Module 1. Managing Medical Pathologies 1

1.1 Urgencies and emergencies

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1. Cardiovascular pathology. Unconscious patient.

1.1 Cardiac arrest. Sudden cardiac death

Estimated incidence of sudden cardiac death (SCD) in athletes is two cases every 100 000 athletes per year.

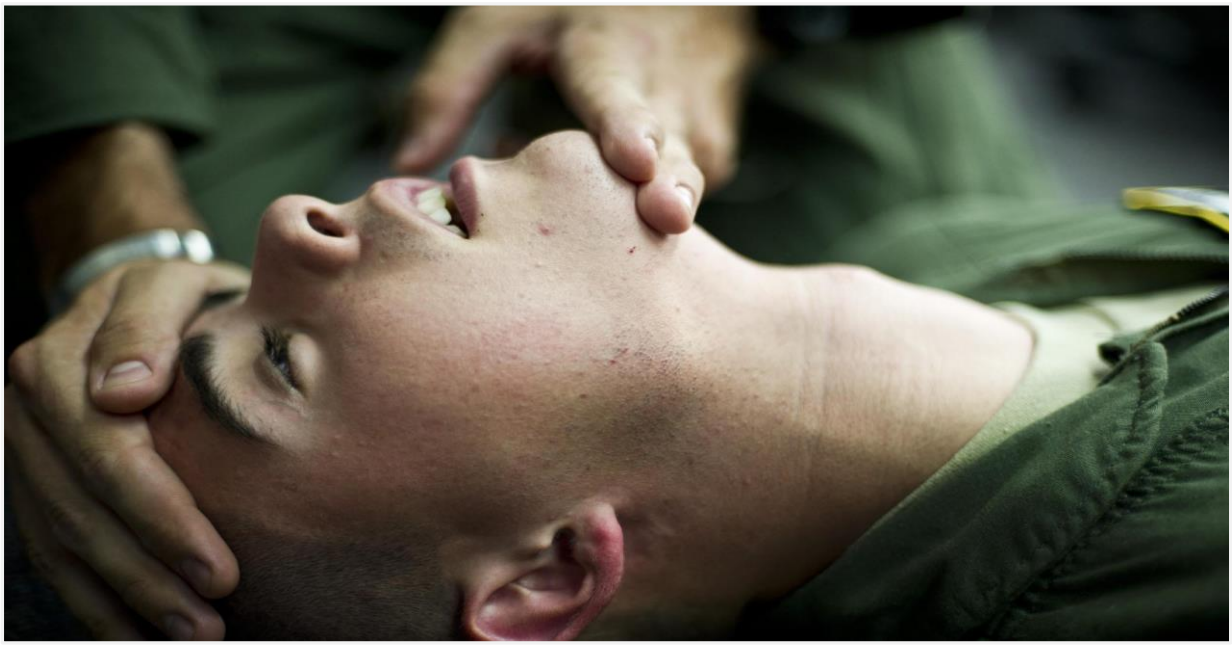
A prevention screening significantly reduces the risk of such events: medical records and physical examinations are the main recommendations of the American Heart Society. To those recommendations, a resting electrocardiogram is added by the *European Society of Cardiology*. Ergometry has been suggested for those who are over 30, though the relationship between cost and effectiveness for the prevention of SCD is controversial.

The most common causes of SCD in young athletes are:

- Hypertrophic cardiomyopathy.
- Congenital heart defects.
- Arrhythmogenic right ventricular cardiomyopathy.
- Aortic stenosis.
- Brugada syndrome

The most common cause of cardiac arrest is the ischemic cardiomyopathy. When an athlete is unconscious a quick and systematic assessment should be done in order to eliminate cardiac arrest. To assess if the patient is breathing well, we have to perform a correct opening of airways (Figure 1).

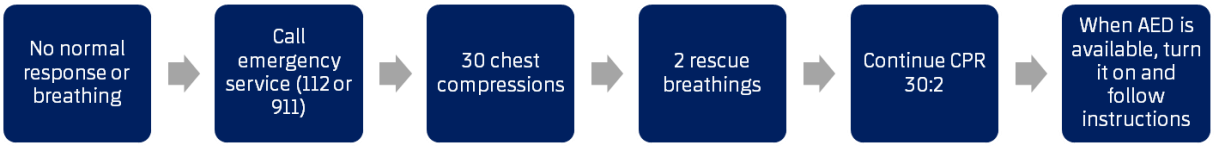
Figure 1: Opening of airways



Source: [Image without heading about opening of airways]. (2017). Taken from https://almostadoctor.co.uk/encyclopedia/airway-management/attachment/120807-f-jh117-089

An unconscious patient who is not breathing normally will be diagnosed with cardiac arrest, so we need to start the algorithm detailed below:

Figure 2: Algorithm for Cardiac Arrest



Source: Monsieurs et al., 2015, https://bit.ly/2WOm08y

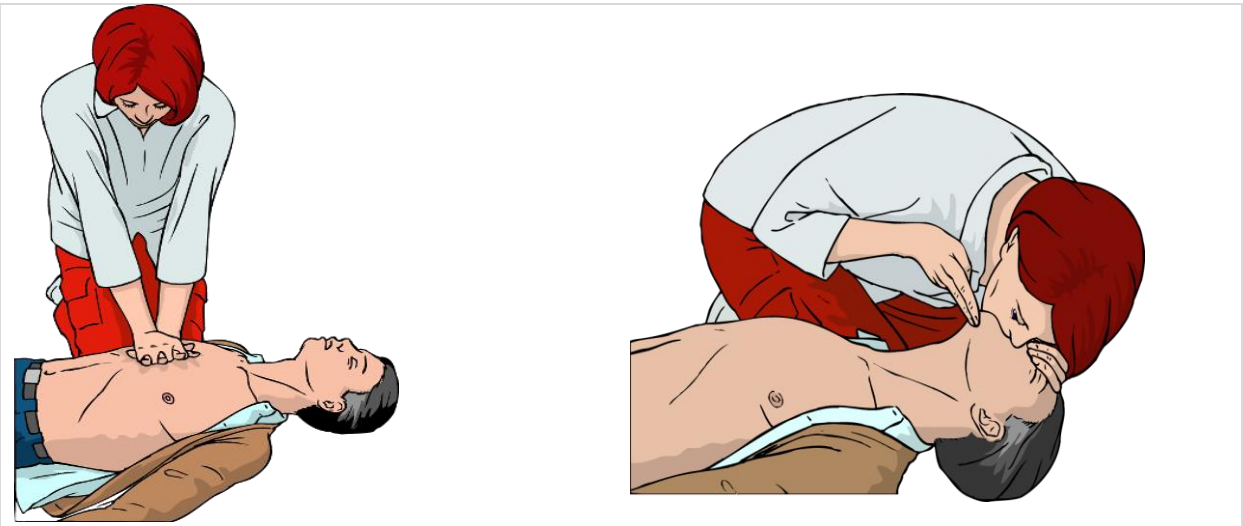
Important considerations for Cardiac Arrest:

- Using an automated external defibrillator (AED) is the procedure that saves lives.
- High-quality cardiopulmonary resuscitation techniques (CPR) reduce mortality and long-term sequelae.
- The early detection of cardiac arrest, of the start of CPR techniques, and of the use of AED are the key for a longer survival.

High-quality techniques:

- 30 chest compressions/2 breathings (Figure 3).
- Compression rate of 100-120/min
- Compression depth of 5-6cm
- Rescuers switch roles every 2 minutes or when there is fatigue.
- Rescuers quickly switch between roles to minimize interruptions in CPR.

Figure 3: Chest compressions and rescue breathings

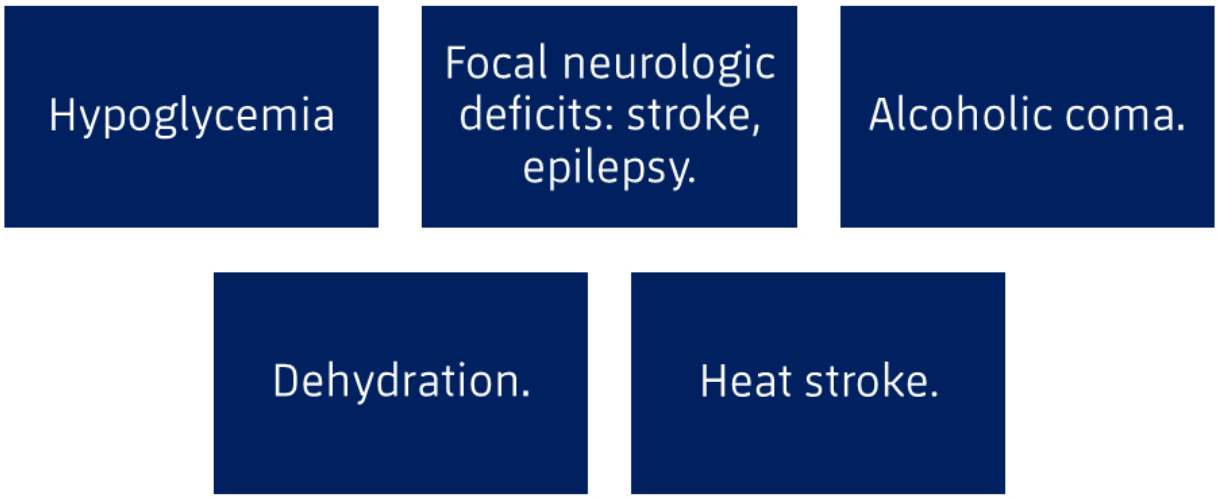


Source: Crespo Naranjo, 2016, http://slideplayer.es/slide/10676796/

1.2 Unconscious patient

A patient who does not respond and has a normal respiratory rate (excluding the traumatic cause). It is important to search the cause for this.

Figure 4: Causes of Cardiac Arrest



Source: prepared by the author.

Whenever this happens, we have to:

- Call emergency number (112 or 911).

- Put the patient in a lateral position (Figure 5).
- Start permeabilisation of airway (Guedel/Mayo tube) if the patient tolerates it.
- Apply ice packs in armpits and nape in case of a heat stroke.
- Do not administer liquids or medicines if the patient is unconscious.
- Perform constant reassessment.

Figure 5: Lateral position

Source: Monsieurs et al., 2015, https://bit.ly/2WOm08y

2. Traumatic pathology

The following is the initial approach to a traumatised patient:

The first action to perform is to assess if the athlete has a local trauma or a polytrauma. Local traumas are more frequent. Polytraumas are more common in specific sports (such as cycling, motorcycling, motor racing, ski, among others)

2.1 Polytrauma

In the case of a polytrauma we have to assess the environment. It is a must to remember that the priority is that both, the patient and the physician, are in a safe environment to start the ABCDE assessment:

A: *airway*

- Monitor the airway.
- Stabilise the vertebral column.
- Permeabilise the airway (open and without obstructions).

- With a polytraumatised patient we should suspect a vertebral column injury until proven, so we should immobilise the cervical column (using a rigid cervical collar), and thoracic and lumbar columns (using a spinal board). The rigid cervical collar will only provide between 40% and 70% of immobilisation, so we need to perform a manual stabilisation.

B: *breathe*

- Guarantee that oxygen reaches the lungs.
- Check that the patient is breathing and in case they are not start breathing with a device bag-valve-mask, mouth-to-mouth breathing or others.
- Permeabilise the airway with an oropharyngeal airway (Guedel/Mayo tube).
- Assess the chest to look for asymmetries and pneumothorax or cardiac tamponade.

C: *circulation* (circulation and control oof the haemorrhage)

- In case of external haemorrhage: apply direct pressure to active haemorrhages, raise limbs. Tourniquets are always the last resource.
- If we suspect internal haemorrhage, we should prioritise obtaining venous access for the administration of fluids, and for the hospital transfer.
- Pelvic and abdominal traumas have a high risk of internal haemorrhage. We should monitor the vital signs: heart rate, blood pressure and capillary refill time.

D: *disability* (neurologic deficit)

- Glasgow Coma Scale assessment.
- Pupillary assessment (size, shape and reaction to light).

Table 1: Glasgow Coma Scale and Score.

RESPONSE		**SCORE**
Eye	Open spontaneously	4
	Open to verbal command	3
	Open to pain	2
	No eye opening	1
Verbal	Orientated to person, time and place	5

	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No verbal response	1
Motor	Obeys commands	6
	Localising pain	5
	Withdrawal from pain	4
	Flexion to pain	3
	Extension to pain	2
	No motor response	1

Source: prepared by the author.

Glasgow Coma Scale interpretation:

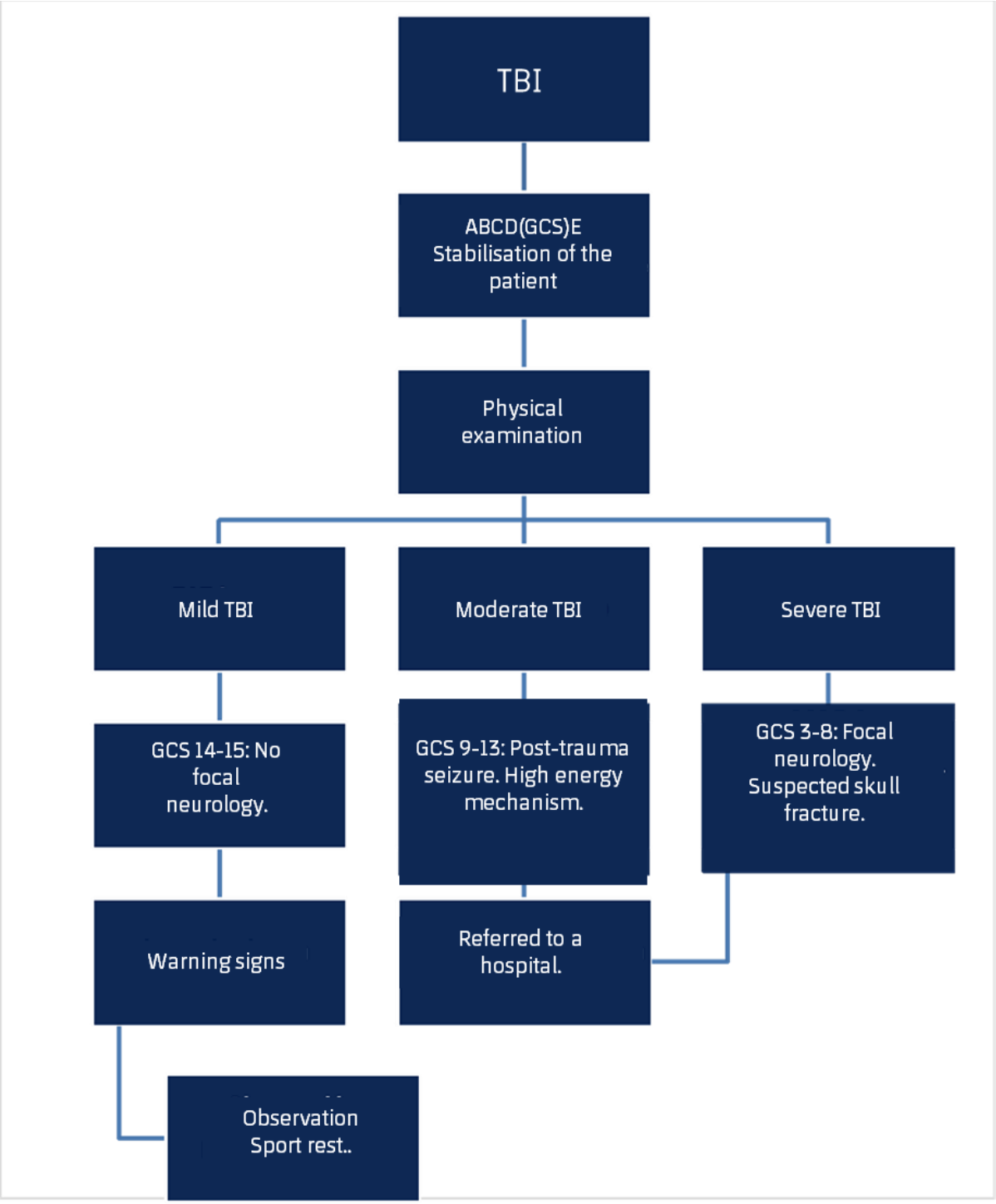
- **Mild TIB:** 13-15.
- **Moderate TIB:** 9-12.
- **Severe TBI:** 8 or <8 **->** Requires ensuring airway permeability.

E: *exposure* (exposure and control of hypothermia)

- Assessment of less visible areas (back, armpits and perineum). We always do it through a block movement with control of the cervical column.
- Avoid hypothermia.

2.1.1 Traumatic Brain Injury

Figure 6: Classification of traumatic brain injury severity (TBI)



Source: prepared by the author.

Important:

If the athlete is unconscious after a TBI or vertebral column injury we should not:

- Move the cervical column.
- Place them in lateral position without stabilising the cervical column.
- Try to permeabilise the airway manually (do not put the fingers inside the mouth).
- In polytrauma in high energy accidents (motor racing, motorcycling, etcetera), we should not remove the helmet if we do not have the required knowledge for the regulated removal from the vehicle with the appropriate material.

Figure 7: What NOT to do with an unconscious athlete after trauma:

Source: "Vídeo. - Simeone sobre golpe de Torres: 'Sentí un ruido desde el banco'", 2017, https://www.diariomas.hn/2017/03/02/video-simeone-golpe-torres-senti-ruido-desde-banco/

Concussion

The management of concussions in athletes has changed over the last years. Different studies have shown that concussions are under diagnosed and underestimated in the sports world.

This type of trauma should be assessed as any other trauma, starting with the ABC assessment approach, and if everything is normal and the potential severe pathology is eliminated, the athlete should leave the playing field for a comprehensive assessment.

Athletes can explain headache, dizziness, nausea, feeling of heaviness or 'fogginess', vision or balance disorders, amnesia, irritability, loss of consciousness or even seizures.

Such symptoms usually improve some minutes after the trauma but they can last for up to 5-7 days.

In the last years, different quick assessment tables have been developed for concussions. One of the most used is the one created by FIFA, which allows the physician or physician extender to perform a systematic assessment of the athlete.

In the case of a patient with warning or disorder signs, the level of consciousness should be referred to a hospital for observation and assessment of complementary examinations (see table below).

Table 2: Warning signs

WARNING SIGNS
Cervical pain
Double vision
Weakness/ Tingling in lower and upper limbs
Sharp headache or progressive increase
Seizure
Loss of consciousness
Cognitive deterioration
Nausea / Vomiting
Aggressiveness / Irritability

Source: prepared by the author.

In case the patient shows symptoms of concussion, they should be immediately taken from the playing field, and they should not be allowed to return to play until the symptoms are completely gone.

The *return to play* process should be done in a progressive way in order to guarantee that there are not any kind of neurological symptoms. This process usually takes between 5-7 days.

Table 3: *Return to play*

Return to play		
Satege	**Allowed Activity**	**Objective**
Rest	Complete mental and physical rest.	Recovery until symptoms are gone.
Aerobic exercises.	Jogging. Stationary bike. Swimming (low intensity).	Increase heart rate.

Specific sports exercises.	Sprint exercises.	Start of sports movements.
Training without contact.	Progression to complex exercises. Progressive resistance training.	Progressive coordination, resistance and load.
Complete training.	Normal team training.	Recover confidence and assess skills.
Return to competition.	Game.	Full recovery.

Source: prepared by the author.

2.2. Local trauma

Initially, a good anamnesis of the mechanism of injury, the type of pain and its intensity (EVA) should be done, this is, a comprehensive physical examination.

In the playing field two decisions have to be made:

- Can the athlete continue in the game?
- Do they need more medical care?

2.2.1. Dislocation

- ***Glenohumeral dislocation***
    - Therapeutic guides advise not to perform reduction manoeuvres before associated fractures are eliminated.
    - Shoulder dislocations are anterior in >95 % of the cases (posterior dislocation should be suspected in two cases: electric shock or as a result of seizure).
    - The most common mechanism of injury is abduction and external shoulder rotation.
- ***Finger/toe dislocation:***
    - Reduction plus functional bandage or splint.
- **Ankle dislocation:**

- Reduction manoeuvres are only recommended when there is a vascular or nerve injury.

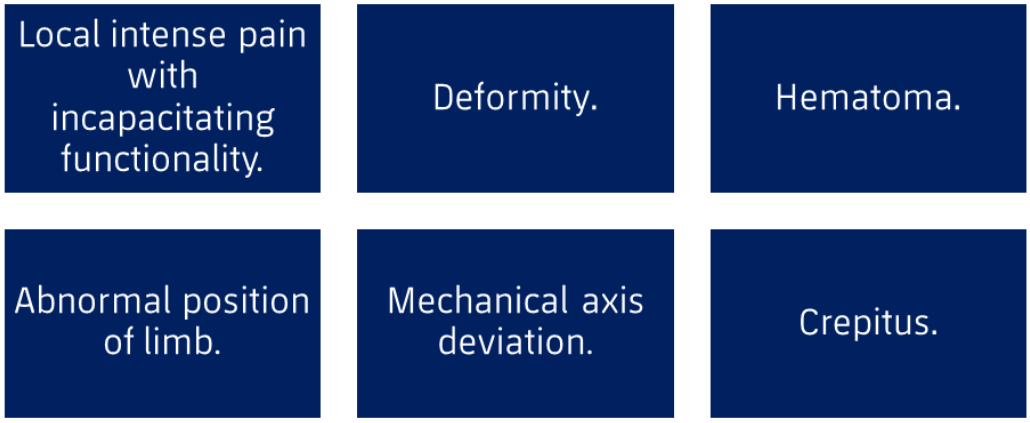
- ***Patellar dislocation:***
    - This is common in patients with joint hyperlaxity and low quadriceps muscles.
    - The recommended manoeuvre is reduction with progressive extension of the knee and lateral press on the patella.
    - After that, the limb should be immobilised. It is advisable that the athlete do not continue the game.

For a correct **dislocation reduction** our objectives should be:

- Overcome the contracture and pain to ease the manoeuvres with local, intra-articular, nerve block anaesthesia or sedoanalgesia.
- Perform a correct post-reduction immobilisation.
- After a dislocation, the supporting tissues of the joints are ineffective, so there is a high risk of relapse. It is advisable not to continue in competition after a dislocation.

2.2.2. Fractures

Figure 8: Symptoms of fracture



Source: prepared by the author.

Derivation criteria:

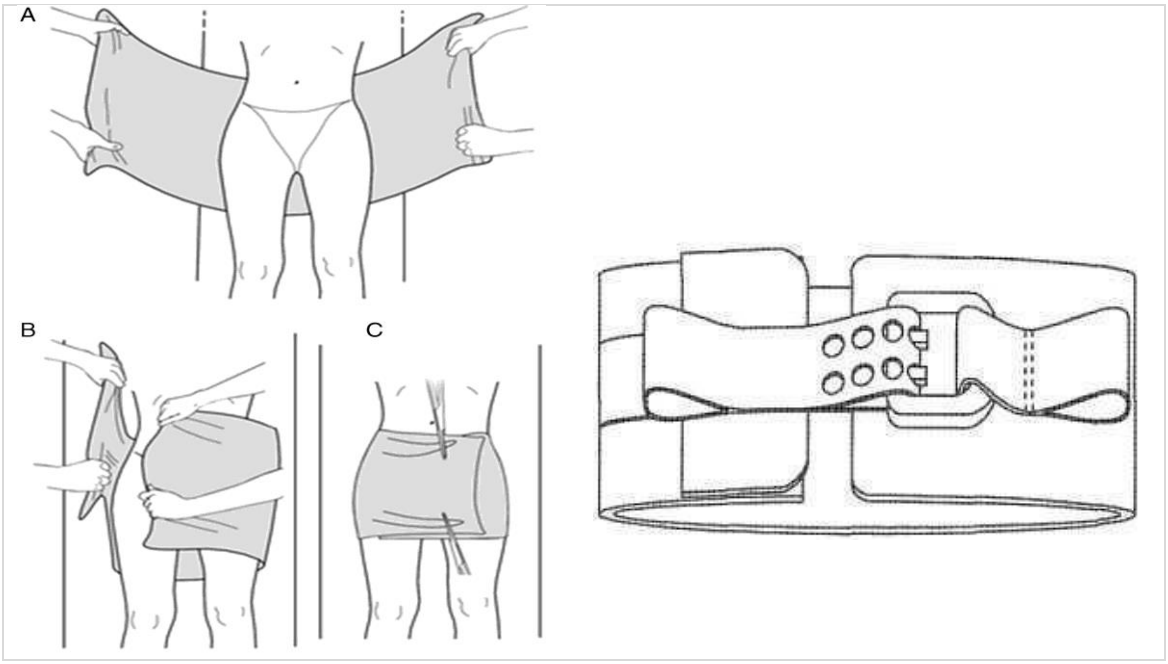
- Suspected fracture of pelvic ring.

- Open fracture.
- Displaced fracture.
- Vascular or nerve trauma.
- Fracture and dislocation.
- Suspected compartment syndrome.

Actions:

- Fracture alignment, unless there is open fracture in which case, we have to avoid movements.
- Assessment of the presence or absence of distal pulses and the sensitivity reactions so as to eliminate vascular or nerve trauma. In case of suspected vascular or nerve injury, perform a traction in the limb to revert the situation. Such manoeuvres should be executed by trained staff.
- In case of a suspected fracture of pelvis ring, the patient should be stabilised with specific devices or with a sheet, as shown in Figure 9.
- Do not forget that a fracture is painful, so administering analgesics is key to the comfort of the athlete.

Figure 9: Pelvic stabilisation devices:



Source: Pablo-Márquez, Bailez-Arias, Yela-Verdú and Santano-Rivas, 2014, https://www.elsevier.es/pt-revista-medicina-familia-semergen-40-articulo-fractura-pelvis-atencion-extrahospitalaria-S1138359314000355

2.2.3. Wounds

Warning signs:

- Loss of substance.
- Arterial bleeding (pulsatile).
- Uncontrolled bleeding.
- Dirty wound.
- Nailed foreign objects.

Actions:

- Assess if the wound allows the athlete to continue participating.
- Assess the use of bandages, suture and closure with staples or skin adhesive. These cures should be performed with maximum hygiene to avoid possible subsequent infections.
- In case of a haemorrhage, direct and constant compression should be used. Lift the limb if it is possible.
- In case of arterial bleeding compression should be longer.
- In case of uncontrolled bleeding, and only if the patient's life is at stake (due to hypovolemic *shock*), performing a tourniquet should be considered. It is very important to write down the time in which it is performed (ischaemic time). Hospital derivation.

2.2.4. Epistaxis

Perform direct compression on the nasal flaps, apply ice and keep sedestation with head leaning forward. Assessment of possible fractures in nasal bones. Anterior tamponade with epinephrine.

2.2.5. Loss of dental pieces

Keep the pieces in saline. Urgency for a maxillofacial surgery to consider reimplantation.

3. General considerations

3.1. Circuit for urgencies and emergencies

In any sports event, possible urgencies and emergencies should be taken into account as precautionary measures. Such precautionary measures should be planned according to the emergency plans of the organising entities and the current regulation.

According to the type of event you should plan:

- Preventive teams: basic and advanced life support ambulances, community health centres.
- Security: police, social protection.

The medical or sanitarian team should be included in the in the precautionary measures and they have to know the resources available. Anyway, it is necessary that the members of the emergency plan know the location of the sanitarian staff and have the means to communicate with them.

The material for urgencies and emergencies should be regularly revised.

3.2. Medical material

The material should be adapted to the type of sport and its competitive level. We will not use the same material for activities with low contact than for activities with risk of trauma of high energy (cycling, motor sports, etcetera.)

Table 4: First aid kit of the team physician

Team physician. First aid kit		
CPR	**Traumas**	**Medication**
Phonendoscope. Tensiometer. Pulse oximeter. AED Oropharyngeal airways. Oxygenation equipment. Resuscitation balloon. Laryngoscope Tracheal tubes.	Rigid cervical collar. Spinal board. Vacuum mattress. Splints / Slings. Functional bandage. Elastic bandage. Material for cure (suture, staples.) Pelvic stabilisation devices.	Infusion equipment. Intravenous medication. - Intravenous fluid therapy. - Analgesics (dexketoprofen, metamizole, fentanyl). - Medication for advanced CPR (adrenaline, amiodarone, adenosine.)

Source: prepared by the author.

1.2 Infection and sports

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Topics:

1. Physical activity and infection: defence mechanisms.
2. Infection and sports performance.
3. Response of the body to physical exercise during infectious disease.
4. Infectious disease and sports participation
    a. Transmission by direct physical contact:
    herpes simplex, dermatomycosis, bacterial infections.
    b. Transmission by cohabitation with young people:
    respiratory and digestive tract infections.
    c. Transmission by blood or secretions:
    infectious mononucleosis, hepatitis A, B, C, HIV
5. Preventive measures for infections in athletes
    a. Hygiene measures
    b. Immunisation
6. Treatment for infections in athletes
7. Olympic and Paralympic Games in Rio 2017: how they get ready for a competition at a prevention and treatment of infectious disease level.
8. Important concept: messages to remember.

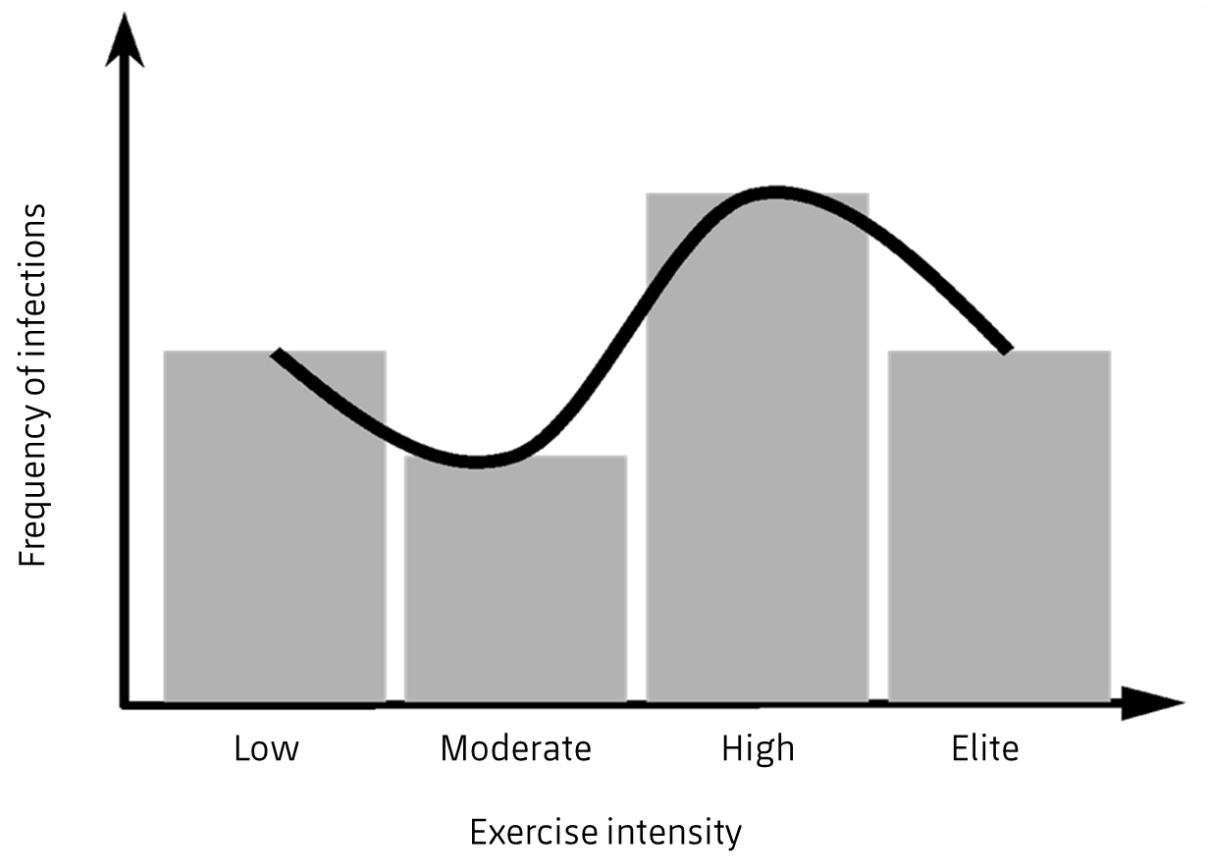
1. Physical activity and infection: defence mechanisms.

It is assumed as a scientific fact at a popular level that physical conditioning helps to prevent infections, while physical exhaustion or poor physical level increase the chances to have common infectious diseases.

Under normal circumstances, a moderate and continuous physical activity practice is a source of health. Likewise, it improves the quality of the tissues that make up the musculoskeletal system, and the adaptation of the respiratory and cardiovascular systems in stress circumstances, it eases the immune response when there is infection (Malm, 2006.) This means it has reliable beneficial effects on psychosocial aspects of the individual. However, a continuous high-intensity exercise jeopardises the immune system when there is an infection (Stuempfle Valentino, Hew-Butler, Hecht and Hoffman, 2016; Gleeson and Pyne, 2016; Grosset-Janin, Nicolas and Saraux, 2012):

- It favours mild infections, especially of the upper respiratory tract.
- It worsens the evolution of these infections when physical exercise is done.
- It has a negative influence in the evolution of the disease as shown below.

Figure 10: S-curve that depicts the relationship between the frequency of infection occurrence and physical work intensity



Source: prepared by the author based on Malm, 2006.

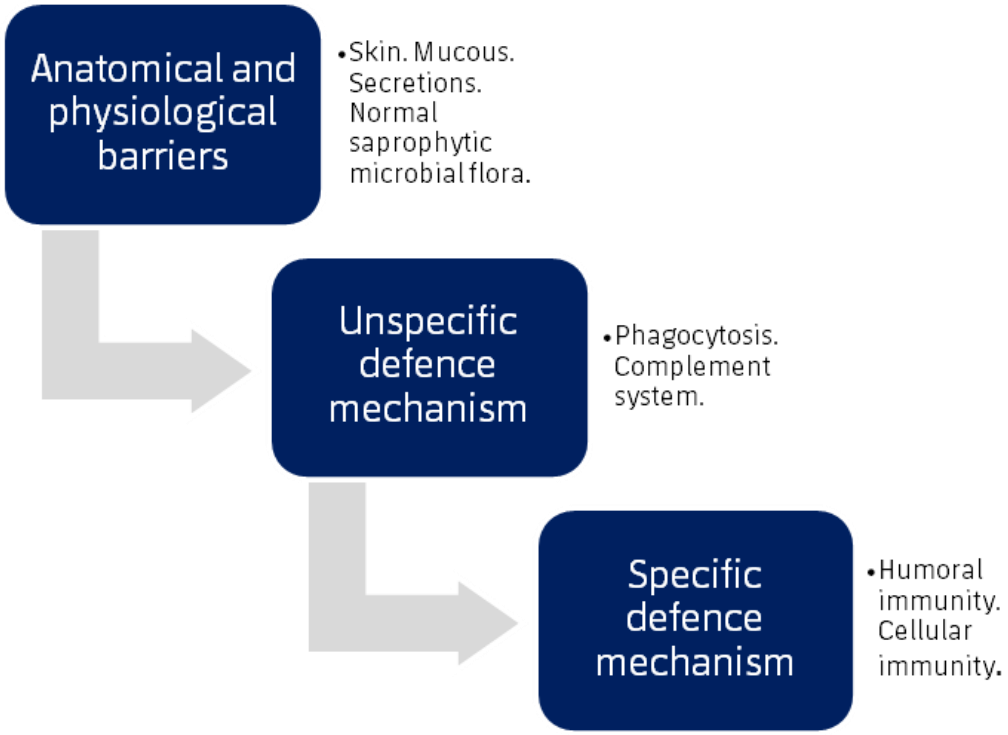
The first line of defence against infections are the anatomical and physiological barriers that prevent the entry of pathogenic bacteria to the organism:

- Skin, mucosa, secretions and normal saprophytic microbial flora.

Exercise has low influence in these barriers, but skin traumas (abrasion, cellulite) or exposure to different types of weather, sunburn as well as frostbite could alter these barriers.

If the micro-organism alters these barriers and enters the organism, a second unspecific (phagocytosis, complement system) and specific (humoral and cellular immunity) defence mechanism appears.

Figure 11: Barriers and defence mechanisms



Source: prepared by the author.

Defence mechanisms against infections

Phagocytosis is the second line of protection made up of polymorphonuclear leukocytes and macrophages that increase during the infection, they increase their functionality as well. However, the phagocytic activity does not increase during the physical exercise.

The complement system is one more unspecific mechanism that is activated during the infection; however, it does not present changes with physical exercise.

Lymphocytes are the defensive cells of the first line, and that is why they are the most important link between exercise and immune response. It seems that they increase with exercise even though their response depend on the population: CD 4 lymphocytes increase during the infection, but there are no changes, and they even decrease during the exercise. However, CD 8 lymphocytes increase in both cases, so the quotient CD 4/CD 8 tends to decrease.

As regards interferon, interleukin 1 can increase with exercise. It seems that there is an activation of the cellular immunity with physical exercise in a similar way that happens with infections. As regards immunoglobulins, there is not increase of total or specific immunoglobulins against antigen in sports practice; however, the decrease of IgA that produces saliva after an effort has been proven, and would predispose to acute respiratory infections, specially viral ones.

Therefore, we can answer to the question: does usual sport or exercise affect host resistance to infection? There is no conclusive information as regards the protection that physical exercise can exert against an infection. It seems that the athlete is not more resistant to infections than the sedentary individual. Moderate exercise improves immunity and decreases the presence of banal infections. However, subjects exposed to excessive volume and intensity trainings, especially if they reach overtraining levels, have infections more often and with a higher intensity (Minoree, Wang and Gupta, 2015.)

2. Infection and sports performance.

It is necessary to inquire if the infection can cause serious complications during exercise, and if the symptoms and signs that appear can decrease sport performance.

Infection is the invasion and growth of pathogenic agents in a suitable host. Infectious disease is the organic manifestation of the fight of the pathogenic agent versus the host, and it depends on the toxins of the pathogenic agent, the locus of infection, and above all, on the different intensity and quality of reaction of the host in putting all its defence mechanisms to work.

The presence of infection and the process that come with it (such as temperature, anaemia, iron deficiency, reduction of catabolite clarifying, hepatopathy, nephropathy, heart residual disease, joint inflammation and myalgias and/or arthralgia) will reduce sports performance at the same time they could put the life of the athlete at stake (Drobnic, 1997; Friman and Ilbak, 1992.)

3. Response of the body to physical exercise during infectious disease.

The evolution of the infection in the athlete is similar to the one in the sedentary individuals. Incubation period, symptoms and resolution do not normally vary. However,

exercise or intense use of the systems test them when they have an infection. This will not happen in rest. Some infections with neurotropic pathogens are potentially more serious or even fatal in individuals who are muscular and active, such as poliomyelitis virus and Coxackievirus (Drobnic, 1997; Wesslen et al., 1992; Priemer, Keil and Kandolf, 1999.)

Intense exercise could be very dangerous and it is contraindicated during the acute and symptomatic phase of infectious diseases, especially the ones caused by those microorganisms that have a predilection for tissues that are activated with the exercise, like in the cases of viral poliomyelitis and myocarditis.

However, in those infections with a low level of general impact, recovery could be stimulated with programmes of low intensity physical activity (Friman and Ilbak, 1992.)

During the acute phase and the convalescence of various illnesses, many physiological responses in physical exercise could be altered in an adverse way.

High temperature alters the cardiovascular response to exercise:

- decreases the ability of work,
- increases heart rate,
- increases cardiac output.

This can provoke presyncope or syncope with a reduced maximum performance. Besides, an orthostatic hypotension could be produced in effort recovery. On the other side, dehydration secondary to temperature would raise these responses.

Body temperature regulation is altered, and combined with dehydration and altered vasomotor response could lead to exhaustion or heat stroke (if we add warm weather conditions.)

In respiratory infections:

- increases resistance of airways,
- there are abnormalities in the quotient ventilation/perfusion
- decreases the diffusing capacity.

Therefore, exercise tolerance is jeopardised. The duration of abnormalities in the pulmonary function could last for weeks.

4. Infectious disease and sports participation.

Physicians should frequently decide when the athlete can return to the training sessions or to competition after and infectious disease.

Athletes are more exposed to infections since they are in continuous contact with contaminated environmental objects or elements that ease the entry of the germ, especially if the mechanical barrier, the dermis, is altered (Adams, 2002.) Top-level competition athletes have different trips during the season that, occasionally, entail extreme weather changes, time and biorhythm changes, and exposure to different diets, and variations in their regular rest as well. On the other hand, many athletes, during their formative and sports practice have a high rate of coexistence in closed groups since they share their residence, locker rooms, sports facilities that are wrongly or little aired, and they are not always hygienic. All these factors make them prone to catch specific infections.

a) Transmission by physical contact

Healthy skin has bacterial and fungal microorganisms that are usually balanced and do not cause diseases. If these bacteria (***Staphylococcus Aureus and Streptococcus Pyogenes***) enter the skin, they can cause infectious diseases.

Some of the bacterial skin diseases are:

- Impetigo.
- Abscess.
- Folliculitis.
- Furuncle.
- Carbuncle.
- Paronychia.

Wrestlers, and contact sports in which athletes have skin infections, should follow the regulation in force sin 1975 - updated in 2011 by NCAA (National Collegiate Athletic Association.)- It proposes:

1. Complete at least 72 hours of antibiotic treatment.
2. Absence of new lesions for at least 48 hours.
3. Absence of moist, draining or weeping lesions.

4. Active lesions should not be covered to take part in competition.

Impetigo:

Caused by *Strerptococcus* or *Staphylococcus*.

- Clinic: each lesion starts as a group of red papules that become vesicles and pimples. It is characterized by skin blisters full of a honey-coloured liquid with ooze and crust (yellowish crust) in face, lips, arms or legs. It is highly contagious. In general, the lesions are painless. Temperature is not a characteristic of impetigo. If there is temperature, we must suspect that the infection has gone deeper. It can occur after an RSV infection.

- Treatment:

    - Dicloxacillin or Cephalexin.

    - Topical Mupirocin.

- The most important item is to prevent the spread of the lesion:

    - Use a fresh towel every single time.

    - Do not share towels or shaving machines.

    - Wash your hands every time after you touch the lesion.

    - Disinfect equipment (mats, towels, protections, water bottles, clothes items) that has been in contact with the lesion.

Folliculitis:

Inflammation of one or more follicles. It can appear in any skin region. It is frequent in beard hair follicles and it is caused by *Staphylococcus*. Athletes can return to their sports activity when lesions cicatrice. Cover inactive lesions with rigid and impermeable dressings.

- Treatment: Dicloxacillin, Cephalexin, Clindamycin.

Furunculosis:

It is a deeper, larger and more painful lesion than folliculitis since it has pus.

- Treatment: Dicloxacillin, Cephalexin, Clindamycin.

Carbuncle:

It is a group of many furuncles. It is usual in the inferior part of the neck in wrestlers. It is very painful and it is spread by direct skin contact.

- Treatment: Dicloxacillin, Cephalexin, Clindamycin.

- *Pseudomonas spp*: they grow in a moist environment. They appear together with folliculitis in athletes due to the use of Turkish baths and steam baths. It is transmitted by contact with towels and clothes.

Viral infections:

- *Herpes gladiatorum:* it is an infection caused by herpes simplex types 1 and 2. It is spread by close and direct contact between two wrestlers. It is an annoying and contagious infections that mainly affects the thorax, ears, face and hands.

- The typical lesions are vesicular on an erythematous base.

- It is characterised by small painful sharp blisters, burning along a nerve tract.

- They could appear together with temperature, photosensitivity, malaise and headahces.

- Blisters are contagious by direct contact on the first 7 days.

- There is not a granted disinfection, and there is only one preventive measure: waiting for the infection to subside.

Fungal infections or mycosis

In general, fungi are microorganisms that grow better in warm and moist conditions. That is why mycosis are usually transferred in public places like swimming pools, showers and locker rooms. These are places visited by many people and in which the conditions of warm and moist are the needed ones.

Besides, fungi can behave as an opportunistic germs, this is, they take advantage of the situation in which the patient has a reduction of their defences. This happens, for example, in patients of advanced age, in people with diabetes or in patients under cancer treatment (chemotherapy), among others. (Romaní De Gabriel, 2019,

https://www.salud.mapfre.es/enfermedades/dermatologicas/infecciones-micoticas-de-la-piel/).

Depending on the affected region we will have (Romaní de Gabriel, 2019):

- *tinea pedis* (athlete's foot),
- *tinea manuum* (in hands)
- *tinea capitis* (scalp)
- *tinea corporis*.

Tinea corporis: this infection is transmitted in contact sports. It is a scaly ring-shaped area that heal form the inside. It could present a single or multiple rings.

Antifungal treatment could be topical or oral depending on the type of infection and its extension.

In the case of *tinea pedis* prevention is done by wearing flip-flops in showers, locker rooms, and drying feet and interdigital folds well.

Cutaneous candidiasis: it is caused by the fungi *Candida Albicans* in any region but, in general, in warm and moist regions like armpits and groin. It is characterised by a red rash that grows. Recommendations are to have a good hygiene, keep the skin dry and in airy places. Talc can help to prevent the infection. It is not very frequent in athletes.

b) Transmission by cohabitation with young people

- Respiratory tract infections: the viruses that cause these infections range from a common cold, rhinopharyngitis, pharyngotonsillitis, tracheobronchitis and otitis to adenovirus, mixed herpes viruses, myxovirus, enterovirus, chlamydia, mycoplasma.

  Infections of the respiratory system are more frequent, especially, in specific groups of athletes (Steffen et al., 2017; Svendsen, 2016). Sports that use the respiratory system at a high intensity and, especially, in variable environmental conditions of temperatures, humidity, pollution, presence of allergens, etcetera, test their physical adaptation system and their immunity (Bjørneboe et al, 2016). The incidence of infection of the upper respiratory tract in cyclists, long-distance runners, mountaineers, swimmers (among others) is higher than in the general

population, especially in specific moments of the season because they are exposed to different environments, different pathogens, and with different levels of immune defence (Malm, 2006; Spence et al., 2007.)

- Common cold is caused by over 200 viruses, and over the half of them are rhinoviruses. Although the symptoms are usually benign and localised in the upper respiratory tract, they can present complications with bacterial sinusitis or otitis media.

  Is it risky to exercise when you have a cold? There is no easy answer, but there are some circumstances in which doing physical exercise is not advisable. **If there is fever, the combination with the excess of heat caused by the exercise and a bad regulation of the temperature caused by fever could lead to a thermal injury.** The organism fights against cold and fever, the thermoregulatory system returns to normal and the loss of heat initiated could lead to dehydration. It is better to rest and avoid exercising when you have fever.

  It is important to keep in mind that frequent colds in an athlete could be an indicator of overtraining.

c) Transmission by blood or secretions

Infectious mononucleosis: it is a disease caused by the *Epstein-Barr* virus (EBV) and it is usual in the first three decades of life.

- Clinical presentation: it is characterised by asthenia, pseudomembranous pharyngotonsillitis, cervical and/or generalised lymphadenopathy, and hepatosplenomegaly is frequent.

- There are leucocytes with lymphocytosis and alteration of the of the liver function tests.

- Diagnosis is confirmed with the detection of specific immunoglobulins IgM against *Epstein-Barr* virus. The disease spontaneously cures, even though the virus can persist in the organism for months, even years.

- In some athletes there are two important complications:

  - Spleen fragility in the acute phase of the disease that can lead to a splenic rupture with a minimum trauma.

  - Persistence of a chronic fatigue or post viral asthenia syndromes that can last for a long period of time, and assessing the patient should be taken into

consideration (we have to take into account possible asymptomatic infections caused by EB virus in order to perform a proper diagnosis.)

Some physicians allow bearable moderate aerobic sport

Contact sports should be avoided until spleen size reduction.

- Other airborne or enteric transmission viral infections are caused by ***Coxsackie B3*** virus which causes myocarditis. It is, generally, spontaneously cured but it could be fatal in some cases. This disease could be a symptom and manifests itself as an arrhythmia or a fatigue state that are not caused by overtraining, but by an infection that should be studied. In occasions, it is possible that it responds to an exercise overexertion in a person with a weak heart due to the infection, or with an inflammatory process in the muscle or connective tissues.

- Upper respiratory tract infections (URI) are a disabling disease for the athlete. During winter months, their frequency can increase (Orizyak et al, 2017.) The effects of URIs on the cardiac, respiratory and muscle functions usually lead to longer complications. Prevention consists in avoiding sudden efforts and having the best recovery possible after the infection. We should have special interest in those athletes with pre-existent inflammatory processes such as asthma, or those who are going to compete in special environments, such as a swimming pool (Hellard, Avalos, Guimaraes, Toussaint and Pyne, 2015), high mountain, a polluted environment, etcetera. Contact sports would also be taken into account (Suzuki y Tagami, 2015.)

- On the other hand, we have to take into account waterborne gastrointestinal infections (Arnold et al., 2017) or foodborne ones. They cause diarrhoea and, probably, dehydration, so they should be prevented.

Infections contracted during sport activities are caused by the contamination of visible skin lesions due to the blood or secretions of an infected mate.

- **Hepatitis B:** currently, there exist the possibility of a protective immunisation for athletes, mainly, for those who participate in contact sports.

  Clinical suspicion:

- **Hepatitis C:** it has an insidious beginning, sometimes it is asymptomatic, and it frequently tends to chronicity, cirrhosis and hepatocarcinoma.

  Clinical suspicion:

- **AIDS** (acquired immunodeficiency syndrome): the abundance of AIDS virus in blood, sweat and saliva is lower than Hepatitis B virus. It could increase when there are skin lesions in people who suffer from AIDS or are human immunodeficiency virus (HIV) carriers. Transmission is possible; therefore, the most efficient preventive measure is that the athletes stop their activities and cure them so there are no possibilities of transmission.

5. Preventive measures for infections in athletes

Hygiene measures

- Personal hygiene (Ranchordas, Bannock and Robinson, 2016)

Handwashing, not sharing towels, clothes items, footwear, etcetera in locker rooms. Wearing breathable fabric, mainly in regions where the infection could raise due to the increase in temperature or moist favouring the growth of fungus that, in normal circumstances, already exist due to the moist environment (as in swimming.) It could also be caused by the chafing between external elements in other disciplines such as the contact with the seat in cycling or motor sports. In combination with the sweat of the athlete, it causes vaginal infections (by *Candida Albicans*.) Changing wet clothes to avoid local moist.

- Environmental health: maximise hygiene in areas where there is moist such as showers, locker rooms, steam baths, Turkish baths, swimming pool chlorination.

Previous knowledge of competitors.

- Skin infections: it is advisable that the athlete with a skin infection does not participate in contact sports.

- Infections transmitted by contact or blood and secretions: if the injured person is bleeding, sport activity should be interrupted until the bleeding stops and the person is disinfected. Physicians and physical therapists should wear gloves and use disposable material to avoid transmission.

- It is recommended to use condoms in sexual intercourse (Psutka et al., 2012.)

<u>Active immunisation</u>

There are vaccines that should be compulsory for people who take part in team or contact sports such as:

- Professional athletes who live in high performance centres, in students' residences or the like. Annual influenza vaccination is recommended.

- International athletes who travel should consult about the required vaccination in the country where the competition takes place.
- It is necessary to check that the immunization schedule of the athlete is updated. Mainly, we have to check that they have the MMR vaccine.

Figure 12: Vaccines

Source: prepared by the author.

6. Treatment for infections in athletes

The belief that antibiotics reduce performance is frequent. Post-infection anaesthesia is caused by the infection, not by the use of antibiotics.

- Antibiotic treatment of the infection does not reduce performance or cause fatigue. There is no evidence that proves this aspect. Performance could be affected in a secondary way by the side effects of some antibiotics or by the idiosyncrasy that conditions the individual (intestinal dysbacteriosis, pyrosis, etcetera) (Malm, 2006; Drobnic, 1997) ***Reduction in athletes' performance in an antibiotic treatment is caused by the infection itself.***
- Antibiotic treatment should not be modified in patients who are athletes since the germs do not select who to attack. In an empirical way and with a treatment, and in specific acute conditions, *antibiotic therapy could be initiated and you can double the initial dose with the aim to reach the MIC as fast as possible*. Experience does not indicate an improved evolution, but in this way a correct treatment for the first days is guaranteed, and we get the athlete to be more alert and controlled.

  Dosage has to be taken into account when dealing with athletes that have a low-protein diet, or are in periods of dehydration. Dosage should be adjusted to those situations in order to reach the right antibiotic availability.

- Treatment with corticoids, when necessary, should be adjusted to the current anti-doping regulations. If needed, we should request a standard Therapeutic Use Exemption (TUE.)

Table 5: Antibiotic treatment of infections

Recommendations for antibiotic treatment of infections in athletes
- Oral administration treatment.
- Pleasant presentation (taste, swallowing.)
- One or two daily doses.
- Minimum adverse side effects
- Treatment with the shortest possible duration (<1 week.)
- Bactericidal antibiotics.
- Associated to effective symptomatic treatment in its right doses.
If there is any concern, consult and expert in infectious diseases.

Source: prepared by the author.

7. Olympic and Paralympic Games in Rio 2017: how they get ready for a competition at a prevention and treatment of infectious diseases level.

A close example of prevention and treatment of the infection are the athletes that participated in the Olympic Games in Rio de Janeiro in 2017. We had a proper assessment to prevent possible infections.

1. We assessed the risks of infections in Brazil:

- Gastrointestinal infections.
- Influenza.
- Dengue and Chikungunya.
- Zika.

2. We checked the previous vaccines of our athletes, especially the MMR one. We consulted mandatory and recommended vaccination to enter Rio de Janeiro:

- Yellow fever: for trips longer than 21 days. Yellow fever vaccine is not mandatory to enter Rio de Janeiro, but it is recommended to enter the Amazon region.

- Hepatitis A: vaccination against this disease is recommended. Besides, you have to watch for poisoned food and water.

- Update vaccination for Hepatitis B.

- Vaccination against typhoid fever is recommended.

- Malaria does not represent a risk in Rio de Janeiro, but it does in the Amazon region.

- Risk of Dengue, Zika, Chikungunya.

- Risk of cholera in open water swimmers.

3. Medical assessment and treatment of possible endemic infections in the country: Zika (Trilla and Trilla-Aymerich, 2016)

It is transmitted by Aedes mosquito bites. In addition, it can be transmitted by sex, transfusions and in pregnancy.

Clinically, it is similar to a mild flu. 75% of the cases are asymptomatic even though there could be some symptoms such as myalgias, arthralgia, headaches, conjunctivitis, asthenia, skin rashes or low fever for a period of 2-7 days. Its incubation period ranges from 2 to 10 days. The disease can appear 15 days after the trip. There is a connection between Zika infection and anomalies in fetal development (microcephaly) with an estimated risk of 1-14%. It is a Public Health Emergency.

Recommendations for athletes:

- It is recommended to use condoms in Rio de Janeiro and during the following 28 days after return, since many cases of infection go unnoticed.

- Cover most of the body with clothes. Wear long-sleeves, pants and light colours.

- Use repellents: DEET, Icaridin, IR3535, Citrodiol. Apply and repeat every 4-6 hours depending on the repellent. Do not apply in children under 2 months old. Use mosquito nets.

- Check if the mosquito nets of the hotel room are in good conditions. Do not open windows since air conditioning works as a protection.

- Check water, ice cubes, caipirinhas and ice-creams. Drink bottled water.

- Wash hands frequently.

- It is recommended to peel off fruit yourself and eat it without skin.
- Do not eat raw food: salad, fish, seafood.
- Do not eat street food.

8 Important concepts

Considerations about the athlete and their relationship with the infection

- Athletes are not more resistant to infections than sedentary people. The period of infection is the same in both cases.
- There are sports level and sports in which infections in the upper respiratory tract are more frequent.
- High intensity exercise can worsen the evolution of some infections.
- It is not advisable to exercise when there are general symptoms of an infection (fever, arthralgias, chills, etcetera.)
- The immune system of athletes can fail when they overtrain or they are in a fatigue state.
- Antibiotics do not cause fatigue.
- Antibiotics do not work in a different way due to exercise.
- It is not necessary to modify the dosage in athletes.
- Infection prevention in athletes is important.
- Medical and vaccination assessments are recommended for the athlete when facing international trips.

Allergy and Sports

Authors: PhD Montse Bellver and PhD. Franchek Drobnic,

Topics:

1. Exercise-induced respiratory diseases
    a. Exercise-induced pathogenesis of asthma
    b. Diagnosis of exercise-induced respiratory diseases
    c. Exercise-induced asthma, bronchoconstriction and rhinitis treatments
    d. Allergy and asthma in athletes: recommendations for not specialised physicians
2. Exercise-induced urticaria and anaphylaxis

a. Pathogenesis

b. Cholinergic urticaria: clinic

c. Anaphylaxia: clinic

d. Diagnosis

e. Treatment

Allergy and Sports

> Physical exercise is a key aspect in the general education of children, and a healthy activity in adults. In children with asthma, an adequate physical exercise positively contributes, from a medical and psychological point of view, to improve adaptability, independence and communication of the children with asthma and their environment.
>
> Suffering from an allergic disease should not be a selective factor to practice sports. The example is that there are many elite athletes who suffer from allergic diseases, and this does not prevent them from practising high-performance sports.
>
> Allergic diseases that can worsen and present symptoms with physical exercise are bronchial asthma, urticaria, mainly, the cholinergic one and anaphylaxis. Durán, 2011, http://jdpbootcamptrainingcadiz.blogspot.com/2011/09/el-deporte-y-las-alergias.html).

Exercise-induced (EI) hypersensitivity disorders are significant problems for recreation as well as for professional athletes. These include:

- Respiratory system.
  - Asthma.
  - Bronchospasm.
  - Rhinitis.
- Integumentary system
  - Urticaria.
  - Angioedema.

- Cardiovascular system.
    - Anaphylaxis.

Although most of the patients survive to such overresponse, it is probable that exercise causes a recurrence of the same conditions and, as consequence, a future exercise activity reduction. In many cases, these disorders are associated to allergic sensitivity (immunoglobulin IgE). A group of experts from the European Academy of Allergy and Clinical Immunology and from the American Academy of Allergy, Asthma and Immunology met to discuss the pathogenesis of these disorders, how to diagnose and treat them, and then they developed a consensus report. The aim is to provide physicians with guidelines for diagnosis, understanding and management of hypersensitivity disorders in order to enable patients to safely resume exercising.

Exercise-induced respiratory diseases

Exercise-induced asthma is defined as the obstruction of the lower airway, and the symptoms in patients with underlying asthma are cough, wheezing or dyspnoea (Bousquet et al., 2007.) The same clinical symptoms in individuals who do not suffer from asthma are defined as bronchoconstriction. It is arguable if EI-asthma and EI-bronchoconstriction are different disorders, since they manifest in a similar way and they share a physio pathological mechanism. Asthma attacks in athletes affect performance significantly.

Exercise-induced asthma (EIA) manifests in almost every person with asthma who are not under control, and in most children with asthma (Bacharier et al., 2008.) EIA or bronchoconstriction does not only prevail in elite athletes (Haatela, Larsson and Bonini, 2005; Bonini et al., 2015), especially in those who participate in endurance sports such as cross-country skiing (Stang, Stensrud, Mowinckel and Carlsen, 2016), swimming (Mountjoy et. al., 2015), road bicycle racing and long-distance cycling, but also in printers, strength sports in special environments such as ice-hockey, and trail athletes. It is more prevalent in professional athletes than in recreational athletes (Parsons et al., 2007; Weiler and Ryan, 2000.)

Exercise-induced rhinitis is characterised by itch, sneezes, rhinorrhoea, nasal congestion and occasional anosmia caused by exercise (Bonini et al., 2006.) This disease also present symptoms in the eyes, ears and throat. Underlying non-infectious rhinitis could be classified in different types (Tabla 6.)

Table 6: Exercise-induced rhinitis

Classification of exercise-induced rhinitis
Etiology

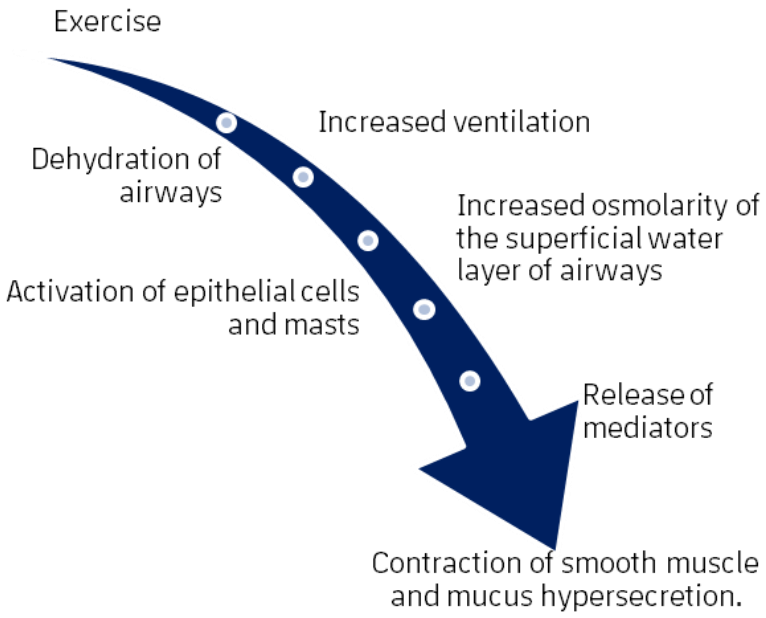
Allergic (IgE mediated)
Non-allergic
Clinical symptoms
Intermittent
Persistent
Mild
Moderate
Severe

Source: prepared by the author.

The prevalence of underlying rhinitis in athletes is similar to the one in nonathletes. Allergic rhinitis affects 25% of adults in Europe and up to 40% of children around the globe (Bousquet et al., 2008; Bjorksten, Clayton, Ellwood, Stewart, and Strachan, 2008.) The latter group is normally encouraged to take part in sports. Athletes who suffer from rhinitis, especially with congestion, usually present disturbed sleep with daytime sleepiness, fatigue and performance reduction.

Exercise-induced pathogenesis of asthma

Figure 13: Exercise-induced pathogenesis of asthma



Source: prepared by the author.

Athletes who suffer from EI-asthma or bronchoconstriction have an increase in the

inflammation markers in airways and in the histamine, tryptase, leukotriene and chemokine levels. These are the same biomarkers we generally observe in asthma. Besides, loss of heat with airways cooling (left air flow) stimulates their receptors and promotes vasoconstriction.

Reactive hyperaemia takes place due to overheating associated with vascular congestion and tissue oedema, and this provokes a greater reduction of the air flow. EIA is also modified by pre-existing atopy with bronchial hyperreactivity and inflammation of the airways; by autonomic deregulation related to intensive training, and by sport specific environmental factors.

Diagnosis of exercise-induced respiratory diseases

We have to take into consideration that patients with EIA could suffer from underlying asthma which is worsen by a low control of exercise. Methacholine challenge can show bronchial hyperreactivity even when basic spirometry is normal and does not correlate with hyperreaction to exercise. SABAs (Short-Acting Beta-2 Antagonists) can revert exercise induced bronchospasm.

The methods and thresholds to record EI-bronchoconstriction are different for recreational athletes and professional athletes.

- For recreational athletes: running for children or jogging for adults for 10 minutes (1km) is adequate to diagnose IE-bronchospasm (decline of 10% in FEV1.)

- For professional athletes: exercise should reach 90% of the maximum heart rate or to 40-60% of maximum ventilation for 6-8 minutes in treadmill or stationary bike (Crapo et al., 2000; Bonini et al., 2007.) This has been stipulated by the authorities. Surely, they will continue updating the specific criteria for asthma diagnosis.

Next, the criteria set for the documentation of EI-bronchospasm in athletes in Beijing 2008 by the Olympic Committee is presented.

- Increase of FEV1 with bronchodilator less than 12% in the baseline or a predicted FEV1 over 200ml.

- Initial decrease of FEV1 equal or superior to 10% in response to exercise or eucapnic voluntary hyperpnea.

- Initial decrease of FEV1 different from 15% after inhaling 22.5ml of NaCL (sodium chloride) 45%g or £ 635mg of mannitol.

- Initial decrease of FEV1 different to 20% in response to methacholine: PC20 £ 4 mg/ml o PD20 £ 400 lg (cumulative dose) or £ 200 lg (non-cumulative dose) in patients that take inhaled corticosteroids (ICS), and PC20 £ 16 mg/ml or PD20 £ 1600 lg (cumulative dose) or £ 800 lg (non-cumulative dose) in patients who take ICS for at least 1 month.[1].

IE-rhinitis is a clinical diagnose but it can be confirmed with stress tests and objective measures of nasal obstruction (maximum nasal discharge, rhinomanometry and acoustic rhinometry), and by mucociliary clearance and the symptoms. However, stress tests are not standardised or validated as a diagnosis tool in IE-rhinitis.

Underlying allergic or non-allergic rhinitis is diagnosed with records, physical examination and specific IgE assessment through skin and lab tests. Nasal allergen tests are usually useful even though they are mainly a research tool. Rhinitis and asthma usually occur together and each of them should be taken into consideration independent of which one is more clinically evident (Bousquet et al., 2008.)

Exercise-induced asthma and bronchoconstriction treatments.

Most of the effective pharmaceuticals for chronic asthma treatments are also effective for IE-asthma and EI-bronchoconstriction treatments. Good control of underlying asthma minimises the reduction of the airway during exercise (Bousquet et al., 2007; Weiler et al., 2007.) Worsening of IE-asthma could be a sign of inadequate control of underlying asthma, and treatment should be considered. Controlling the rhinitis could also improve the control of asthma. A lower nasal congestion should improve sleeping which means an improvement in the quality of life, and, probably, in sport performance. Some pharmaceuticals for asthma and rhinitis are forbidden for athletes that take part in regulated competitions.

Short-Acting b2-antagonists (SABA) are effective to revert IE- asthma or bronchoconstriction, and they are used for their prevention. The effectiveness of inhaled SABAs (salbutamol and terbutaline) against asthma or bronchoconstriction is optimal ***20***

[1] In the case of an athlete with declared but controlled asthma that registers a negative result in bronchial challenge tests, but still seeking for approval to use inhaled b2 antagonist, the following documentation in the medical record presented should be included: consults with their physician for asthma treatment, visits to the emergency department of the hospital, admissions due to acute asthma exacerbations and treatment with oral corticosteroids. Additional information that can help include: age of start of asthma, a detailed description of day and night asthma symptoms, triggers, medicine use, records of atopic disorders or childhood asthma, and physical examination together with the results of skin tests or RAST to prove the presence of allergic hypersensitivity. Negative bronchial challenge tests and the results of allergy tests should be included in the presentation to the Olympic International Committee.

minutes after inhalation and it decreases within a few hours.

Long-Acting b2-Antegonists (LABA) (formoterol and salmeterol) provide protection up to 12 hours after inhalation. However, only formoterol has quick action as SABAs. Therefore, we have to choose formoterol or a SABA but not salmeterol to revert IE-asthma or bronchoconstriction. Inhaled b2 antagonists could mask the worsening of airways inflammation, and they should never be regularly used without inhaled glucocorticoids. (Bousquet et al., 2007). In addition, tachyphylaxis occurs with the regular use of b2-antagonists (Lang, 2007). This reduces the protective effect against asthma or bronchoconstriction, even when used in combination with an inhaled corticosteroid (Bousquet et al., 2007.) Therefore, avoiding the daily use of b2-antagonists will optimise their rescue or preventive effects when they are needed the most.

Inhaled glucocorticoid and/or antileukotriene control underlaying asthma and reduce IE-asthma or IE-bronchocontriction in most of the patients (Weiler et al., 2007; Koh, Tee, Lasserson and Irving, 2007). Zileuton is an inhibitor of leukotriene formation and montelukast, zafirlucast and pranlikast are antagonist of CYSLTR1 receptor. It is important to highlight that the tachyphylaxis of inhaled antileukotrienes and glucocorticoids has not been reported (Bousquet et al., 2007.)

H1-antihistamines and cholinergic antagonists have low impact in asthma or bronchoconstriction, while chromone administered before exercise reduces EI-bronchoconstriction in a 30%

Inhaled xanthine, calcium channel blockers and furosemide have moderate mitigating effects on EI-bronchoconstriction, but side effects usually relegate them (Bousquet et al., 2007; Weiler et al., 2007.)

In IE-asthma or bronchoconstriction that are difficult to control, the combination of inhaled glucocorticoids, oral antileukotrienes and/or inhaled b2-antagonists could result beneficial (Bousquet et al., 2007.)

Nasal administered corticosteroids, for allergic and non-allergic rhinitis, reduce the symptoms and even congestion, and they also improve the quality of sleep (Hughes et al., 2003.) Non-sedating antihistamines reduce the itch, snores and rhinorrhoea (but not congestion) of allergic rhinitis (Tanner, Reilly and Meltzer, 1999.)

Nasal sprays with sedating antihistamines (azelastine) reduce the symptoms, but they spread through the mucous and cause sedation (Golden et al., 2000; Chicharro, Lucia, Vaquero and Pérez, 1998.) Nasal administered decongestants have a quick effect, but they cause rebound congestion (rhinitis medicamentosa) if used regularly. Nasal administered anticholinergic (ipratropium) quickly inhibits rhinorrhoea, and it is the rescue or

prophylactic treatment by excellence when rhinorrhoea is the main symptom.

Nasal administered chromones are not effective rescue agents and provide minimum benefits when administered before exercise. CYSLT antagonists benefit rhinitis as well as asthma.

Other therapeutic options beyond pharmacotherapy in treatments for EI-asthma, EI-bronchoconstriction and EI-rhinitis could include avoidance of allergy triggers or irritants and immunotherapy in patients with specific allergies (Bousquet et al., 2007.) For exercises in cold weather a mask could contribute to the heating of the inhaled air. Infections, gastroesophageal reflux, sinusitis and exposure to contaminants and tobacco smoke should be addressed. Warming up and cooling down exercises could reduce EI-asthma or bronchoconstriction. Depending on the pathophysiology, hydration should be encouraged.

Which pharmaceuticals for asthma and rhinitis are regulated in sports events?

- Stimulants are forbidden during competition, including nasal and oral decongestants (ephedrine, methyl ephedrine)
- Nasal administered decongestants (oxymetazoline, phenylephrine, propylhexedrine) are allowed under certain control.
- B2-antagonists are forbidden, unless a first-time authorisation for therapeutic use of inhaled b2-antagonists in asthma is obtained, even when the inhaled b2-antagonists do not enhance performance. Oral b2-antagonists, ineffective for EI-bronchoconstriction, are forbidden in regulated competitions.
- Although sedating antihistamines are not forbidden, they jeopardise performance and should be avoided.
- Oral and parenteral administered glucocorticoids are forbidden, but topical nasal glucocorticoids are allowed. Inhaled glucocorticoids during competitions need a brief authorisation for therapeutic use.
- Diuretics such as furosemide are forbidden because they can mask the presence of other forbidden drugs. A therapeutic use exemption is not valid if the urine of an athlete contains diuretics in threshold level of a forbidden substance (Fédération Internationale de Football Association [FIFA], 2006).

Allergy and asthma in athletes: recommendations for non-specialist physicians

- An early detection and a correct diagnose are key for the successful management of

exercise-induced (EI) hypersensitivity disorders.

- Asthma symptoms and/or EI-asthma and basal spirometry are not good indicators of EI-asthma in professional athletes.
- Exercise, methacholine, mannitol or hypertonic saline solution or a eucapnic voluntary hyperpnea test are better when performed by expert staff.
- Underlying asthma and rhinitis treatments should follow the guidelines available. Underlying rhinitis should be assessed and treated in patients with EI-asthma since severity of asthma and EI-asthma increases.
- A combination of different types of drugs is often needed to completely control EI-asthma in athletes. Athletes who take part in competitions have to take into account the latest antidoping regulations of the World Antidoping Agency (http://www.wada-ama.org/en/) and the International Olympic Committee (http://www.olympic.org/uk/organisation/commisions/medical/ index_uk.asp).
- If the treatment for EI-asthma does not work, a differential diagnosis with EI-vocal chords, EI-arterial hypoxemia, EI-pulmonary oedema induced by swimming, bad physical condition, other pulmonary disorders and cardiovascular diseases should be performed.
- When anaphylaxis occurs during exercise, it is necessary to perform a thorough intake record of food in the last 24 hours, and to pay attention to derivatives of wheat and seafood.
- Athletes with risk of El-anaphylaxis should have an action plan for future events. This includes stopping exercising with the first warning or symptom, having Epipen (epinephrine injection) available and knowing how to use it, adopting the Trendelenburg position when hypotension symptoms appear.

Exercise-induced urticaria and anaphylaxis

Exercise-induced anaphylaxis is a physical allergy caused by hard exercise and sometimes by moderate exercise (Castells, Horan and Sheffer, 2003.) In these patients, exercise practice does not invariably come with anaphylaxis, it only appears occasionally and it usually surprises the patient. Some athletes develop a food-dependent El-anaphylaxis when they exercise several hours after the intake of a food allergen to which the person is sensitive to, or in some cases, the intake of any type of food (Morita, Kunie and Matsuo, 2007; Du, 2007). Fatigue symptoms, pruritus, heat, flush and urticaria could evolve into angioedema, whizzling, rhinitis, gastrointestinal symptoms and cardiovascular syncope (Sampson et al., 2006.) Factors that favour it could include the use

of aspirins or NSAIDs (nonsteroidal anti-inflammatory drugs), exposure to high levels of pollen, insects' bites, extreme temperatures and humidity, even stress or menstruation.

The most frequent food allergies are caused by wheat (60%), and seafood (18%), but also by peanut, nuts, milk, egg, ((Morita et al., 2007; Romano et al., 2001) fruit and vegetables. The loss of sensitivity towards El-anaphylaxis along time is unusual, but in a study that records 10 years, severity of the episode was stabilised in a 46%, receded in a 47%, and worsened in a 7% (Castells et al., 2003.)

Pathogenesis of exercise-induced urticaria and anaphylaxis

Anaphylaxis and urticaria develop after the release of mediators such as histamine, CYSLT and PGD2 that cause vasodilation, improve vascular permeability and contract the bronchial smooth muscle. These mediators are secreted by mast cells and basophils activated by allergens (Schwartz, 2006.) El-anaphylaxis and urticaria associated with food specific IgE could be developed in this way.

In El-anaphylaxis associated with food, exercise increases the entry of recently consumed food proteins (but digested in an incomplete way), allergens included, in the circulation and they migrate to perivascular and tissue spaces where there are mast cells with allergen specific IgE. The increase in the absorption of allergens derived from wheat gliadin occurs in an experimental way with exercise or aspirin intake. For those with El-anaphylaxis without food allergy, pathogenesis is not so safe. Some cases occur only with exercise, others with exercise after the intake of any type of food. Anaphylaxis during an activity can occur together with an insect bite (Schwartz, Yunginger and Schwartz, 1995), or with an underlying disease such as systemic mastocytosis (Fricker, Helbling, Schwartz and Muller, 1997; Haeberli, Bronnimann, Hunziker and Muller, 2003) with activating mutations of the set tyrosine kinase which increases the risk of anaphylaxis(Simons et al., 2007.) Some cases of El-anaphylaxis occur in athletes with cholinergic urticaria that raise their body temperature with exercise, with cold- induced urticaria and chronic urticaria that have IgG autoantibody anti-IgE receptor that worsen during exercise. In other cases El-anaphylaxis or urticaria can occur in the context of a idiopathic anaphylaxis.

Clinic: Cholinergic urticaria

Cholinergic urticaria is characterised by the development of rounded papules in the area of skin redness. Rounded papules occur together with itchy skin. It has a spontaneous solution within minutes or hours.

Cholinergic urticaria is mainly caused by physical exercise and also by sweat, heat and anxiety. If physical effort has been intense, rounded

papules spread in the whole skin surface.

Cholinergic urticaria prevention should be done with an adequate warm up, avoiding exposition to high temperatures and taking preventive medicine, usually antihistamines, before exercising. Avoiding excessive sweating also contributes to avoid the problem.

Some patients undergo a temporary urticaria outbreak which spontaneously disappears with the continuation of physical exercise. In any of the cases, the right thing to do is to stop exercising when the first symptom appears, which, in general, is generalised itching. Cholinergic urticaria outbreaks are completely finished within minutes or hours (Basomba, s. f., pp. 8-9, Montgomery, 2015.)

Clinic: anaphylaxis

Within allergic diseases, anaphylaxis is the most serious one, since it compromises many organs of the body at the same time (Bonini and Palange, 2014.)

An anaphylaxis is easy to identify due to its quick development (seconds or minutes), and its manifestations. After contact with the triggering allergen, the patient will almost instantaneously develop generalised itching (it is usually initiated in palmoplantar region in hand and feet), spread urticarias lesions (rounded papules), facial swelling (angioedema), cough, chest whizzing and fatigue (bronchial asthma attack.) In more serious cases there is abrupt fall blood pressure (hypotension), palpitations (tachucardai) laryngeal oedema (oedema glottidis) which can ultimately lead to loss of consciousness. The severity of the condition forces an adequate an immediate treatment of anaphylaxis. A thorough and detailed study should be carried out by the allergist in the shortest time possible.

Causes for anaphylaxis are very diverse. The most important ones due to their frequency are: food and pharmaceuticals (Basomba, s. f., pp. 9-10.)

Exercise-induced urticaria and anaphylaxis diagnosis

Anaphylaxis should be diagnosed according to the clinical consensus criteria proposed in 2015 (Sampson et al., 2006.) The clinical record should show exercise and an identification of the food and time in which it was eaten in the last 24 hours. Measures for IgE against relevant allergens should be performed with skin tests (even of fresh fruit and vegetables), and with a lab *test*. An exercise provocation test can be performed with or

without food. Differential diagnosis for EI-anaphylaxis includes heart and respiratory diseases with the corresponding evidence. A recurring re-assessment is recommended for loss of sensitivity to food and exercise, since the record of food dependent EI-anaphylaxis is unpredictable (Du, 2007.)

Cholinergic and cold urticarias are mayor considerations in exercising (Powell et al., 2007; Zuberbier et al., 2006.) Cold urticaria is caused by contact with air, fluids or other objects at low temperatures. Swimmers and skiers are at a higher risk. Drowning by cold-induced anaphylaxis could happen in cold waters. Urticaria caused under these conditions could be confirmed if an ice cube on the skin for up to 20 minutes induces urticaria during overheating. Cholinergic urticaria occurs minutes after the increase of body temperature, whether it is passive (warm shower) or active (exercise), and it can advance until an angioedema, bronchospasm or hypotension. The diameter of a calorigenic urticarial weal is smaller than 5 millimetres, while the ones associated with EI-anaphylaxis are much bigger. Solar, aquagenic, vibratory, dermatographic and physical pressure urticarias could be associated with anaphylaxis.

Exercise-induced urticaria and anaphylaxis treatment

Treatment for EI-anaphylaxis or urticaria is based on prevention and the treatment of the acute process (Sampson et al., 2006; Simons et al., 2007.)

Prophylactic management consists of avoiding triggers, especially food. Specific food allergens should be avoided for at least 6 hours before exercising. As a general rule, these patients should refrain from making physical effort up to two hours after eating, independently of any other consideration. A dietitian will help to handle exposure. 'We should keep in mind that minimum quantities intakes, sometimes unnoticed, of this food are enough to cause anaphylaxis' (Basomba, s. f., p. 11.)

When EI-anaphylaxis occurs after the intake of any type of food, an abstinence period of 2 to 4 hours is generally the right one, but individual variation should be considered.

Teachers, close friends and family members of children with food allergy probably need special assessment. We should consider avoiding beta blockers, angiotensin-converting-enzyme inhibitors and angiotensin receptor blockers, since these are pharmaceuticals that can increase the severity of anaphylaxis. Aspirins and NSAIDs should also be avoided since they increase gastrointestinal permeability. Prophylaxis with H1 and H2 antihistamines could relieve urticaria (Poweel et al., 2007), but it does not prevent cardiovascular and respiratory manifestations of anaphylasis.

The objective of the immediate treatment is to improve the cardiovascular (hypotension) and respiratory manifestations since these are the main causes of death (Sampson et al.,

2006.) A personalised emergency plan should be developed: how to use an identification medical alert device, and exercising with a trained mate. Patients should learn to recognise the first symptoms and signs of El-anaphylaxis, and should immediately stop exercising.

> With the appearance of the first symptoms, the initial symptom is usually itching, especially in palms and soles, patients should stop exercising and seat or lie on the floor in case of dizziness (Basomba, s. f., pp. 11-12.)

When a severity sign appears, difficulty for swallowing or breathing or syncope, treatment for anaphylaxis should be immediate. In general, it is necessary to administer adrenaline subcutaneously and intramuscular glucocorticoids. Patients and their close ones should learn the management of these pharmaceuticals. If these pharmaceuticals are not available, patients should be immediately taken to a health centre.

> Some patients have a temporary improvement of the symptoms, but within a few hours, they present a relapse. That is way, if the situation has been serious from the beginning, a period of observation in the following hours is recommended, preferably in a health centre. (Basomba, s. f., p. 12).

However, 'if the patient carefully observes all the preventive measures, physical exercise is a safe activity. However, it is always recommended to carry with them the treatment to be administered in case of a reaction' (Basomba, s. f., p.11.)

Athletes should learn to take the Trendelenburg position to ease the perfusion of vital organs when hypotension occurs, and they should learn to inject an intramuscular epinephrine injection (EpiPenÒ o EpiPenÒ Jr.) in the lateral thigh in order to improve air flow and vascular integrity. Once the emergency staff is involved, anaphylaxis management should be performed according to the guidelines.

> There is a group of patients, quantitatively low, who suffers from anaphylaxis of unknown origin (or Idiopathic Anaphylaxis). In these cases, it is not possible to detect the underlying allergic factor after a thorough

examination, so in these cases the trigger agent is hidden.

In these patients, the only effective prevention is the one focused to avoid the triggering factors of the reaction, as it usually happens with physical exercise. (Basomba, s. f., p. 11).

In this case we should also take into account the intake of food that triggers the response.

1.3 Skin Pathologies and Sports

Author: PhD María Antonia Pol Reyes (2005), Dermatology Depertment in Consorci Sanitari de Terrassa.

Introduction

There are different reasons why sport practices are more frequent in the population. These reasons range from pure fun to keeping youth. That is why we find more and more pathologies associated with sport practice. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

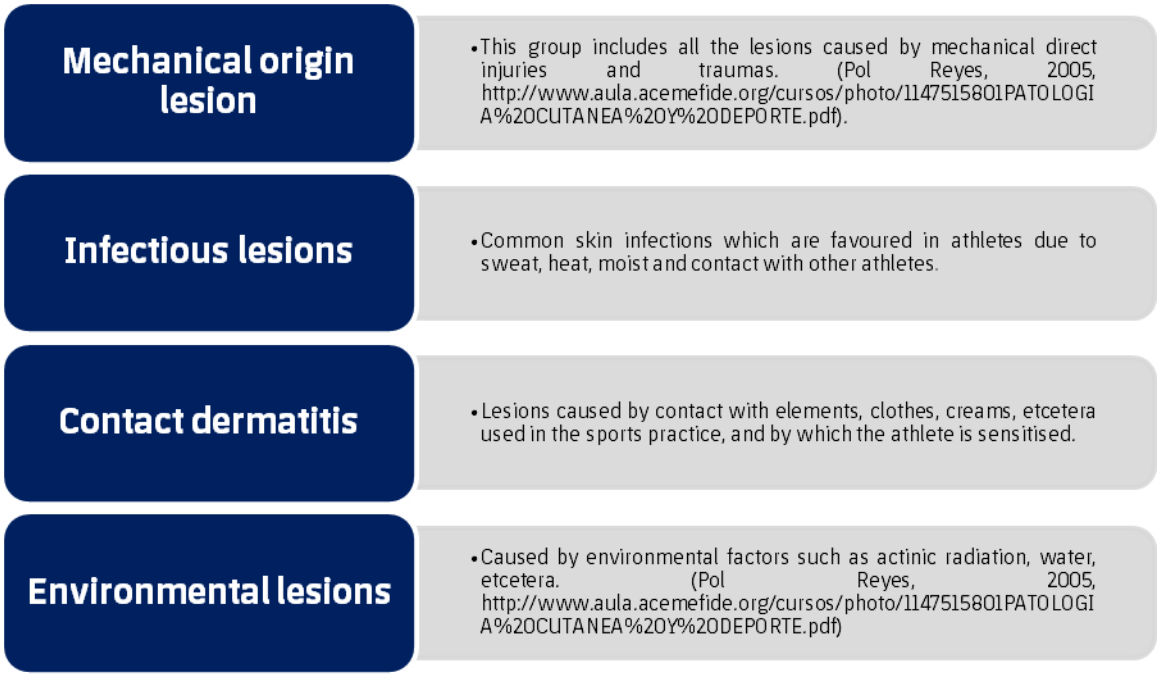
Predisposing factors

The most influential factors in sports pathology are: body constitution and type of skin with the subsequent predisposition of the individual to develop certain illnesses, characteristics of the environment in which the sport is practised, and the specific sport discipline with its most frequently used accessories and elements. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

Classification

'Every skin lesion associated with sport practice could be classified in some of the following groups (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf):

Figure 14: Skin lesions



Source: prepared by the author based on Pol Reyes, 2005.

Skin Lesions Caused by Mechanical Injury

The skin is the anatomic and functional interface between the human body and the environment. In sports practise the skin is under a greater exposure to different types of skin trauma, acute or chronic, and they can cause different alterations. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

These skin lesions are very varied and they are grouped in diverse types, as the table below shows.

Table 7: Haemorrhagic Lesions

HAEMORRHAGIC LESIONS			
Pathology	***Clinical presentation***	***Treatment***	***Comments***
Black heel, calcaneal	• Blue-black pigmentation in	There is no treatment. It is important to calm	It is secondary to extravasation of

petechiae or talon *noire*	posterolateral aspect of one or both heels. ● Well-delimited. ● Painless. 	the patient (Pol Reyes, 2005.)	erythrocytes. It has an acute occurrence before the callus is formed. It is a recurrent trauma in sports with abrupt stops with heel against the floor which causes the rupture of small capillaries. It frequently appears in football, basketball, tennis, volleyball, long jump among others. If we cut the skin with the blade of a scalpel, we could see the black dots.
Black palm.	Haemorrhagic lesions are similar to the previous ones but in hand's palms.	There is no treatment.	It is common in golfers, climbers, and especially in weightlifting.
Ping-pong *Patch*	Annular purpura with a 2-3cm diameter caused by the abrupt impact of a ping-pong ball in the skin.		
Runner's-rump	Not well-defined hyperpigmentation caused by small ecchymosis that occurs in the upper intergluteal cleft in long distance runners. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).		It is caused by continuous and repetitive contact that takes place in the gluteus in every lunge. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

Athlete's nail	• Haemorrhagic colour under toe nails, especially in big ones. • Painless.  	There is no treatment, however, it heals when the sport is abandoned.	Abrupt stops with the toe hitting the tip of the shoe, or the continuous contact are the causes for these subungual haemorrhages. We can find it sports such as tennis or other racquet sports, basketball, football, rugby, volleyball, ski, hockey, *footing*, marathons, excursions, etcetera. Apart from the haemorrhagic colour usually occurs together with toenails thickening and the possibility of detachment (Pol reyes, 2005.)

Subungual Hematoma	• Haemorrhagic colour under toenails means an acute occurrence. • Acute and disabling pain due to the formation of hematoma. 	Perforating the ungual layer and extracting the haemorrhagic content brings pain relief (Pol Reyes, 2005.)	Acute appearance after a stomp in team sports such as basketball, handball, football.
Golfer's Vasculitis	Appearance of petechiae and purpuric lesions in inferior limbs in the area of socks. They can cause mild pruritus and pain. 	Topical corticosteroids. It could be prevented wearing compression socks.	They usually appear after exercising or long walks in warm days. This is due to alterations in thermoregulation and microcirculation with hematic extravasation.

Source: prepared by the author based on Pol Reyes, 2005.

Table 8: Blisters and Erosions

BLISTERS AND EROSIONS			
Pathology	***Clinical presentation***	***Treatment***	***Comments***

Friction Vesicles and Blisters		Treatment is focused on eliminating the content of the blister, leaving the pocket (Pol Reyes, 2005), using hydrocolloid dressings. It is prevented wearing reinforced socks.	'They appear due to violent and repetitive chafing in the same spot when protective calluses are not formed. In hands they appear in tennis..., rowing, weightlifting..., gymnastics' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).
Abrasions	There is a denudation of the epidermis that exposes the dermis. 	For their treatment washing the wound with water and soap, and applying ointment or hydrocolloid patches is recommended.	Synthetic grass causes more problems than natural grass. Synthetic clothes are more aggressive than cotton. 'A special form of abrasion is called 'Salabrasion' caused by skin erosions in the chafing area of the swimsuit in people who are in the sea for long periods of time' (Pol Reyes,

			2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

Source: prepared by the author based on Pol Reyes, 2005.

C- ACUTE INFLAMMATORY LESIONS

Table 9: Acute Inflammatory Lesions

ACUTE INFLAMMATORY LESIONS			
Pathology	***Clinical Presentation***	***Treatment***	***Comments***
Jogger's Nipple	It is more usual in cold weather (due to erect nipple), and when t-shirts are wet since it favours chafing. Intensity of the lesion ranges from mild irritation to nipple fissures.	Diprogenta cream. Prevention: wearing silk or cotton t-shirts, and covering the nipple with Vaseline or medical tape to reduce chafing (Pol Reyes, 2005.)	'Initially, it was found in women who run for long periods of time not wearing bra. Currently, women protect themselves wearing soft bras especially designed; therefore its incidence in females reduced, and there are more cases in male cross-country runners who wear fibre t-shirts. It also appears in cyclists' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOL

			OGIA%20CUTANEA%20Y%20DEPORTE.pdf.)
***Crawl* Swimmer's Shoulder**	'Mechanical acute irritant dermatosis that appears with the continuous rubbing of beard on the right shoulder. 'Erythematous plaque... that appears in the anterior region of the shoulder a few hours after swimming' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf). It spontaneously disappears after a few hours.	It is very intense, the use of topical corticosteroids is recommended. Prevention: shaving before swimming.	
Pool Palms	Erythematous plaques or maculae in palms caused by contact with rough surfaces of swimming pools. It is favoured by hyperhidrosis of the stratum corneum epidermidis due to long ba 	It does not have treatment, but it disappears within a few days.	
Acne Mechanica or Superficial Folliculitis	'It appears as a consequence of four mechanical factors such as heat, occlusion, rubbing and pressure acting on the skin due to different elements such as rugby shoulder pads, acne on shoulders..., isothermal wetsuits of divers..., occlusive dressing' (Pol Reyes, 2005,	Topical antibiotics in hydroalcoholic solutions (erythromycin and clindamycin.)	

	http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf.) 	Prevention: immediate shower after exercising.	
Acne Keloidaes Nuchae or Deep Folliculitis	It causes deep acne lesions. When healing can cause keloids. 	Topical antibiotics, and sometimes oral ones such as doxycycline.	It occurs in sports in which helmets are worn. It is caused by the chronic irritation on the skin.
Ingrown Toenail	'The lateral edge of the nail is pounded in the dermis, and it acts as a foreign body causing inflammation and pain first, and then exuberant granulation tissue' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).	Topical antibiotic (mupirocin or fusidic acid.)	It is caused by tight shoes, wrongly cut nails or biomechanical abnormalities.

			
Pressure Urticaria	They are deep erythematous inflammatory nodules in regions of skin under constant pressure. They cause itching and pain. They appear between 30 minutes and 12 hours after stimuli and they could last for many days. They could appear in the hands or climbers and rowers, in the soles of runners, and in calves due to shin pads.	Oral anti-inflammatory drugs, antihistamines and corticosteroids.	They usually have a great impact in the quality of life of the athlete. They are associated with chronic urticaria.

Source: prepared by the author based on Pol Reyes, 2005.

D- REACTIVE LESIONS

Table 10: Reactive Lesions

REACTIVE LESIONS			
Pathology	***Clinical presentation***	***Treatment***	***Comments***
Surfer's Knots	'Fibrous nodule that appears on the anterior surface of the tibia, and on the forefoot in people who practice surf... They are foreign body granulomas caused by the silica of the sand of the board' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEP	A surgical treatment is suggested in case of discomfort.	In other sports, reactive nodules can appear on the back of the feet, knees and knuckles due to friction and repeated trauma.

	ORTE.pdf). Sand enters the skin due to little erosions. 		
Cauliflower Ear	Hematomas that present a posterior reorganisation appear due to traumas during the fight. In general, they are painless. 	Surgical treatment. Prevention: protective headgear.	A complication, when the deformation is extreme, is otitis externa due to a bad drainage of the external auditory canal. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).
Rower's Rump and Saddle Sores and Chafing:	'Lichen simplex chronicum caused by friction due to rowing on an unpadded seat for hours' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf) or by constant chafing with the bike saddle.	Topical corticosteroids. Prevention: padded seats.	

Calluses and Corns	Hypertrophy of the stratum corneous caused by chronic friction on the same region (Pol Reyes, 2005.) 	If they cause discomfort, they should be treated with urea cream 30% or 40%.	Most frequently observed mechanical dermatosis in athletes.
Nail Corns and Helomas	'Hyperkeratosis punctata with a keratin deep central core which causes a great sharp pain in its central pressure (it differs from warts, since in the latter pain is caused by lateral pressure.) 'They appear in bony projections... of the foot' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf). They are painful. 	Keratolytics, peeling with scalpel, orthopedic (insoles of dicharge), and sometimes, surgical procedures.	

Source: prepared by the author based on Pol Reyes, 2005.

E- MISCELANEOUS

- **Striae Distensae:**

  It appears in gymnasts and weightlifters who perform great extensions and apertures putting the skin under high tension. It usually appears in the anterior shoulder, in the low part of the back, and thighs. It is caused by the breaking of the elastic fibre of the dermis. It is worse if it happens during puberty, and if athletes use anabolic steroids. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

Stretch mark creams are used to keep the region moist and elastic when it is red. If they are white, treatment is not necessary.

- **Piezogenic papules of heels** (Figure 15)

  They are herniations subcutaneous adipose tissue into the dermis on the laterals of the heels. They are soft papules with skin colour, and they are only seen in standing position. They are painful, and there is not effective treatment. They appear when overloading weight on the heel. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

Sports: basketball, gymnastics, long jump and marathon. Wearing orthotic devises for the heel could be beneficial.

Figure 15: Piezogenic Papules of Heels

Source: Prepared by the author 7

Source: prepared by the author.

- **Subungual Exostosis** (Figure 16): 'A bony overgrow on the tip of the distal phalanx of toes. Record of repeated traumas... Surgical treatment (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf). It frequently occurs in the big toe.

Figure 16: Subungual Exostosis

Source: prepared by the author.

- **Green Hair:**

> It is frequent in people with blonde, grey or white hair who are exposed to swimming pool water. It is caused by copper salts. 3% hydrogen peroxide bleaching for 2-3 hours is an effective treatment. Chlorine in swimming pools makes hair lighter but not green. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

It disappears over time.

Skin infections in sports

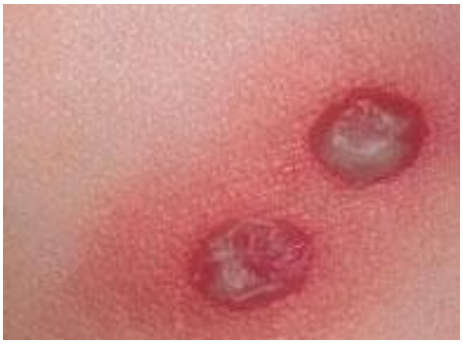
They are disorders 'that could be found in population in general, but with higher incidence in athletes since heat and wet conditions are appropriate' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf) due to direct contact with other athletes or with infected surfaces

(swimming pools, showers and floors in gyms.) Besides, intense stress produced by training causes alteration in the immune system.

Bacterial infections

- **Contagious Impetigo:** 'Superficial infection caused by *beta-haemolytic Streptococcus* or by *Staphylococcus Aureus'*(Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf) or by both. There are two clinical form that are highly contagious:
    - Bullous impetigo (S. Aureus) presents vesicles and blisters that last for some days, and when they burst there is skin denudation (Figure 17.)

Figure 17: Bullous Impetigo



Source: prepared by the author.

    - Non-bullous impetigo (*Streptococcus and Staphylococcus*) is the most frequent one. It presents small superficial pustules and vesicles that quickly disappear and are covered with honey-coloured crusts (Figures 18 and 19.)

Figure 18: Non-bullous Impetigo:

Source: prepared by the author.

Figure 19: Non-bullous impetigo:

Source: prepared by the author.

Treatment: it is very important to eliminate crusts washing the lesions, applying topical antibiotics (mupirocin or fusidic acid.) If it is very large, we should add amoxicillin / clavulanic acid. In contact sports, it is recommended to stop the sport practice or to cover the lesions.

- **Folliculitis and furuncles:** caused by *Staphylococcus Aureus.* 'They are frequent in cyclists, horse riders, and motor pilots due to the friction of the perineum, gluteus and thighs with the seat or saddle'(Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf). Sweating and occlusion favour it. Treatment: fusidic acid and topical mupirocin, local heat and drainage of furuncles (deeper follicle infection.) It is suggested to use amoxicillin / clavulanic acid as an oral medication.

- **Pitted Keratolysis** (Figure 20) Feet infection caused by corynbacterias (saprophyte) in combination with hyperhidrosis. They appear as punctiform depression in soles, and they have an unpleasant odour. It is not contagious. Interdigital spaces are not affected (DD with mycosis.) 'It appears in athletes who wear hermetic footwear with rubber soles, and tendency to hyperhidrosis' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf). Treatment: use of astringent substances such as aluminium chloride of 20% once a day, followed by the application of fusidic acid or topical erythromycin.

Figure 20: Pitted Keratolisys

Source: prepared by the author.

- **Gram-negative Athlete's Foot** (Figure 21): 'Involvement of the interdigital toe spaces with exudative, suppurative, macerated and unpleasant odour lesions resistant to antifungal treatment' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf). Generally caused by pseudomonas. Treatment: povidone-iodine to dry exudation and oral ciprofloxacin.

Figure 21: Athlete's Feet

Source: prepared by the author.

VIRAL INFECTIONS

- ***Molluscum Contagiosum*** (FigurE22): Pearly, raised and pallid papules between 2 and 4 millimetres. It is highly contagious and autoinoculable. The chosen treatment is curettage with topical anaesthesia (EMLA). If there are few lesions the alternative is to use potassium hydroxide of 10% (Molusk of Molutrex.)

Figure 22: Molluscum Contagiosum

Source: prepared by the author.

- **Verruca Vulgaris** (Figure 23). 'direct contact and traumas favour contamination. Plantar warts are the most common ones among athletes since they are transmitted when athletes are barefooted in public places... Keratosis with black spots' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf) and pain due to lateral pressure (DD with helomas with keratin central core, and pain by central pressure.) Treatment: cryotherapy and keratolytic (anti-warts solutions such as ISDIN or Keratix.)

Figure 23: Verrucas Vulgaris

Source: prepared by the author.

- **Herpes Simplex** (Figures 24 and 25) 'small vesicles grouped on an inflammatory base that last for 2-3 days until crust formation. Recurrent herpes labialis is frequent after sun exposure' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf). It is also caused by stress. Herpes *gladiatorum* appears in wrestlers in chest and limbs. Treatment: 200 mg of acyclovir five times a day or Valacyclovir 500 twice a day for 5 days. Topical: alcohol or acyclovir cream.

Figure 24: Herpes Simplex

Source: prepared by the author.

Figure 25: Herpes simplex

Source: prepared by the author.

Fungal infections

- **Tiena *pedis* or athlete's feet** (Figures 26,27 and 28): Caused by dermatophyte fungi. It is probably the most frequent skin infection in athletes. There are 3 types:
  - Moccasin which is chronic and affects the whole foot.
  - Vesicular which is acute and pruriginous.
  - Interdigital which is the most common one. (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

Treatment: oral and topical antifungals (Terbinafine one tablet a day for 14 days.)
Prevention: drying feet very well, wear sweat-absorbent footwear and socks.

Figure 26: Tinea *Pedis*

Source: prepared by the author.

Figure 27: Tinea *Pedis*

Source: prepared by the author.

Figure 28: Tinea *Pedis*

Source: prepared by the author.

- **Tinea *cruris* or jock itch** (Figure 29): Typical of male sex. Many times, it is transmitted by autoinoculation of tinea *pedis* or tinea unguium. They appear as bilateral erythematous plaques with an active border and a lighter core. Treatment: topical antifungal, and many times oral prescriptions (such as terbinafine or itraconazole.) (Pol Reyes, 2005).

Figure 29: Tinea *cruris*

Source: prepared by the author.

- **Tinea *corporis* gladiatorum** (Figure 30): they are ringworm lesions with active borders and lighter cores. They grow fast, duplicating their size in 15 days. This allows to differentiate them form another ringworm lesions with a slower evolution. A topical and oral treatment is recommended (due to the risk of transmission with other athletes) like in other types of mycosis (Pol Reyes, 2005.)

Figure 30: Tinea Corporis

Source: prepared by the author.

- **Tinea unguium** (Figures 31 and 32): it is more frequent in athletes who suffer from nail traumas. They usually affect the distal or lateral portion and cause thickening and change in colour. There is a type that presents superficial white patches on the nail plate which id called superficial white onychomycosis. If it is mild, the treatment could be topical with antifungal nail polish (Locetar, Odenil, Ciclochem u Ony-tec.) If it affects over the half of the nail, an oral antifungal treatment is needed: terbinafine once a day for three or four months, or Itraconazole2-0-2 one week per month for four months. If possible, perform a preliminary culture and an analysis with liver function tests before treatment (Pol Reyes, 2005.)

Figure 31: Tinea unguium

Source: prepared by the author.

Figure 32: Tinea Unguium

Source: Prepared by the author.

- **Pytiriasis versicolor** (Figures 33 and 34): Caused by the genus of saprophyte fungi Malassezia Furfur which are usual in seborrheic skin regions, and become pathogen under the appropriate conditions (seborrheic skin plus hyperhidrosis). As a consequence, it is observed in young athletes during the summer season. Scaly white, pink or brown patches in back, anterior thorax and arms. Treatment: Topical antifungals 2/day for two weeks. It is not contagious but recurrent. When treatment finishes there is secondary hypopigmentation which could last for one or two months. (Pol Reyes, 2005.)

  Hypopigmentation of lesions is also caused when sunbathing since the fungus acts an ultraviolet radiation (UV) filter. The most comfortable treatment is the oral one: Fluconazole 150 a capsule per week for two to four weeks (depending on the extension) or Itraconazole twice a day for seven days.

Figure 33: Pytiriasis versicolour

Source: prepared by the author.

Figure 34: Pytiriasis Versicolour

Source: prepared by the author.

Parasitic infections

- **Sea swimmer itch** (Figure 35): 'we find it in athletes who take part in saltwater sports in the coasts of Florida and the Caribbean... It is caused by coelenterate larvae in contact with the skin and swimsuit' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf). It is developed as a rash of pruriginous papules and crusts in the region of the swimsuit. Treatment: topical corticosteroids, antihistamines, and sometimes oral corticosteroids.

Figure 35: Sea swimmer itch

Source: Prepared by the author.

- **Larva *migrans*** (Figura 36)**:** they are larvae that live in moist and sandy soils in tropical countries. They enter the skin and cause erythematous linear serpiginous and pruriginous lesions. Treatment: albendazole (Eskazole 400) two tablets a day for five days or Ivermectin 200mg/kg in two separate doses in a week.

Figure 36: Larva migrans.

Source: prepared by the author.

Allergic contact dermatitis

'There are plenty of substances with sensitivity power present in athlete's equipment. If there is a recurrent inflammatory dermatosis an allergic contact dermatitis should be considered' (Pol Reyes, 2005, http://www.aula.acemefide.org/cursos/photo/1147515801PATOLOGIA%20CUTANEA%20Y%20DEPORTE.pdf).

Wearing footwear, sports clothes, diving equipment, ankle braces, knee pads, metallic objects, therapeutic elements, among others causes this type of allergy. Confirmation diagnose is based on epicutaneous contact tests. Treatment: topical corticosteroids, oral antihistamines, and sometimes oral corticosteroids (Pol Reyes, 2005) (Figuras 37, 38 and 39.)

Figure 37: Allergic contact dermatitis

Source: prepared by the author.

Figure 38: Allergic contact dermatitis

Source: prepared by the author.

Figure 39: Allergic contact dermatitis

Source: prepared by the author.

Environmental injuries

Caused by environmental factors such as antinic radiation, cold, heat and water.

Table 11: Environmental Injuries

Sun and heat:	Sweat:	Cold:	Water:
• Sunburns. • Photosensitivity caused by pharmaceuticals, plants, perfumes. • Solar urticaria. • Polymorphous light eruption. • Sudamina.	• **Cholinergic urticaria** (Figure 40): erhytema or small prurigineous papules, especially in upper parts of the body. They appear after exercising, or are caused by a warm bath or shower, fever or stress. • Treatment: oral antihistamines.	• **Perniosis** (Figure 41): frostbite, urticaria caused by cold, cheilitis, cracks and xerosis, ungual dyschromia (complete white nail.) • **Cold panniculitis or equestrian periniosis** (Figure 42): subcutaneous painful erythematous purplish plaques and nodules, especially on thighs. It was first described in women who rode horses. Treatment: anti-inflammatory drugs.	• Aquagenic pruritus and urticaria

Source: prepared by the author.

Figure 40: Urticaria caused by sweating

Source: prepared by the author.

Figure 41: Equestrian Perniosis

Source: prepared by the author.

Figure 42: Cold Panniculitis or Equestrian Perniosis

Source: prepared by the author.

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