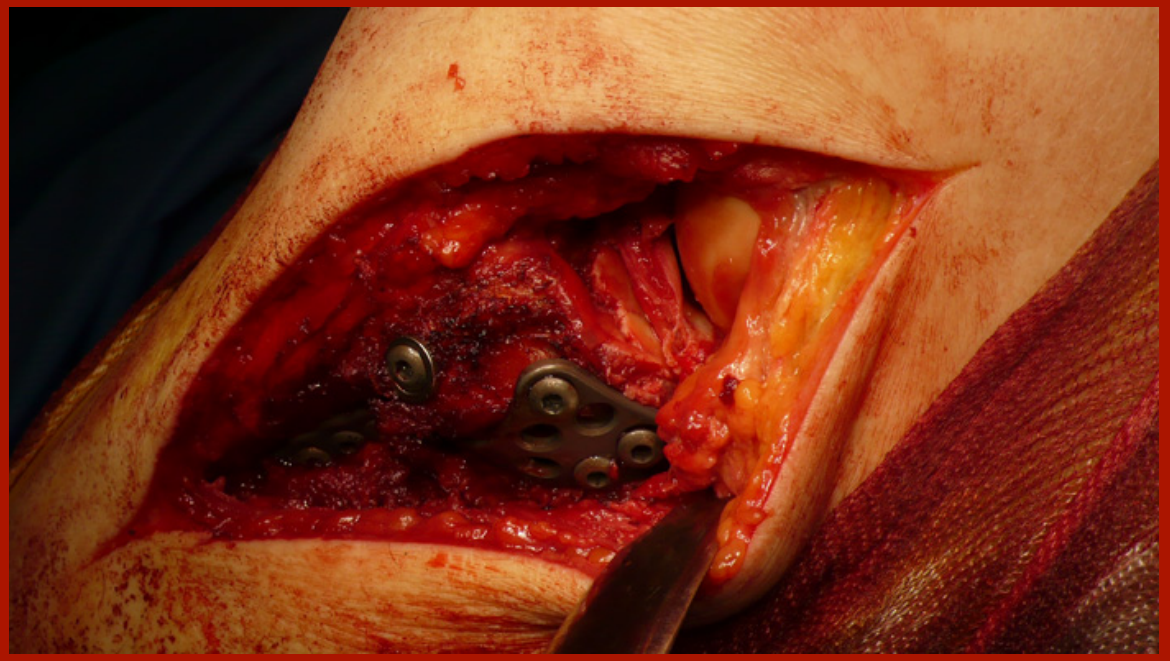
Fractures with depression- 2

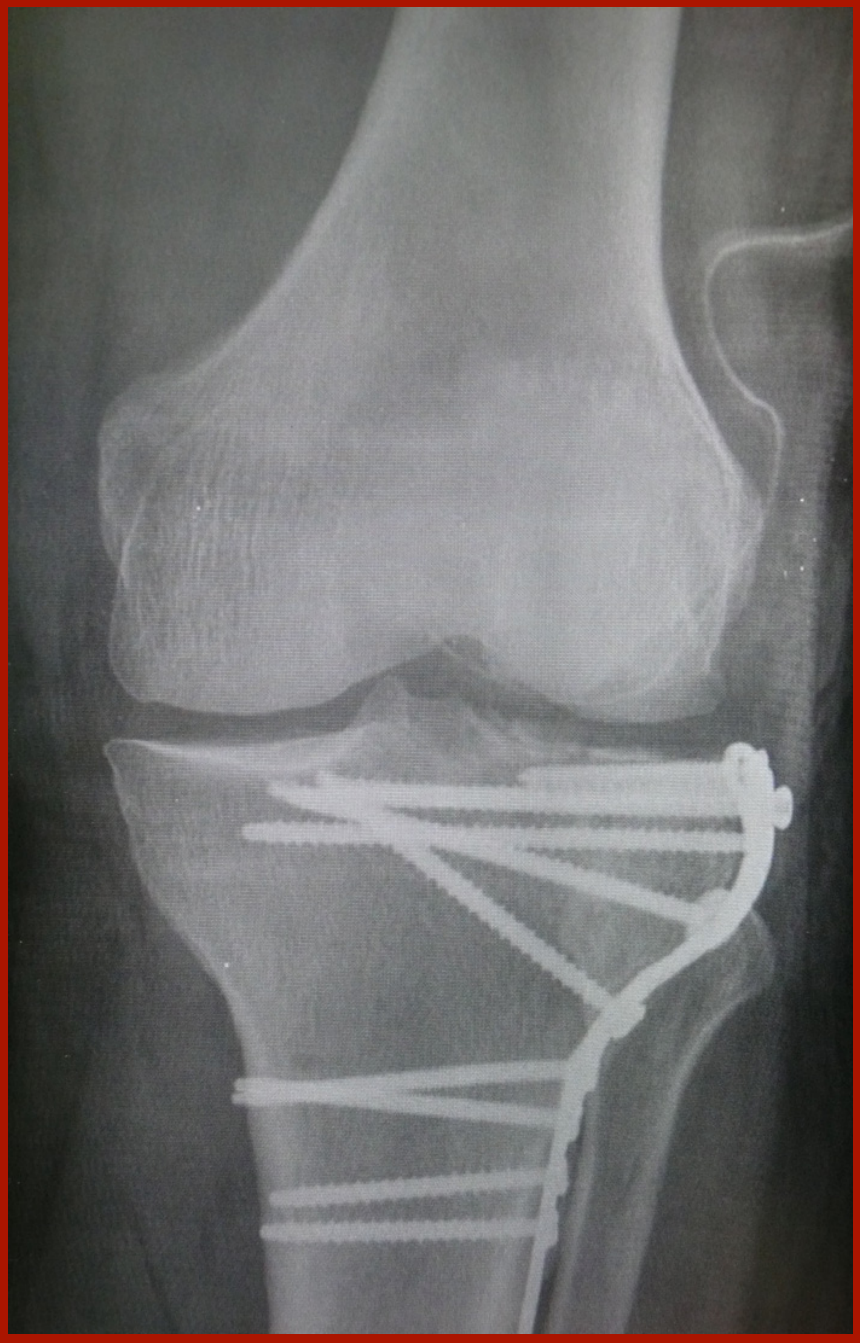
Fractures with split-depression





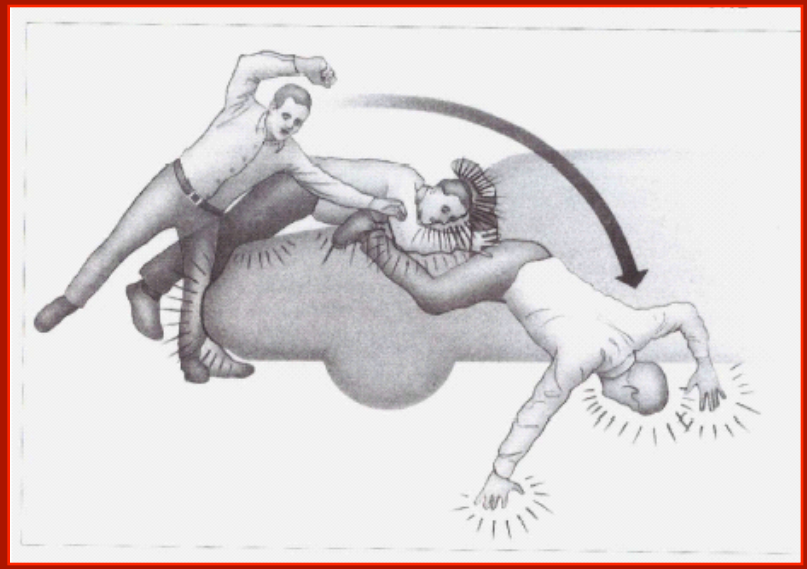






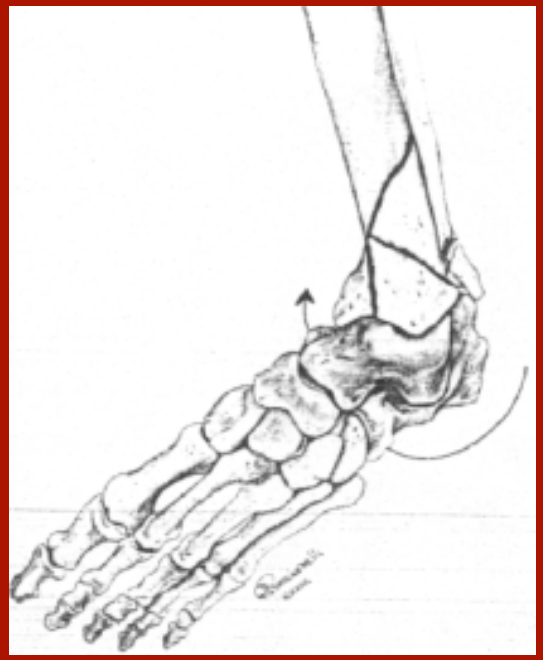
DISTAL TIBIA FRACTURES

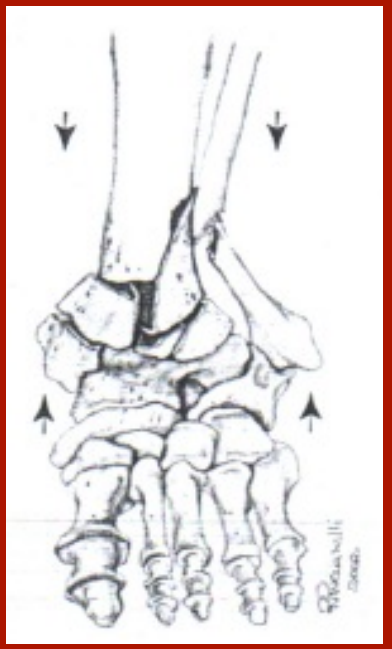
- Open fractures 2.1%
- Represent 11% of fractures in drivers of vehicles
- 14.4% of pedestrians (especially when the vehicle is low)
- 75% of cases associated with fibular fracture
- In motorcycle accidents are frequent, especially in the ankle where it remains trapped between the motorcycle and asphalt



Fracture mechanism

- Low-energy trauma → Rotating mechanism
- High-energy trauma → Axial compression



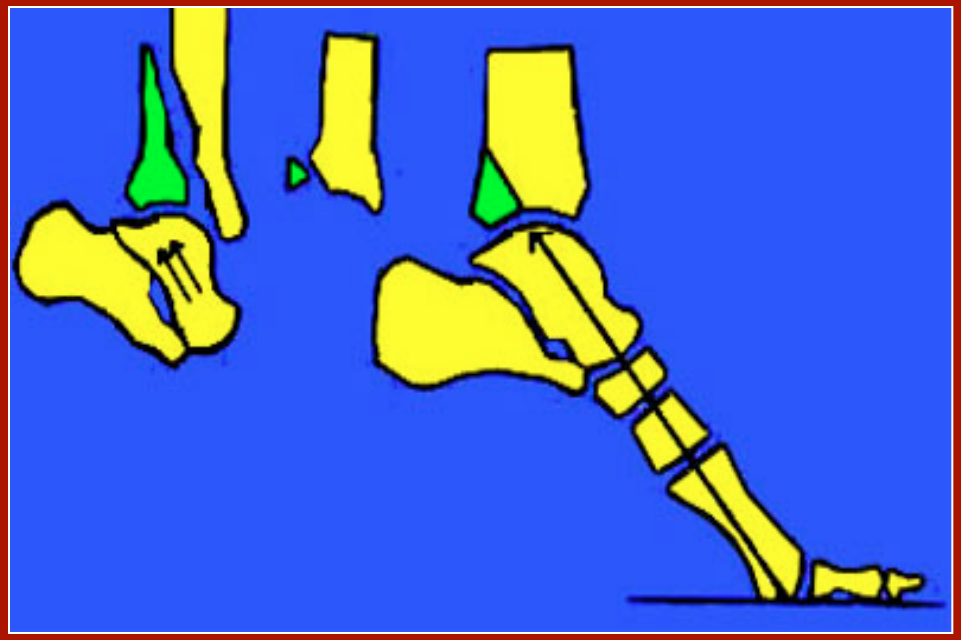


Dorsiflexion fractures

- Dorsal hyperflexion brutal and vertical compression(foot on the brake pedal)
- Astragalus urges that fractured malleolus and the anterior border of the tibia
- The anterior marginal fractures are partial or total
- Sometimes the entire front edge is fractured, in bulk or in several pieces, causing a subluxation or dislocation of the talus forward

Plantar flexion fractures

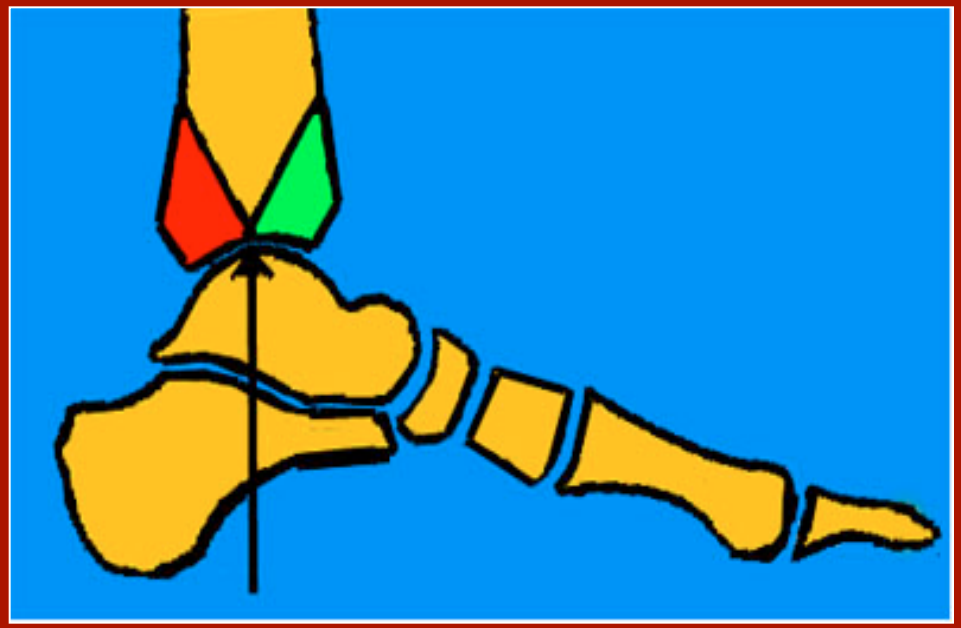
-Fracture of posterior margin of the tibia and fracture of malleoli

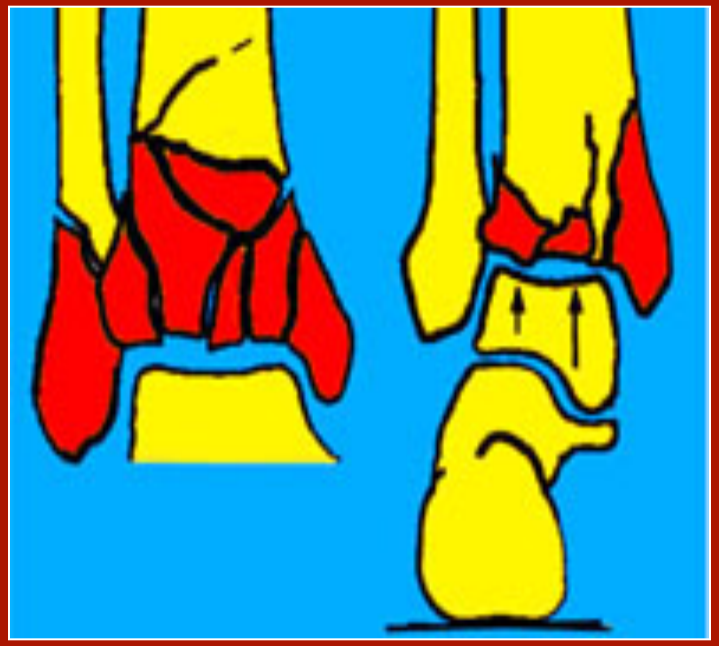


-Posterior parcel fracture

-Total marginal fracture

Compression fractures

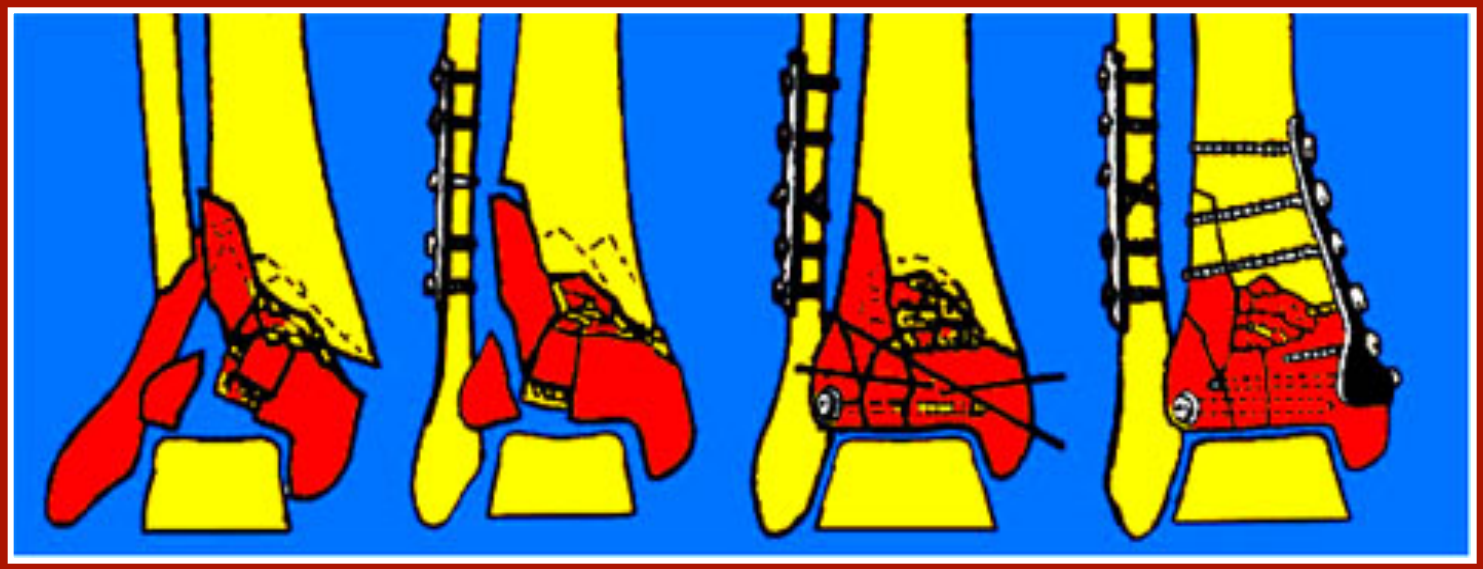




- Marginal fractures: two main fragments
- Astragalus can dislocate forward or backward
- Astragalus can impact within the margins of the fracture
- The fibula is always fractured
- The fracture of the medial malleolus is always vertical

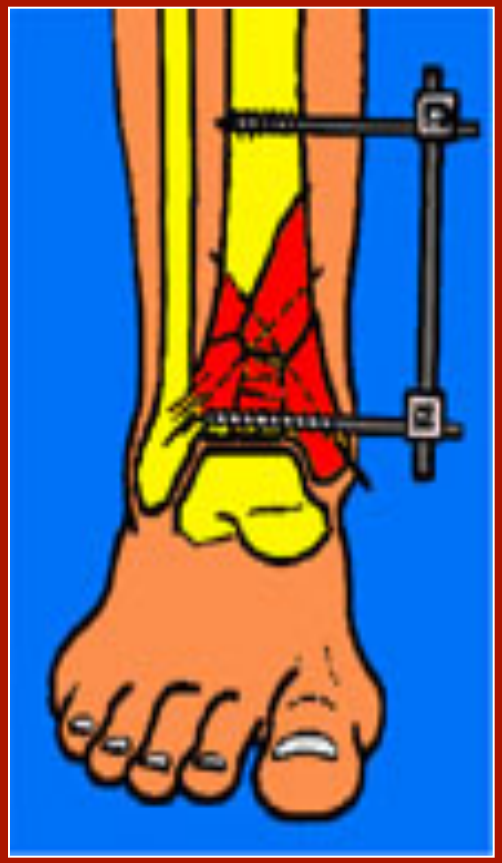
TREATMENT- 1

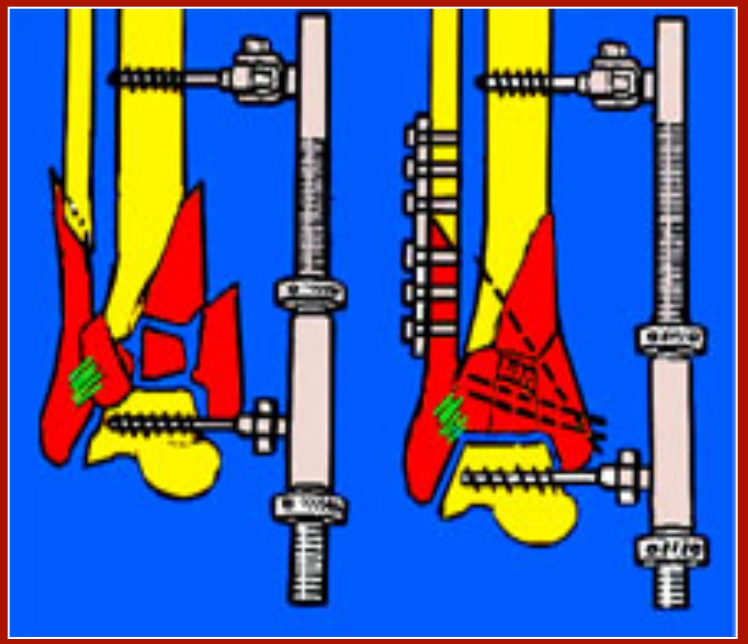
- Fixation of the fibula
- Reconstruct the articular surface (wire + screws)
- Osteosynthesis of tibia by medial plating
- It is important to perform anatomic reconstruction



TREATMENT - 2

OPEN FRACTURES





- **Anatomical osteosynthesis of the fibula (restore length) to reconstruct the articular surface (wire + screws)**
- **External fixator on the tibia or between the tibia and talus**

Radiologic evaluation -1

To study the fracture using CT scans is important to make optimal treatment

Radiologic evaluation -2

- **Fracture of medial, lateral and posterior malleolus.**
- **Lag screw fixation**



Open fractures

CASE REPORT

- Patient aged 43 years;
- Motorbike fall;
- Leg trapped between the bike and asphalt with the cylinder of the bike on the right ankle;
- Skin of the lateral surface of the leg burn.

Preoperative evaluation

Surgical treatment

Conclusions

The evaluation and selection of the appropriate surgical technique to be implemented, according to the varius of cases, is essential for faster recovery and better management of post-operative patient.

Thanks for your attention!!!