

# Baqueira-Beret Medical Center



traumatologia i medicina  
d'esports d'hivern

Dr. Aleix Vidal i col·laboradors

## **SNOW SPORT**

# **TIBIA PLATEAU FRACTURES**

# Baqueira Beret

## Main data from last 10 ski seasons



Data

**2005 to 2014**

22.894 snow sport  
lesions have been  
treated at Centre  
Mèdic Baqueira.

# Injuries per season

## Main data from last 10 ski seasons



### Data

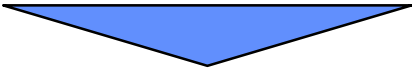
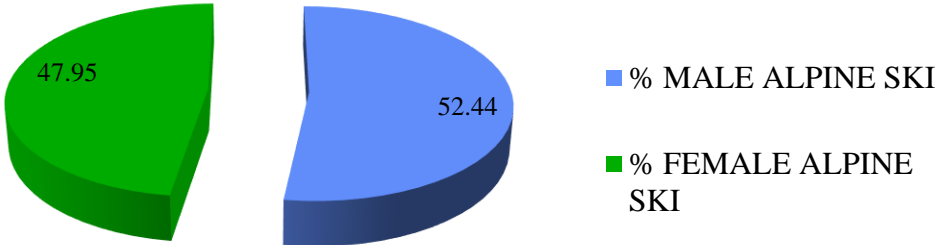
- **Ski: 2,4** per thousand ski days
- **Snowboard: 5,3** per thousand ski days

# Probability of injuries

## Distribution per gender & age



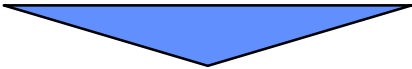
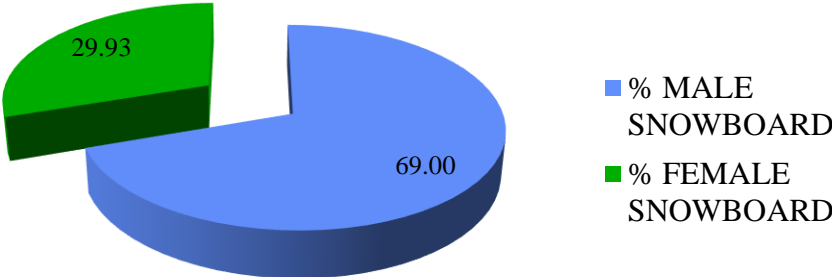
**ALPINE SKI INJURIES BY GENDER**



Mean Age: 33



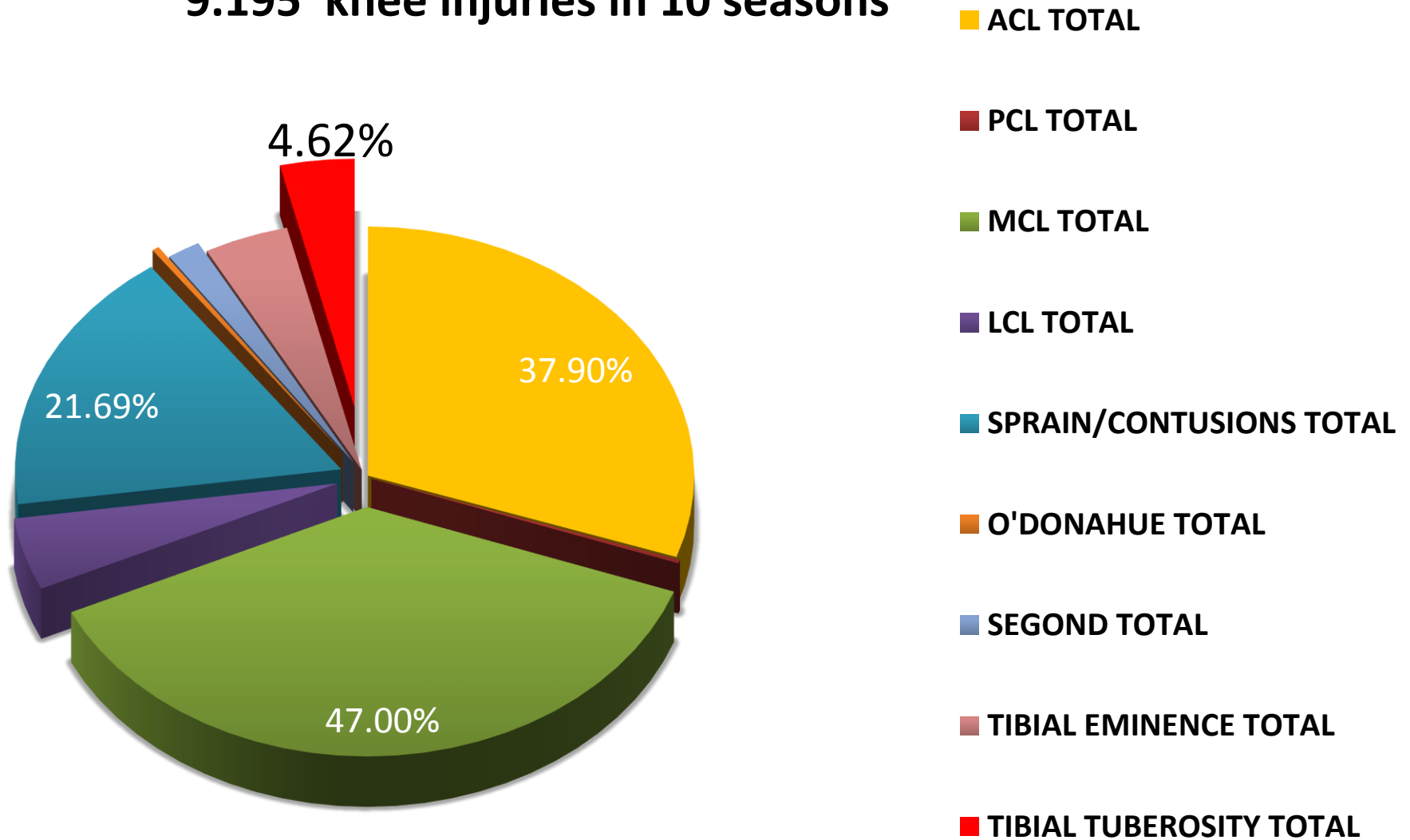
**SNOWBOARD INJURIES BY GENDER**



Mean Age: 26

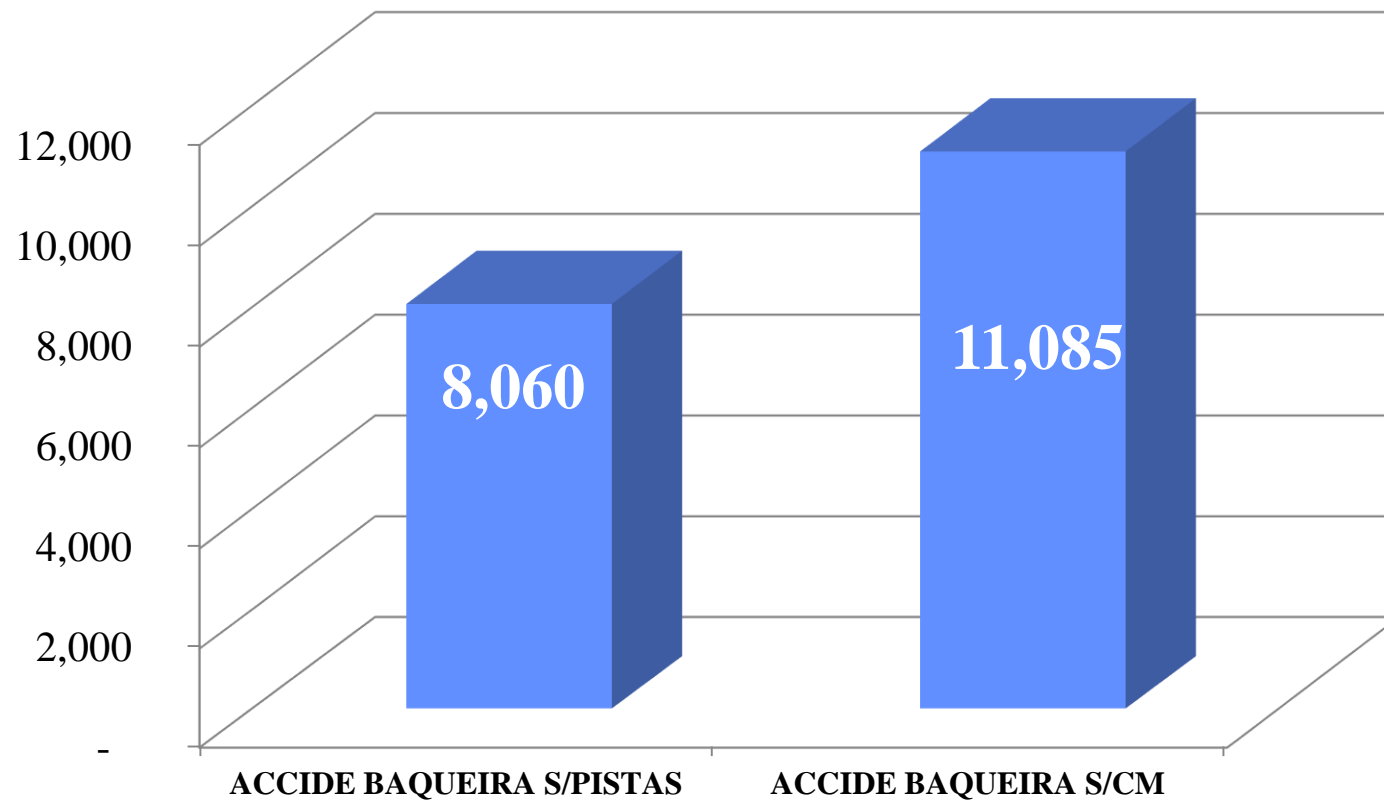
# Tibia Plateau Fractures

9.195 knee injuries in 10 seasons



# Accidents according to Ski Patrol versus MC

## Main data from last 4 ski seasons



Total of skiers in 4 seasons: 3,098,359

# Materials & Methods

# **Knee Injuries**

## **Main data from last 4 ski seasons**

For the present study,  
we have reviewed Knee Injuries seen  
at Baqueira Beret Medical Centre  
during 4 consecutive seasons.

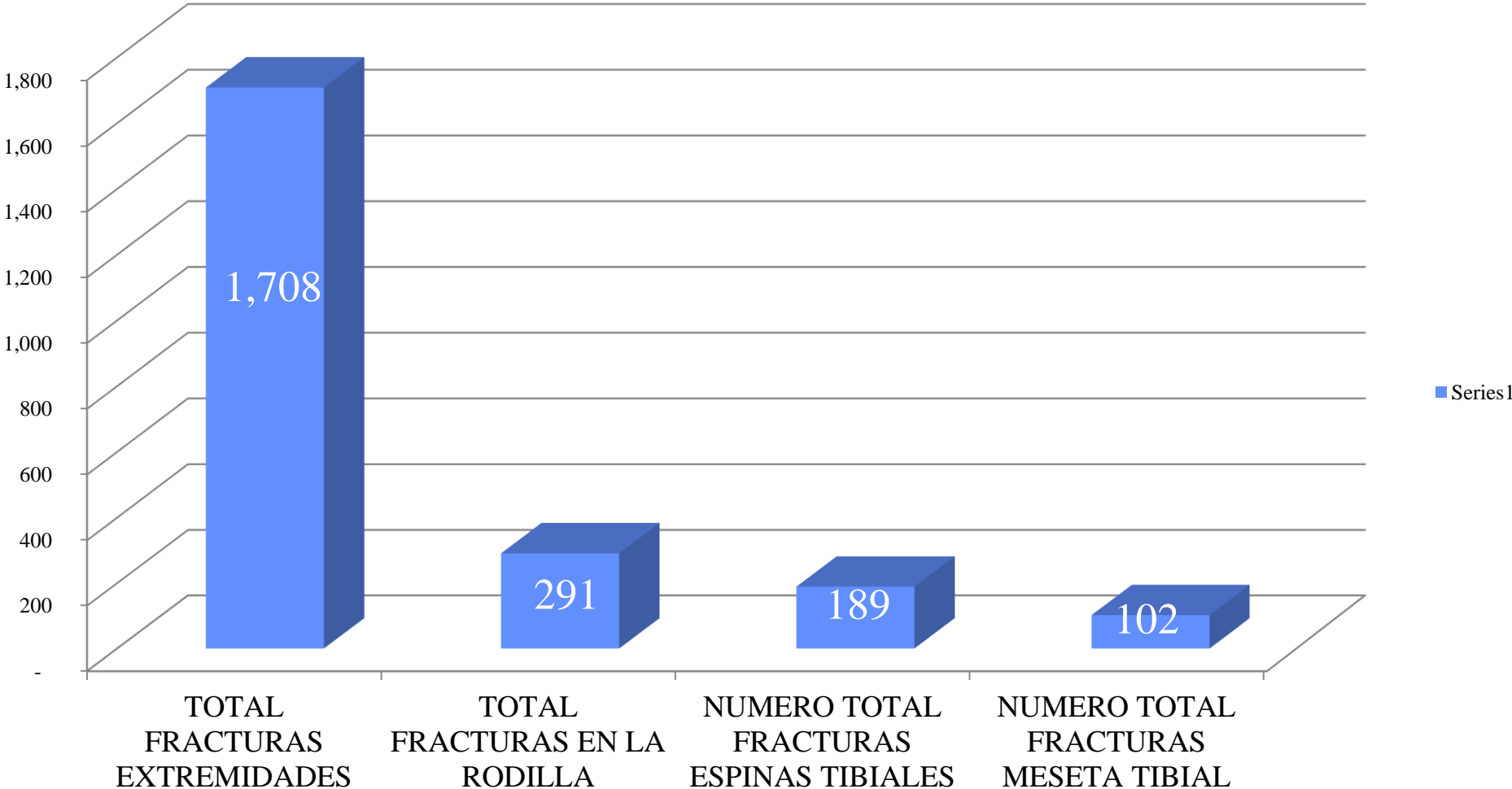
Total skiers in 4 seasons: 3,098,359

Total ski accidents : 11.085

Total of knee injuries: 2.538

# Fractures in Lower Extremities & in the Knee

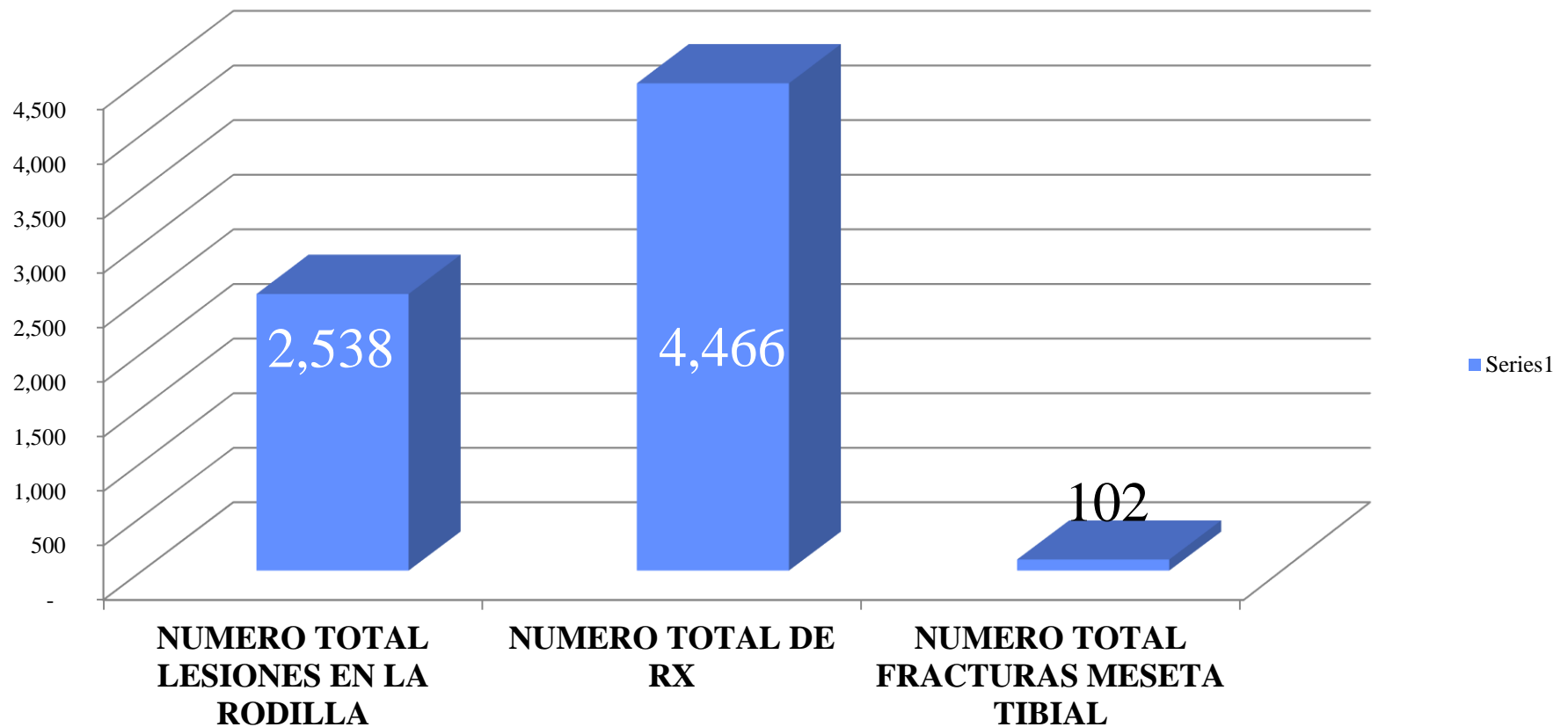
## Main data from last 4 ski seasons



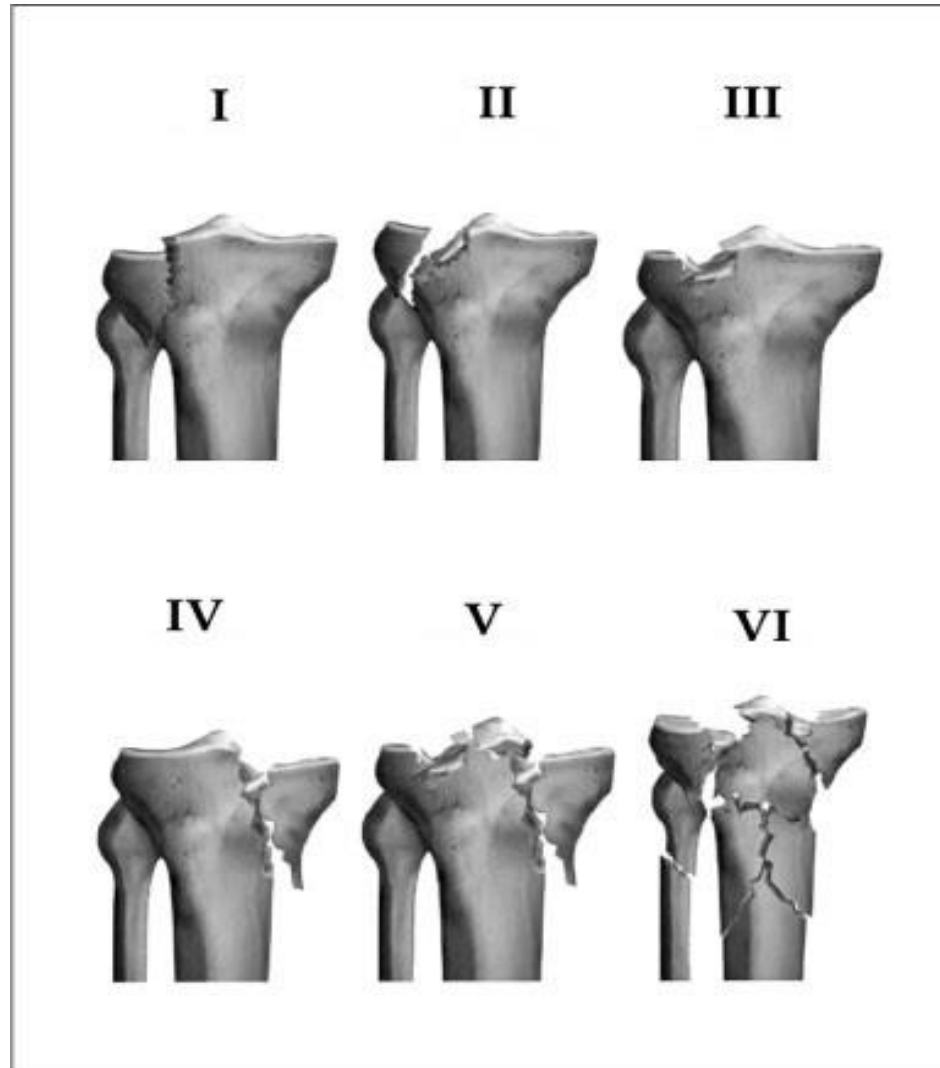
# Tibia Plateau Fractures

Main data from last 4 ski seasons

Study of 4.466 Knee X-rays



# Schatzker classification



**Low  
Energy**

**High Energy**

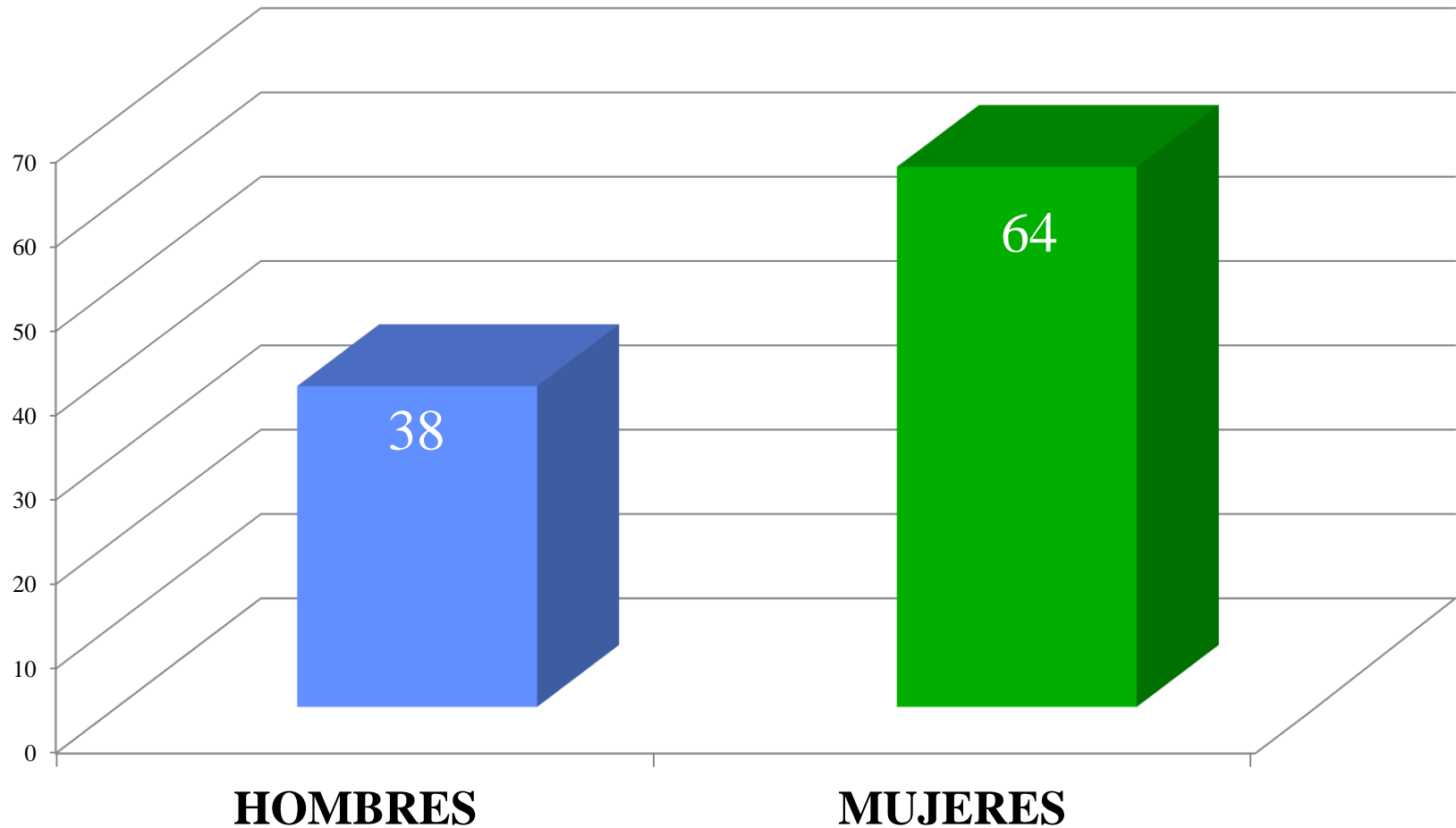
# Skier Level Classification Criteria

Source: Baqueira-Beret Ski Resort

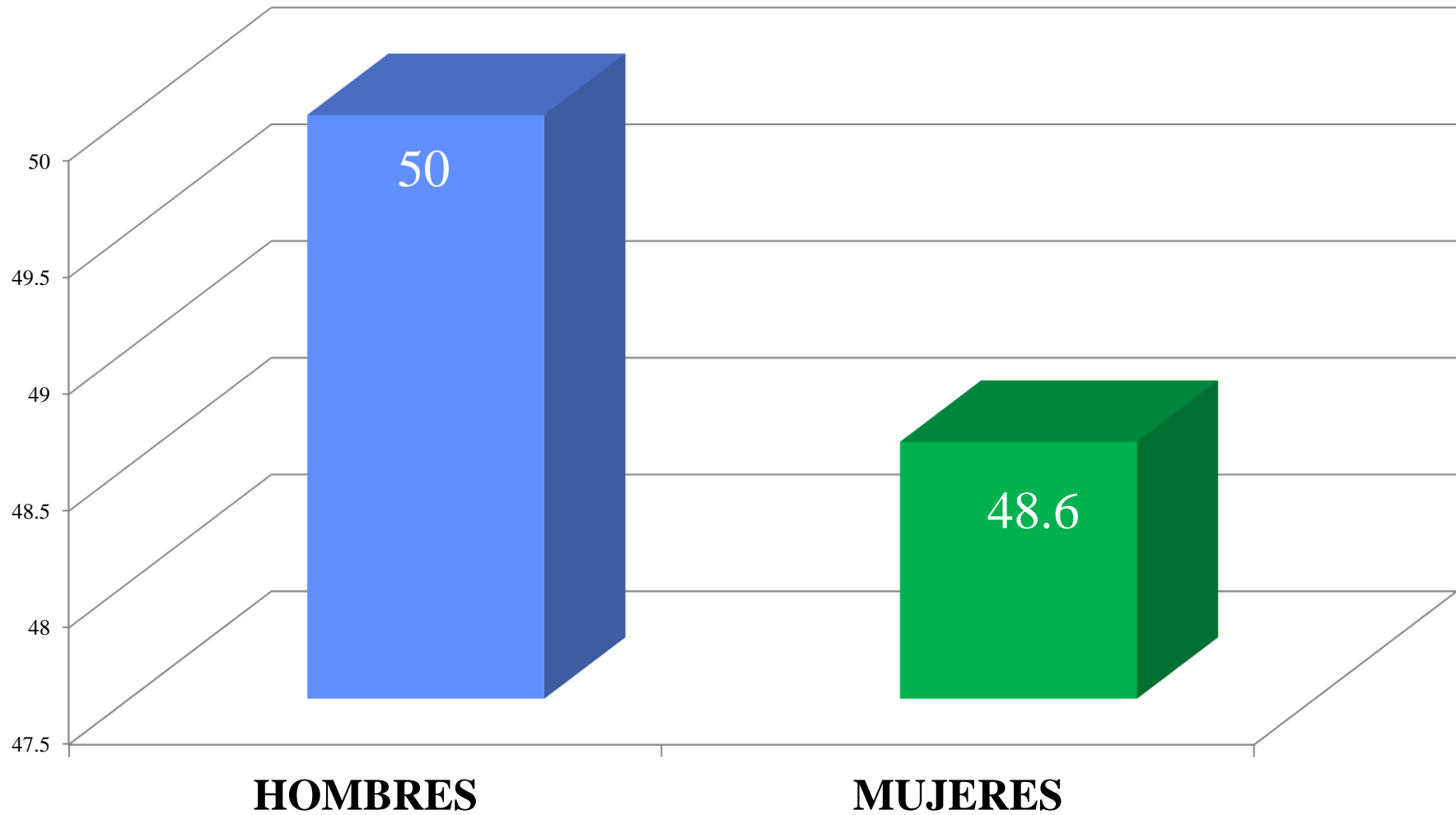
- **BEGINNER:** A skier who is skiing for the first time and in beginners area.
- **INTERMEDIATE:** A skier who can ski throughout resort easily and can ski red slopes/pistes.
- **EXPERT:** A skier who can ski throughout resort easily and can ski black slopes as well as off piste.

# Results

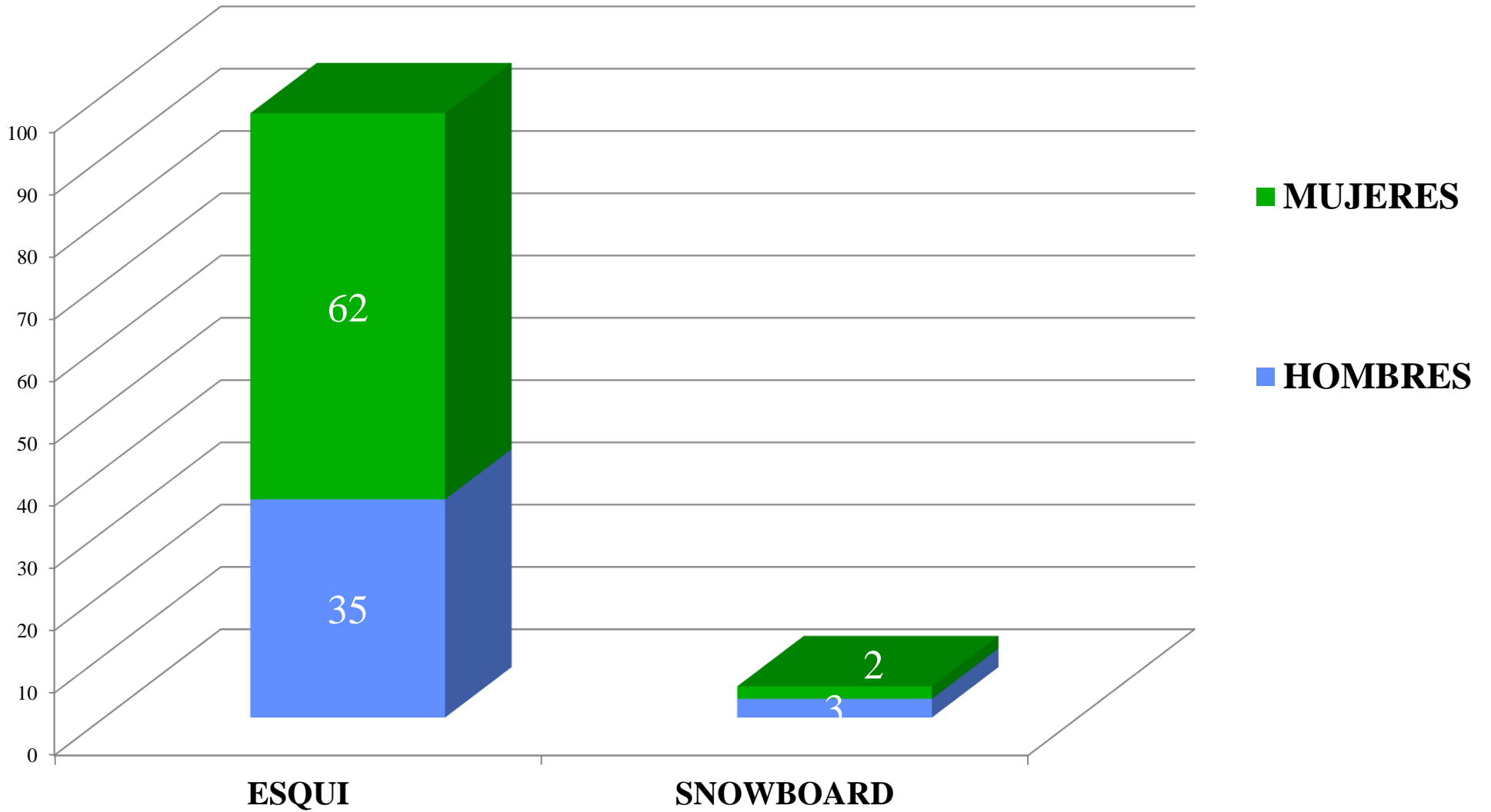
# Tibia Plateau Fractures by Gender



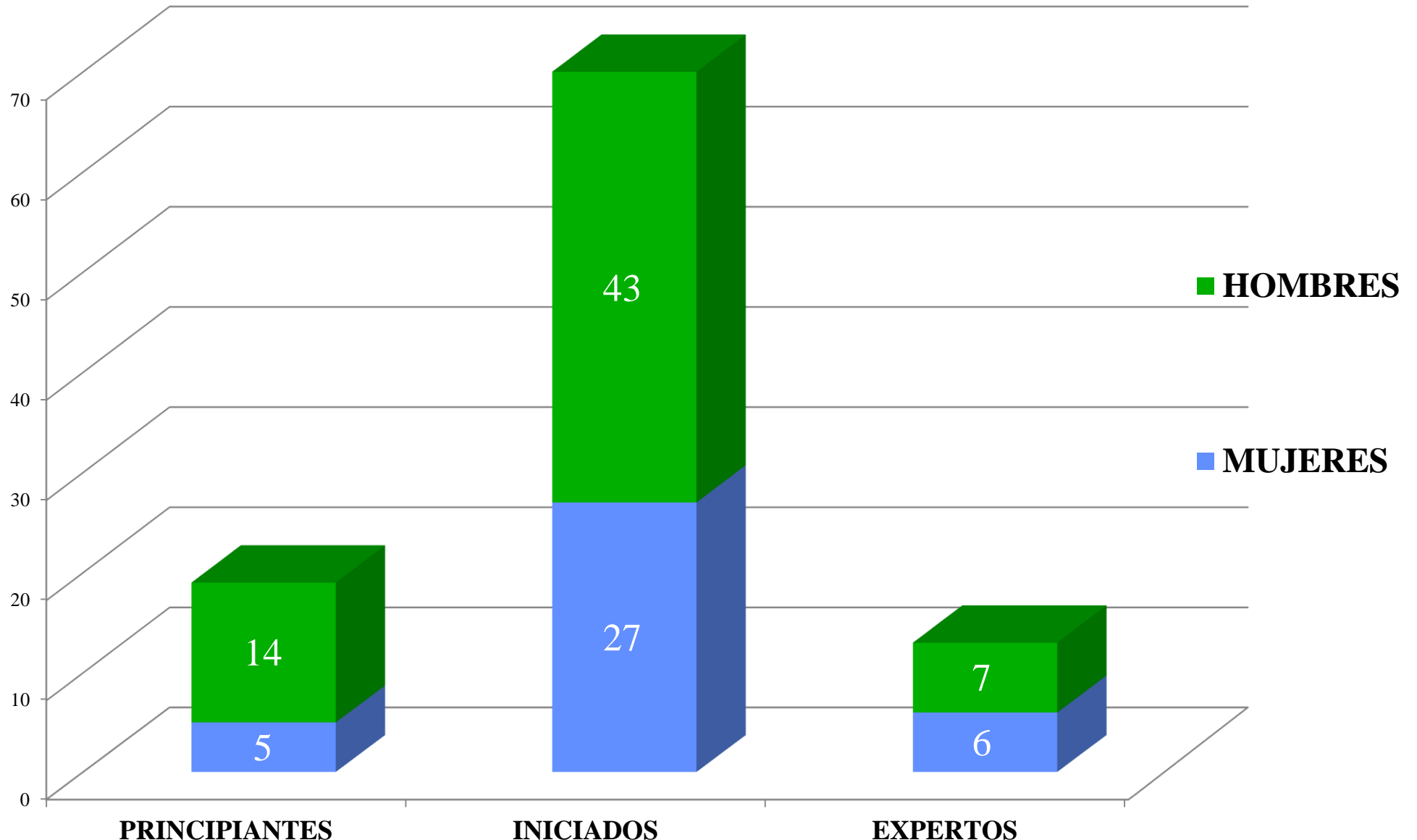
# Mean Age 49 y.o.



# Snow Sport Category/Type

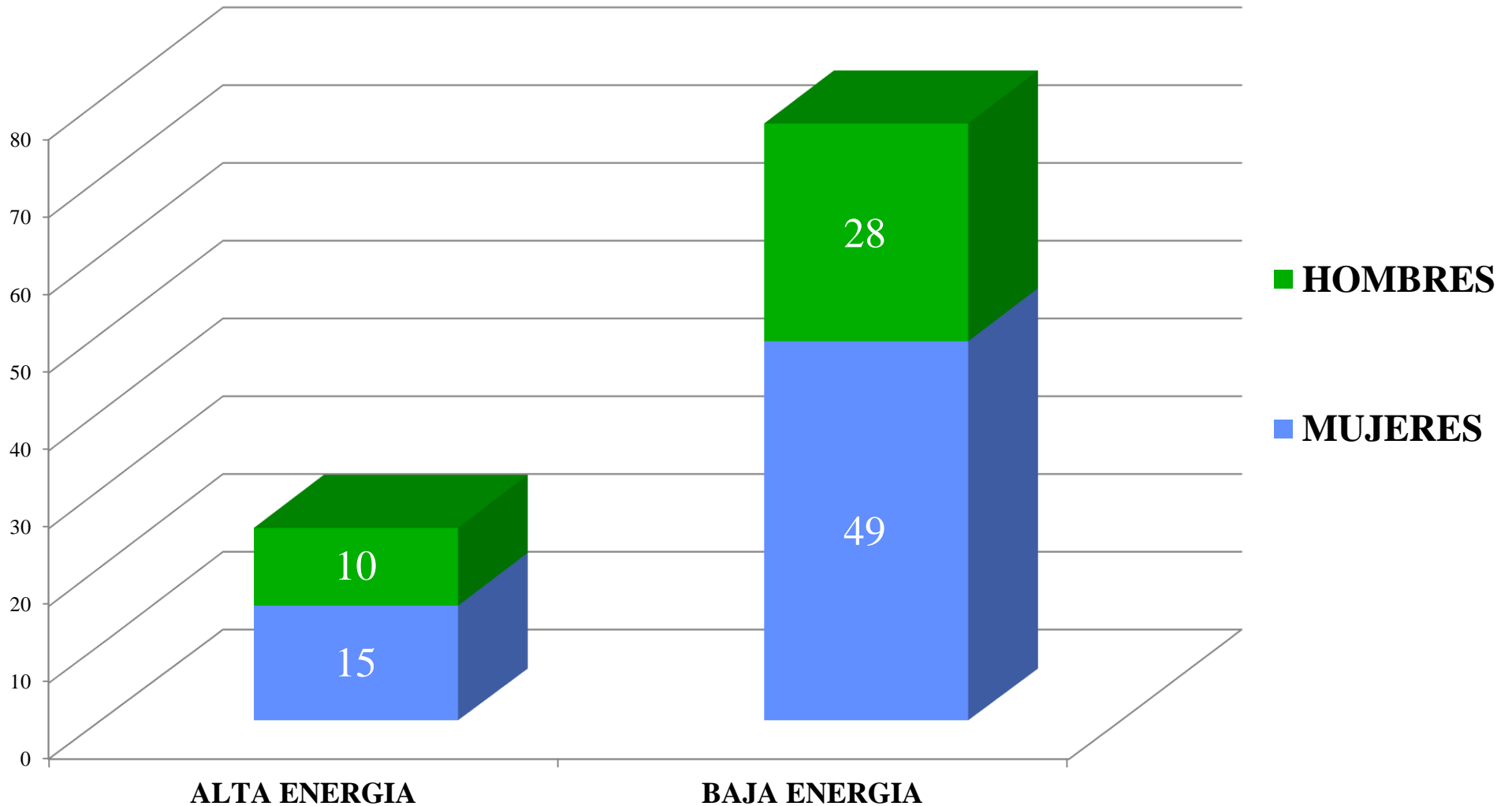


# Skier Level by Gender

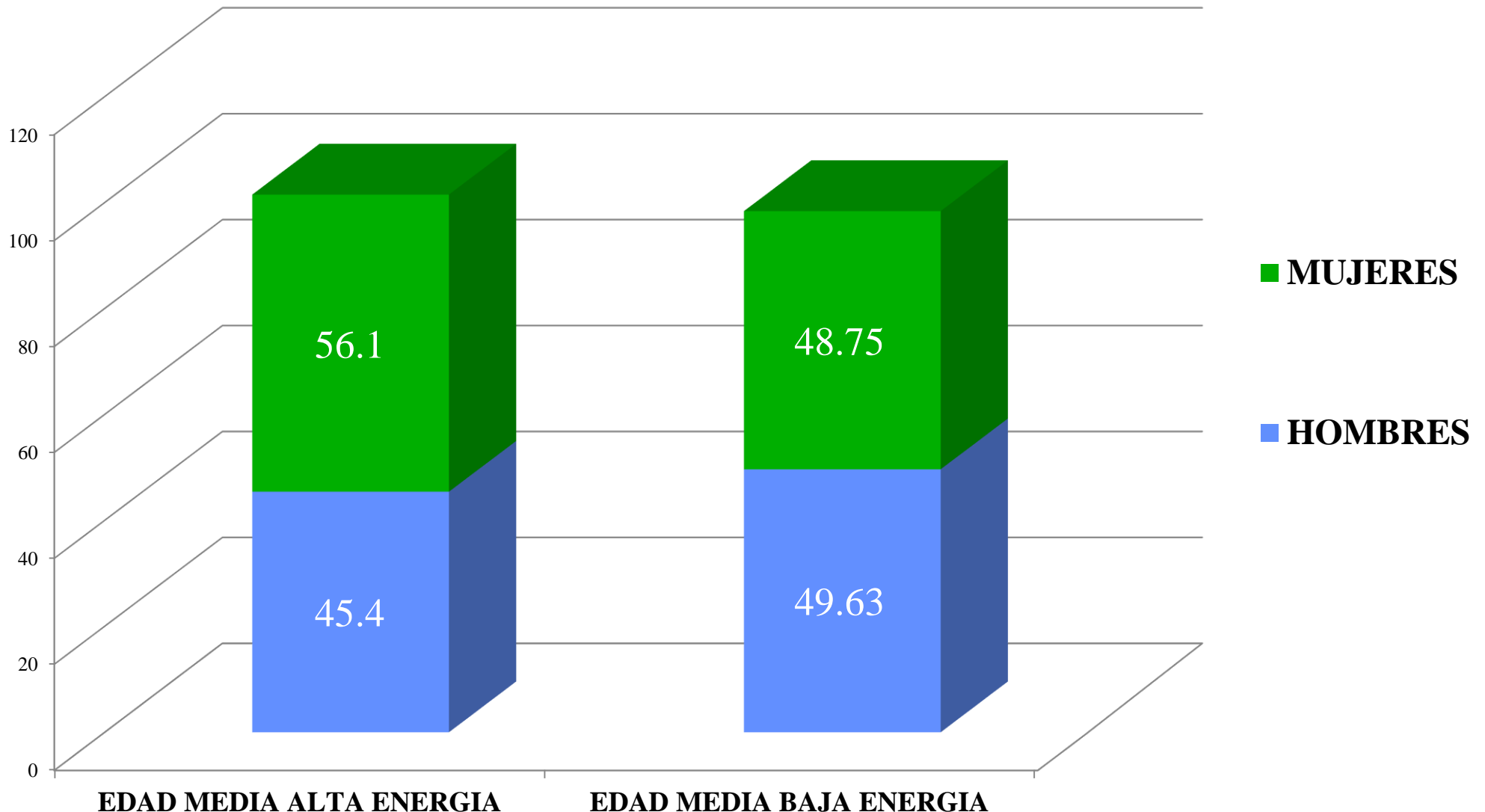


# Division by Groups

## Schatzker Classification

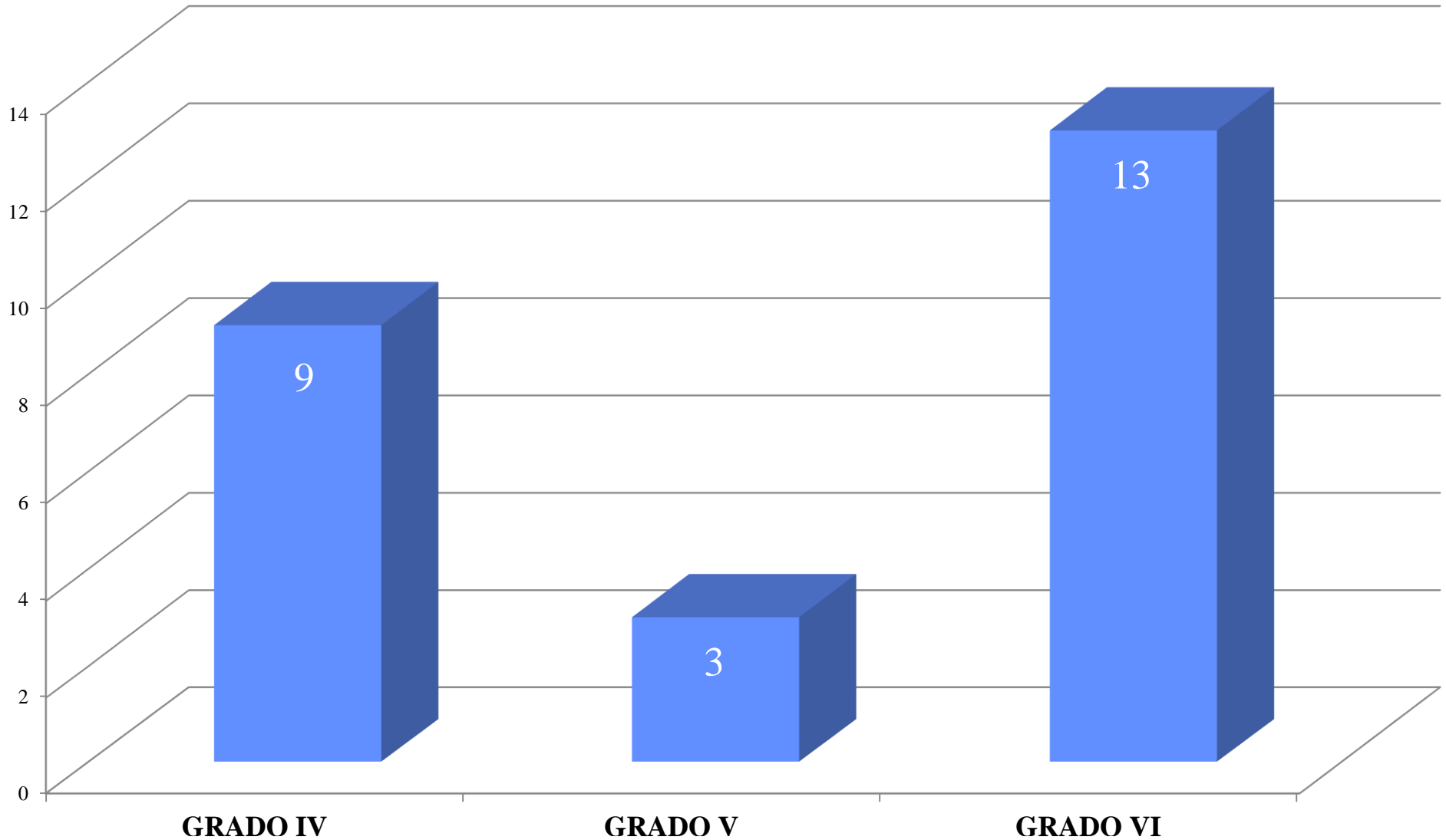


# High Energy – Low Energy



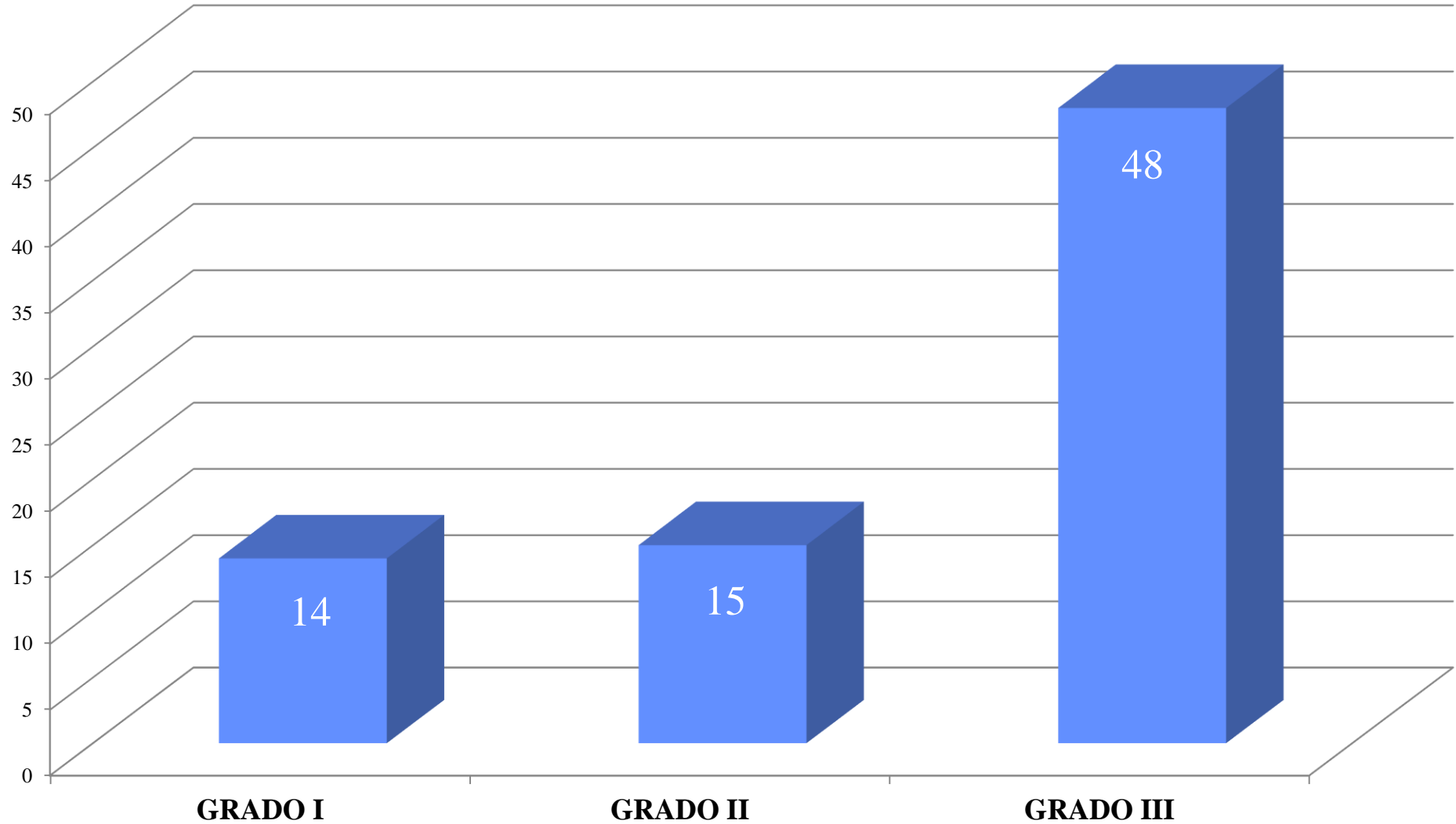
# High Energy Fractures

## Schatzker Classification



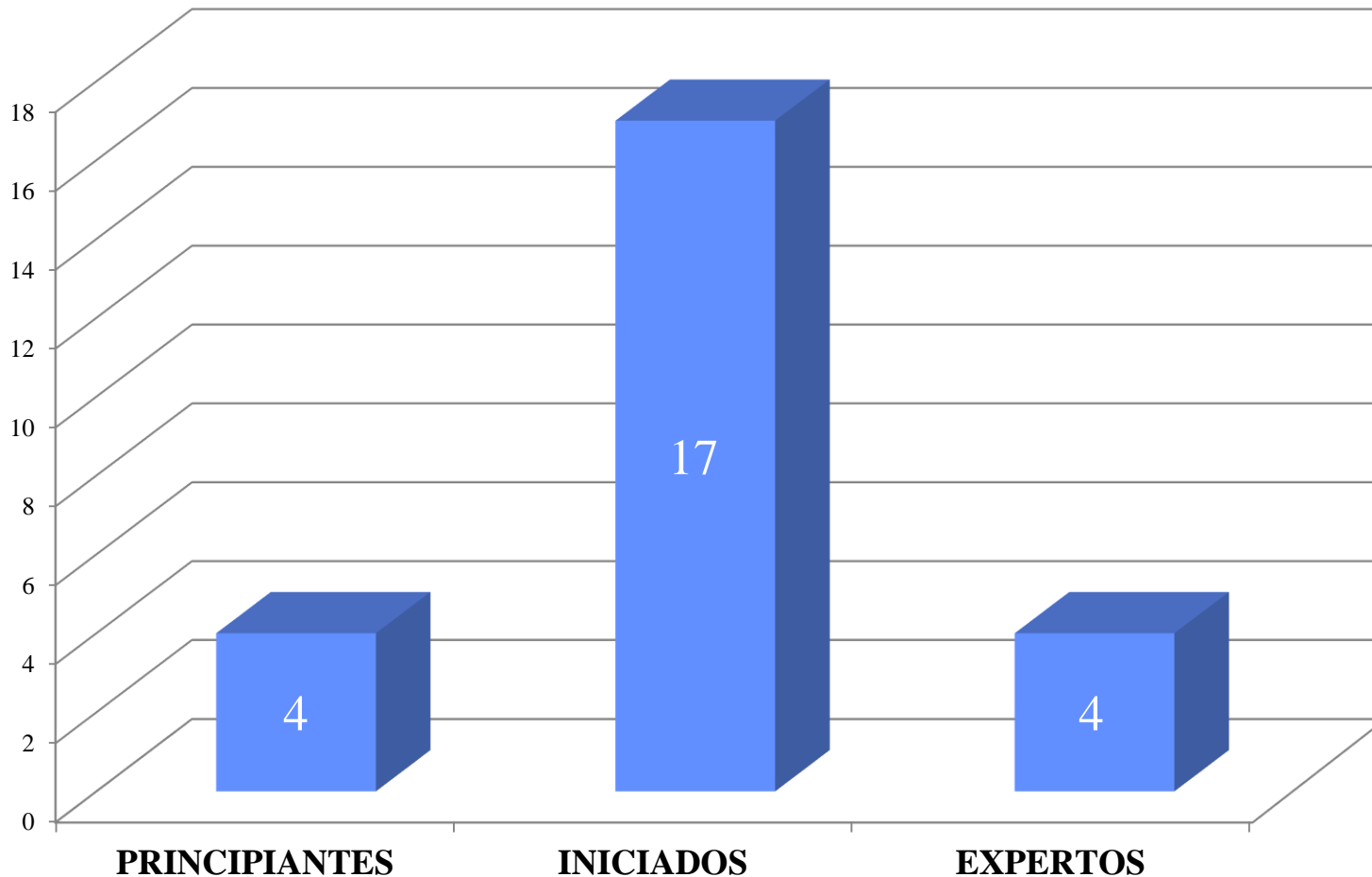
# Low Energy Fractures

## Schatzker Classification



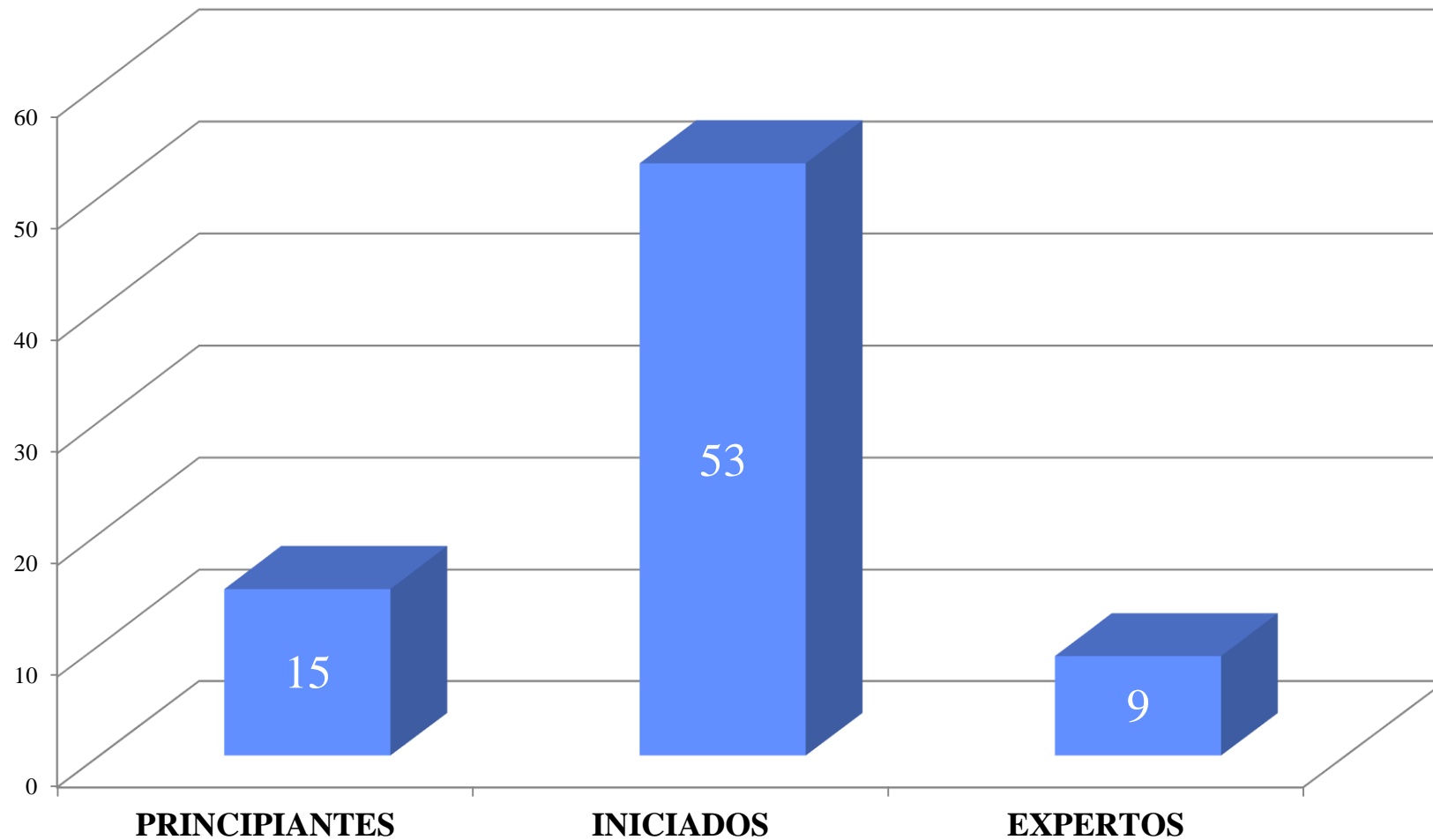
# Schatzker Classification and Ski Level

## HIGH ENERGY

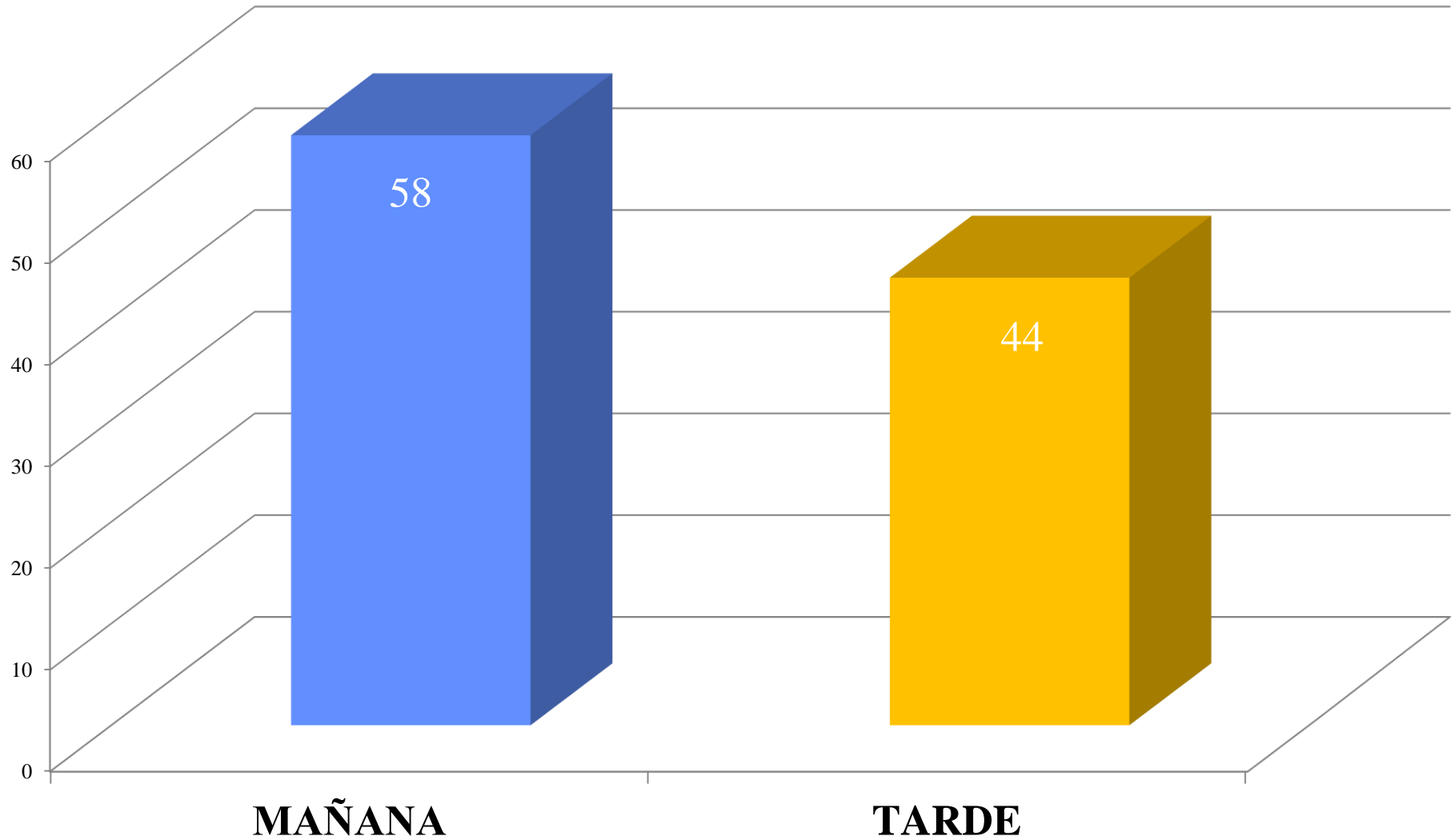


# Schatzker Classification and Ski Level

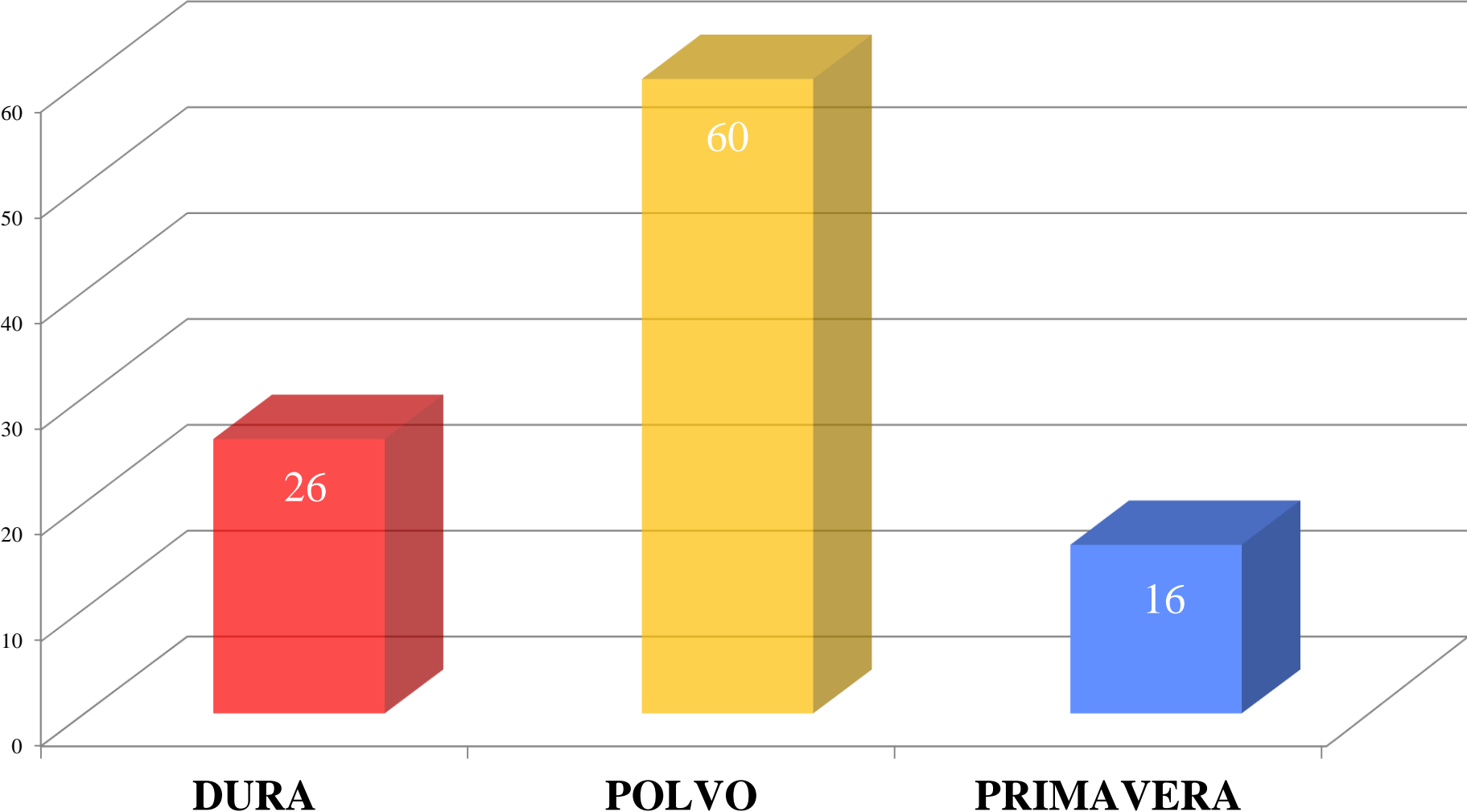
## LOW ENERGY



# Time of Injury



# Snow Type



# Conclusions

# 102 Tibial Plateau Fractures

In the present study, Tibia Plateau Fractures represent

- **4%** of all knee injuries
- **6%** of total fractures in lower extremities and
- **1%** of all fractures seen in our Center in the past 4 seasons

# 102 Tibial Plateau Fractures

- **62%** were Female and **37%** were Male
- Mean age **48.6** yrs.
- **68%** were intermediate skiers,
- **18%** beginners and
- **12%** experts.

# 102 Tibial Plateau Fractures

- **75%** were low energy fractures ( grade I,II,III) and
- **24%** of fractures were high energy fractures (grade IV, V, VI).

# 102 Tibial Plateau Fractures

- **58.8%** were skiing in powder snow
- **25.4%** were skiing in hard snow
- **15.6%** were skiing in wet snow
  
- **56%** of fractures occurred before 13 pm
- **44%** of fractures occurred between 13&17 pm

# Take home message

Risc factors must be taken into account  
in **addressing prevention** of  
Tibia Plateau Fractures.

# Thank you for your attention



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# Agenda

1. Baqueira Beret – Epidemiology

2. Barcelona Teknon – Treatment

# Agenda - Treatment

1. Explore the Fracture ID

2. Classify

3. Treatment Options

4. Take Home Message

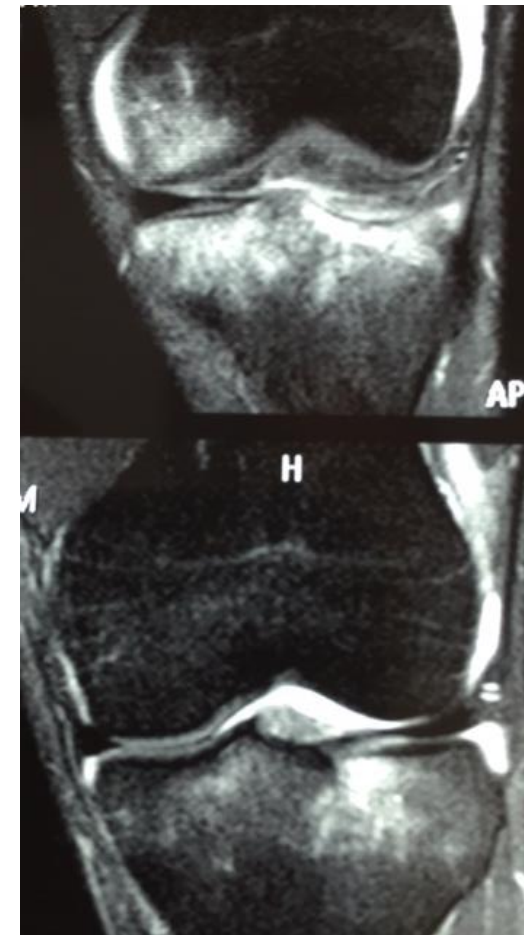
# Fracture Characteristics

**Kennedy JC and Bailey WH, 1968, Experimental tibial plateau fractures. JBJS**

- Soft Tissue Injuries
- Grade of Dislocation
- Grade of Comminution
- Grade of Joint Injury
- Grade of Osteoporosis
- Nerve or Blood Vessel Injuries

# Evaluate complementary tests

- X-Ray in two planes
- CT Scann
- Angiography
- MRI



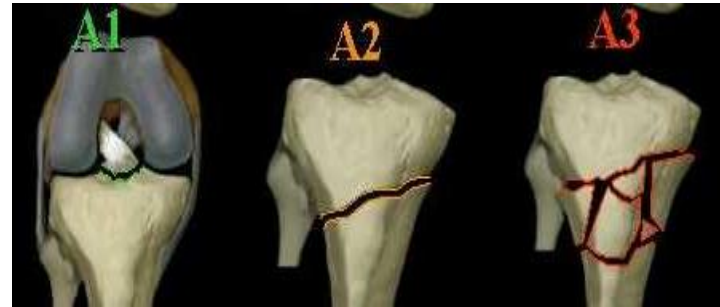
# Classify the Fracture

**A = extra articular:**

A1 = avulsion fracture

A2 = metafisaria simple

A3 = metafisaria multifragmentaria

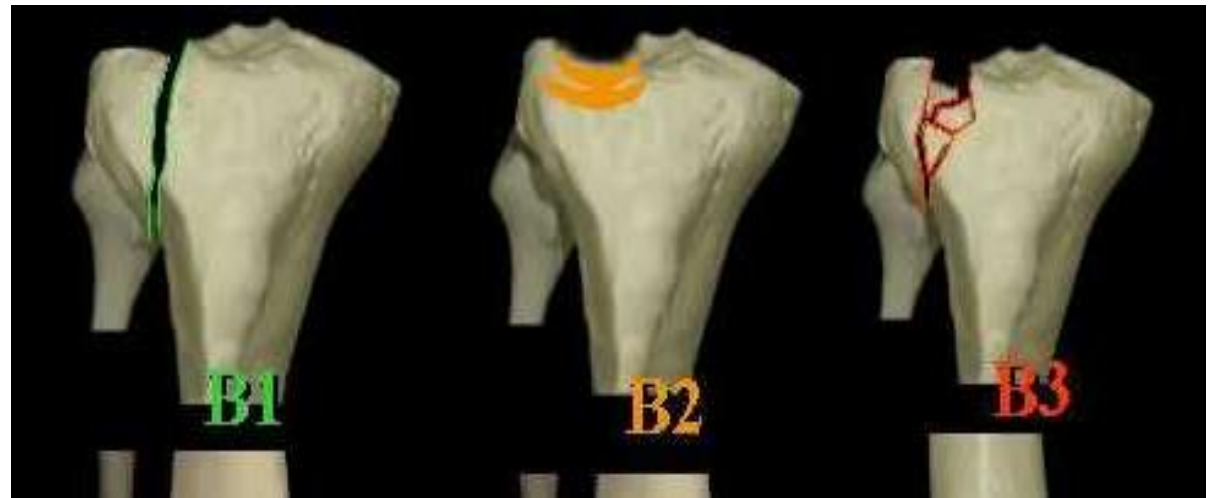
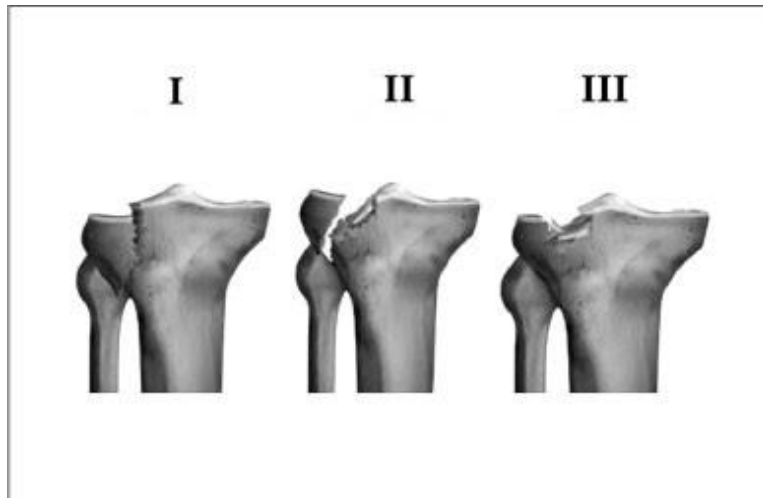


AO 41B (B1-B2-B3) = Schatzker type I – II y III

AO 41C (C1-C2-C3) = Schatzker type IV – V y VI

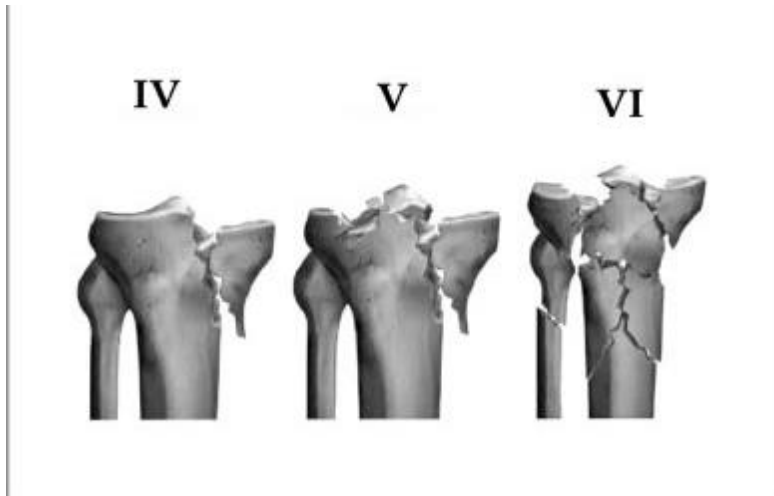
# Classify the Fracture

Schatzker type I – II y III = AO 41B (B1-B2)



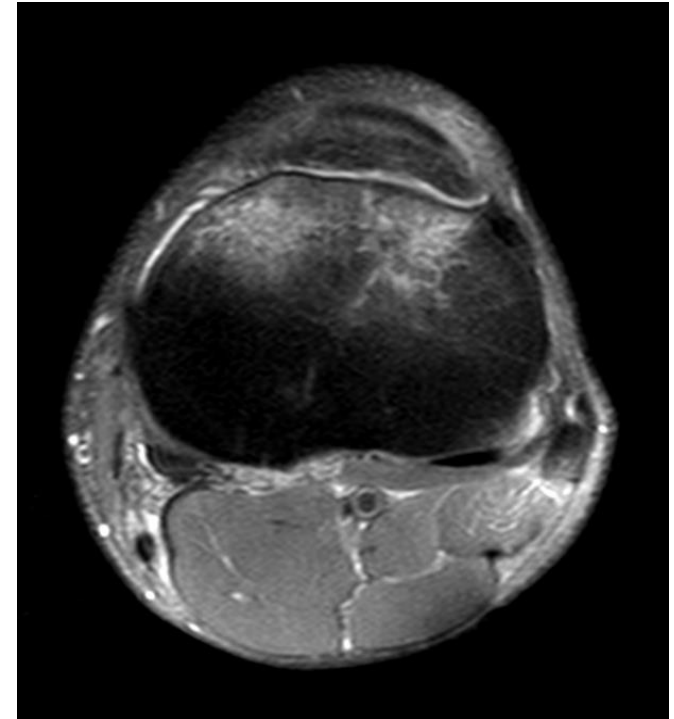
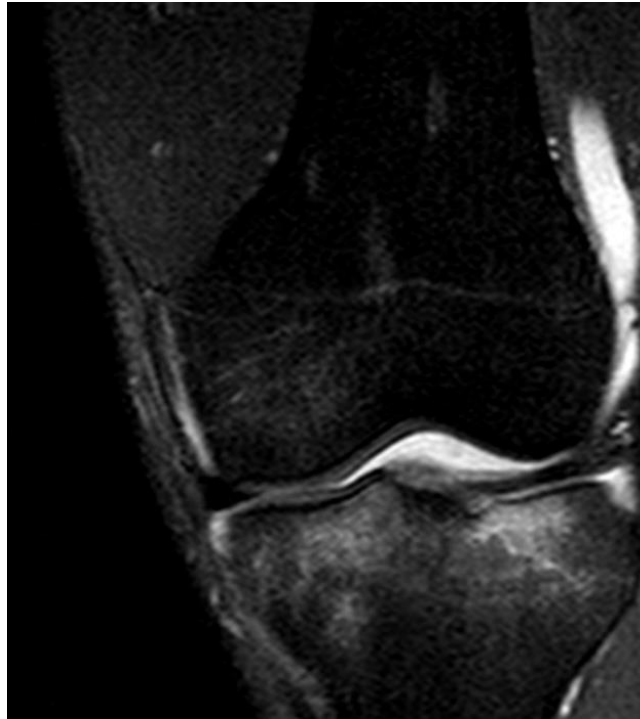
# Classify the Fracture

Schatzker type IV – V y VI = AO 41C (C2-C3)



# Classify the Fracture

According to MRI



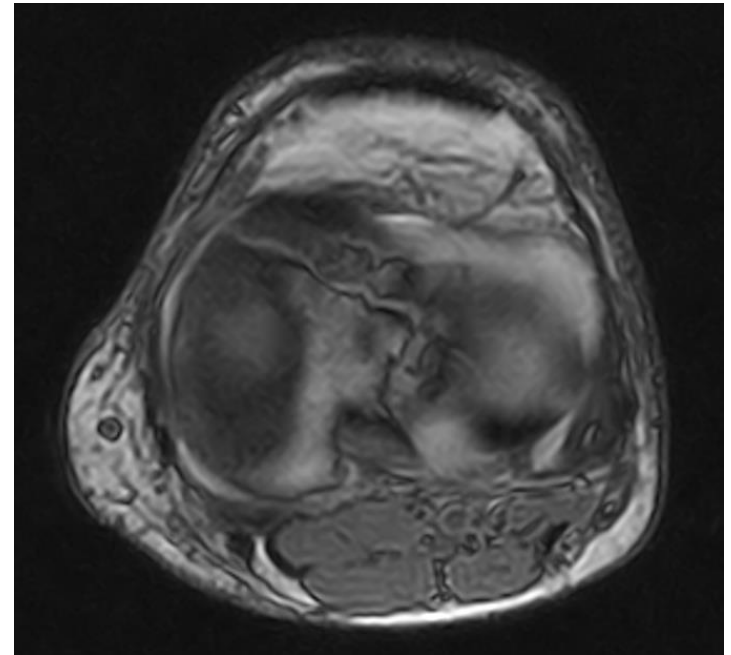
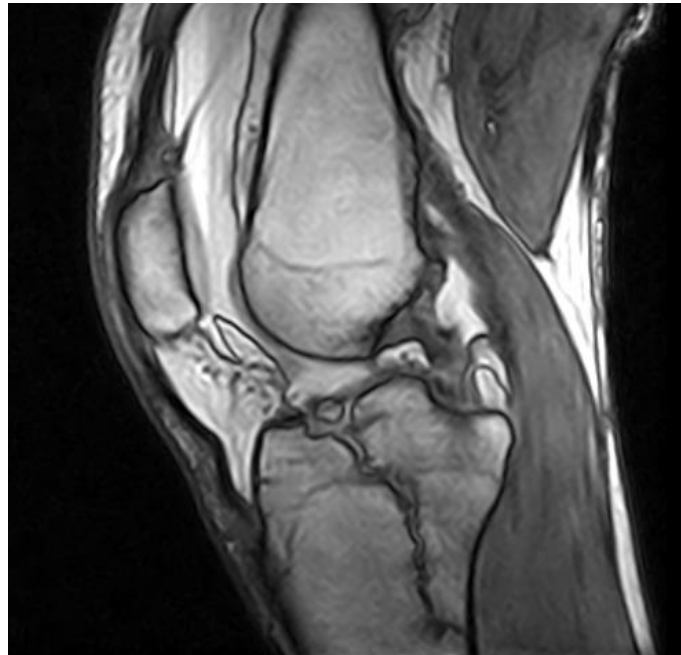
# Classify the Fracture

According to MRI



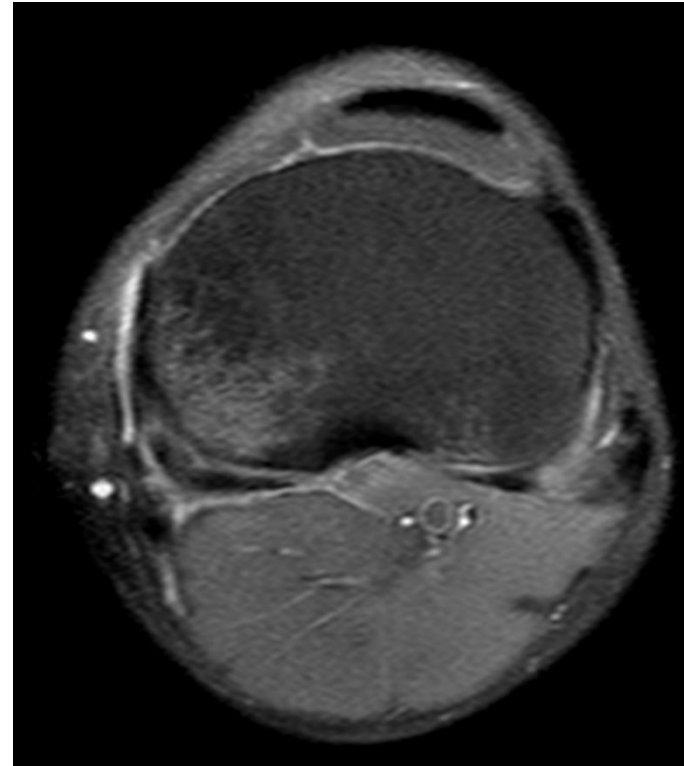
# Classify the Fracture

According to MRI



# Classify the Fracture

According to MRI



# TREATMENT

- **Conservative Treatment**
- 

- **Urgent Surgical Treatment**

- **Difered Surgical Treatment**

# 1.- Conservative Treatment

- Step lower than 2 mm (CT)
- Axial Stability
- General/Local contraindications

# 2.-Surgical Treatment.

## Goals

- Preserv **Soft Tissues**. Vascular Decompression
- Restore **Mechanical Axis**
- Reconstruct **Joint Surfaces**

## **2.- Surgical Treatment**

**Urgent**

**Diferred**

# 2A.- Urgent Treatment

## When:

- Vascular Injury
- Compartmental Syndrome
- Open Fractures
- Floating Knee
- Politrauma



# 2B.- Differed Treatment

## Decision Making:

- Soft Tissues
- Surgical Planning

# Surgical Planning

## 1.-Bone Grafting:

- - Autograft
- - Alograft
- - Bone Substitutes

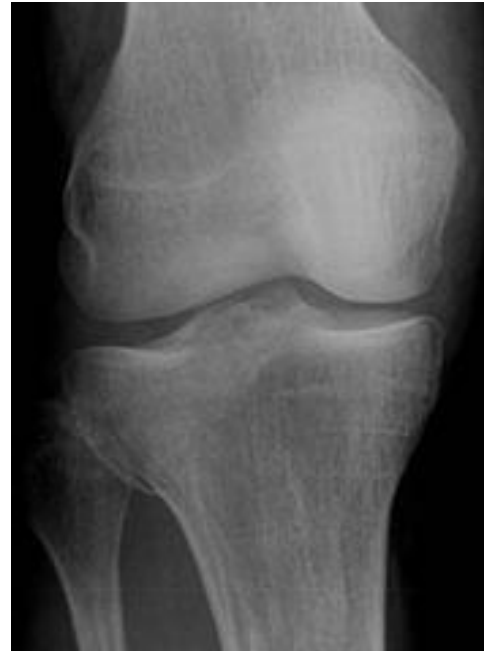
## 2.-Stabelize the fracture:

- - Screws
- - One or more Plates
- - Hybrid Fixation
- - Joint Fixation

# Decision Making

## 2.- Stabilize the Fracture:

- - **Screws**
- - One or more Plates
- - Hybrid Fixation
- - Joint Fixation



# Decision Making

## 2.- Stabilize the Fracture:

- - Screws
- - **One or more Plates**
- - Hybrid Fixation
- - Joint Fixation



# Decision Making

## 2.- Stabilize the Fracture:

- - Screws
- - One or more Plates
- - **Hybrid Fixation**
- - Joint Fixation



# Decision Making

## 2.- Stabilize the Fracture:

- - Screws
- - One or more Plates
- - Hybrid Fixation
- - **Joint Fixation**



# TIBIA TUBEROSITY FRACTURES

We have reviewed tibia tuberosity fractures surgically treated between 2011 and 2014

# 42 Tibia Tuberosity Fractures X-ray

- 7 fractures 41 B1 y B2



and



- 23 fractures 41 B3



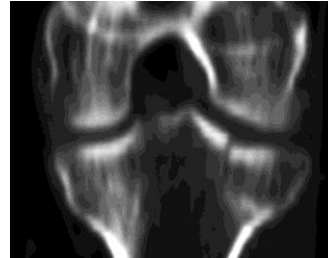
- 12 fractures 41 C3



# 42 Tibia Tuberosity Fractures CT

- **2 fractures 41 B1**

(7 fractures 41 B1 y B2)



- **14 fractures 41 B3**

(23 fractures 41 B3)



- **26 fractures 41 C3**

(12 fractures 41 C3)



# 42 Tibia Tuberosity Fractures 3D CT

- **2 fractures 41 B1 y B2**

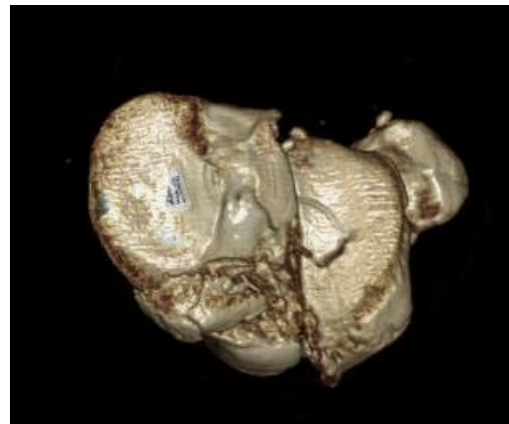
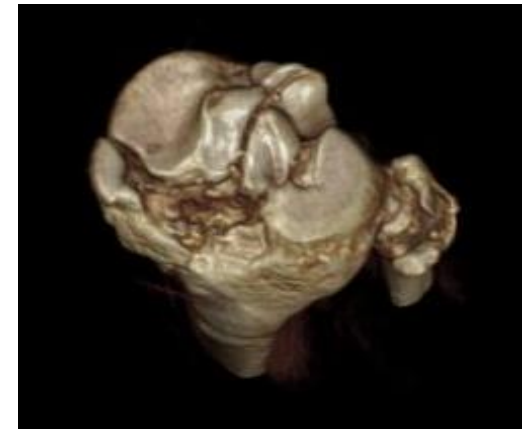
(7 fractures 41 B1 y B2)

- **14 fractures 41 B3**

(23 fractures 41 B3)

- **26 fractures 41 C3**

(12 fractures 41 C3)



# Does classifying the fracture help in decision making?

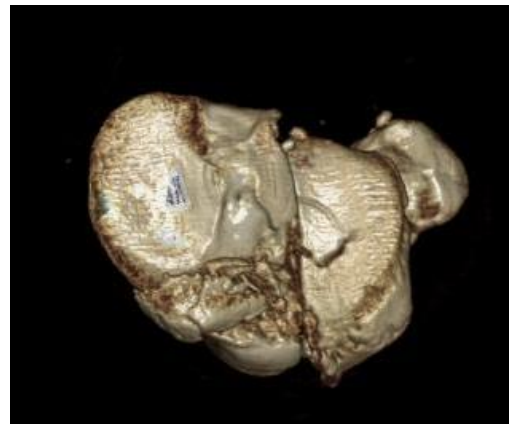
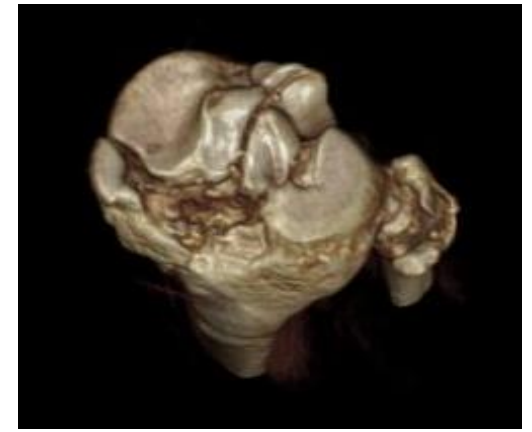


# 42 Tibia Tuberosity Fractures 3D CT

There are no rules

- **14 fractures 41 B3**  
(23 fractures 41 B3)

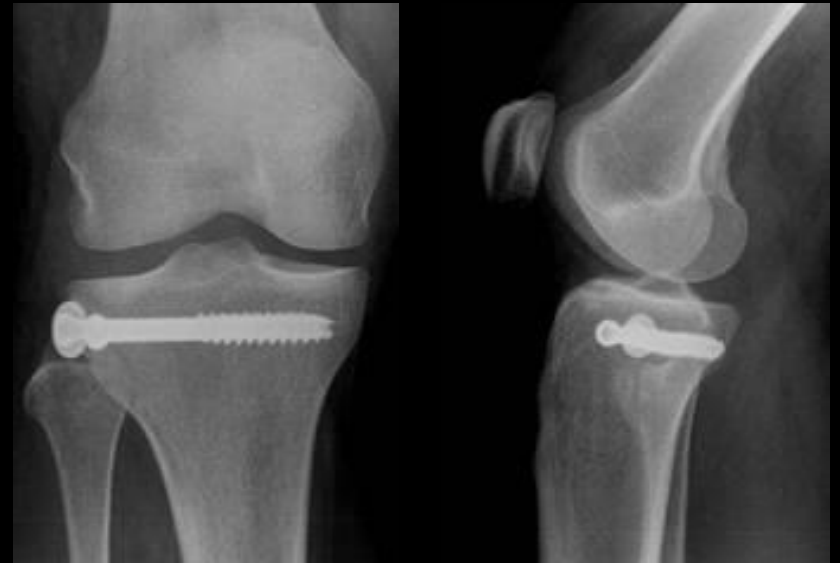
- **26 fractures 41 C3**  
(12 fractures 41 C3)



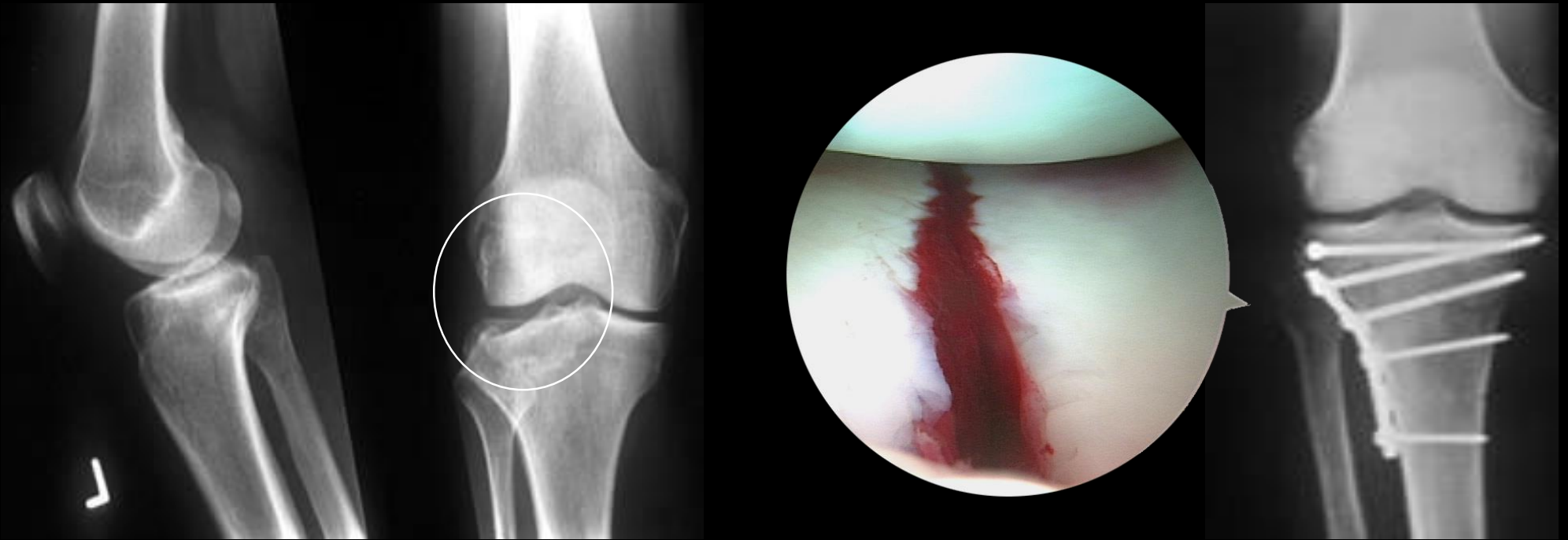
# Does classifying the fracture help in decision making?

The **final decision** is the result of several factors including **surgeon's skill, surgical planning and logistics**. (equipment and graft) in each case.

- 2 fractures 41 B1



- **14 fractures 41 B3**



**Arthroscopy guided and percutaneous surgery...**

- **14 fractures 41 B3**



**...except for 6 cases where 3D CT scans influenced our initial decision.**

- **14 fractures 41 B3**



**In 6 B3 fractures the 3D CT scan showed the need of an anatomical designed plate**

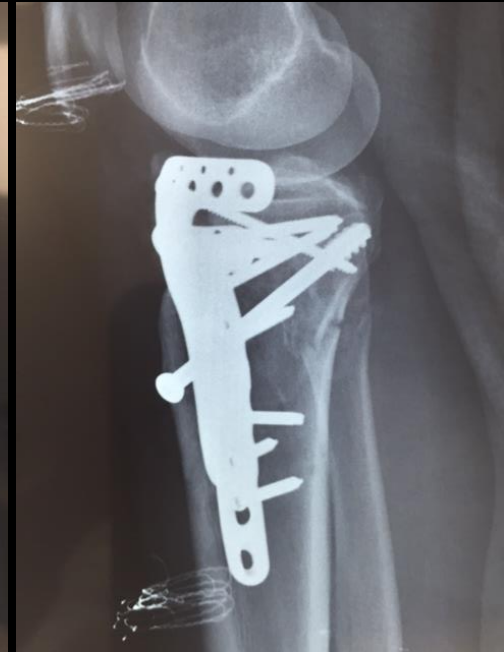
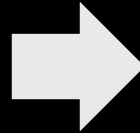
- **26 fractures 41 C3**



**Double plate system was used in 26 C3 fractures but with complications...**

- **7 arthroscopy artrosclerosis**
- **2 fractures needed upper tibia osteotomy**
- **1 distal femur osteotomy**
- **3 plate infections**
- **2 failed fracture fixation**

- 2 fractures 41 C3 lost their fixation



- **Why did the fixation failed?**



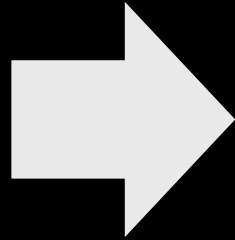
**Front**



**Lateral**



**Posterior**



- 2 fractures 41 C3 lost their initial fixation



# Agenda - Treatment

1. Explore the Fracture ID

2. Classify

3. Treatment Options

4. Take Home Message

# Take Home Message

## **1.- 3D CT Reconstruction**

Define radiological instability criteria. (postero-medial fragment and head of the fibula)

# Take Home Message

## 2.- Soft Tissue Care

Release compartments

Repair meniscus and soft tissues

Close by layers

# Take Home Message

## 3.- Surgical Pearls

Restore extensore mechanism

Make metaphysis functional and stable

Anatomical reconstruction and rigid fixation for the epiphysis

# Take Home Message

## ... Surgical pearls

Harvest sufficient bone graft

Have required surgical logistics

Be prepared to solve complications

# Thank you for your attention



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