The Rationale and Use of Anti-Inflammatories and Pain Killers in the Rehabilitation of Sports Injuries

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Curriculum vitae

Gordon Irving studied at Newcastle, England where he obtained a MB BS. He came to South Africa in 1974 where he specialized in Anaesthesia. He then pursued his interest in Sports Medicine, lecturing in Physiology and Sports Science at UCT, and obtained a MSc in Sports Medicine in 1983. Until recently he was in private practice as a GP, seeing mainly sports-medicine problems. He is now at Groote Schuur Hospital, studying Anaesthesia and chronic pain with special interest in pain of spinal origin.

Summary

The use of non-steroidal anti-inflammatory drugs and analgesics is widespread amongst the South African athletic population. This paper briefly looks at the pathophysiology of the healing response to injury and suggests that non-steroidal drugs, if used at all, should be confined to the first three days following an injury. Analgesics should be simple and effective and corticosteroid injections should be avoided whenever possible.

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Next to vitamin pills and tonics, non-steroidal, anti-inflammatory drugs (NSAIDs) and analgesics are probably the most widely used medication in the South African athletes' sports kit. The promotion of the trauma pack, consisting of a week's supply of anti-inflammatory tablets, fosters in the mind of the doctor and athlete the pharmacological notion that pain and inflamation due to extrinsic (direct), or instrinsic (indirect, overuse) trauma requires a minimum of five to seven days therapy. Unfortunately, the above hypothesis whilst profitable for the drug companies, has not been convincingly

demonstrated. Surprisingly few studies examining the efficacy of anti-inflammatories are present in the literature and those that are available often lack suitable controls, give no details of other interventions used concurrently, or show no advantage for the use of NSAIDs[1]. Some workers, using suitable controls, failed to show any advantage for indomethacin (50mg TDS) over placebo[2]. Others [3,4] have shown certain NSAIDs such as Ibuprofen compared to Aspirin resulted in an average of two days earlier return to activity, especially if they were given within the first two days of injury. Unfortunately, studies comparing anti-inflammatories and the physical modalities of ice, rest and early mobilisation do not yet appear to have been undertaken.

Very few studies on the efficacy of NSAIDs

To understand the rationale of the use of anti-inflammatories it is necessary to briefly review the phases of healing post-injury. Healing of ligaments and soft tissue injuries, in general, has been shown to occur by scar tissue and not by regeneration of the damaged tissue[5]. The actual phases of the healing process can be arbitarily divided as follows[6]:

Phase 1. Acute inflammatory. (0-72 hours dependent on severity of injury).

There are two main components:

1. *Humeral response*

   These involve the blood born factors which are activated in response to trauma.

   i. The intrinsic blood coagulation system, triggered by contact with damaged vessel wall surfaces or exposed collagen, helps to stem excessive bleeding.

   ii. The fibrinolytic system is also activated to prevent widespread generalised clotting.

   iii. The kinin system vasodilates local blood vessels and increases vascular permeability.

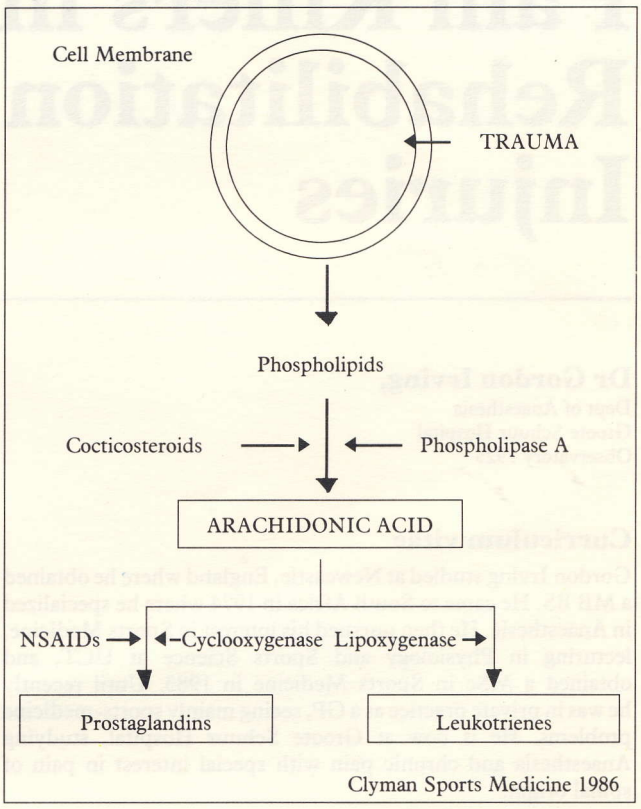
   iv. The complement system stimulates phagocytosis (removal of cell debris) and chemotaxis (attraction of inflammatory cells).

2. *Cellular response*

   i. Degranulation of mast cells with the release of histamine and serotonin.

   ii. Formation of prostaglandins and leukotrienes via arachidonic acid due to the action of phospholipase on cell membrane phospholipids released when the cell wall is damaged (Fig 1).

Figure 1. Prostaglandin Formation



The cellular and humeral responses occur together, the complex interactions being mediated by complement components and various prostaglandins.

The few investigations done show no convincing advantage for the use of NSAIDs

Phase 2. Repair phase (48 hours to 6 weeks)

This phase is characterised intially by macrophage removal of cellular debris and is followed by synthesis and deposition of randomly orientated collagen. Revascularisation also occurs at this stage. From 3 to 14 weeks post-injury and for up to 6 months after injury the collagen contracts[5] thereby decreasing ligament laxity and possibly muscle flexibility[7].

Phase 3. Remodelling phase (3 weeks to 12 months or more).

During this phase collagen is remodelled according to the stresses placed on it. Thus the tensile strength will be greatest in the direction of the forces it has to withstand. However, the repaired ligaments contain mainly immature Type III collagen fibres when compared to normal ligaments which are composed mainly of Type 1 collagen. Type III collagen is deficient in the number of cross linkages between and within tropocollagen sub-units. Thus the collagen of repaired ligaments is deficient in both content and quality even at 40 weeks of healing[5].

There is obviously no clearcut distinction but a merging between Phases 1 and 2 in the healing process. And progressively the collagen being orientated and increasing in tensile strength in Phase 2.

Having reviewed the pathophysiology, what pharmaceutical agents are used to effect Phase 1 (the inflammatory phase)? This is the period when the athlete is most likely to request medication.

Physiologically illogical (detrimental) to the repair process if you continue with NSAIDs after the first 3 days post-injury

Anti-Inflammatories

There is a logical rationale in using anti-inflammatories to prevent or lessen the inflammatory process in Phase 1. The main anti-inflammatories agents used are the non-steroidal anti-inflammatory drugs which block the formation of prostaglandins and, to a lesser extent, leukotrienes (Fig 1). The prostaglandins of the E series appear to be involved in pain production and potentiation as well as increasing vascular permeability, possibly by unzipping the tight junctions between endothelial cells. However, after the initial imflammatory phase (72 hours) other prostaglandins are formed. These include the F series which enhance the formation of ground substance and thus favour wound healing[8]. Thus it would appear physiologically illogical and maybe detrimental to the repair process to continue anti-inflammatories after the first three days post-injury.

It should be noted that, like all medications, anti-inflammatories have side effects. The incidence of upper gastrointestinal tract symptoms attributed to NSAIDs has been reported to be as high as 33%[9]. Unfortunately mucosal damage due to NSAIDs may occur without any symptoms[10]. In one reported study, significantly fewer patients with peptic ulcer haemorrhage had ulcer symptoms when taking non-steroidals, compared with a group not taking non-steroidal anti-inflammatories[11]. The cause of the gastric mucosal injury is probably due to a decrease in cytoprotection by blocking prostaglandin synthesis. Prostaglandins affect the mucous and bicarbonate secretion, increase mucosal blood flow, facilitate sodium transport and aid migration of basal mucosal cells to the lumen, for repair of mucosal injury. Thus peptic ulceration due to NSAIDs may be a combination of topical damage as well as weakening of the mucosal lining due to prostaglandin inhibition[12].

Mucosal damage due to NSAIDs may occur without any symptoms

Although peptic ulceration has been reported mainly in those taking long-term anti-inflammatory medication, even the young and healthy taking a short course of NSAIDs (including Aspirin) are at risk of intestinal mucosal damage.

It has been suggested that NSAIDs should be avoided in injuries where there is an open wound or where there is a separate focus of infection present[13]. The reasoning for this recommendation is that non-steroidals partially block the formation of leukotrienes (Fig 1) which aid in the mobilisation of macrophage destruction of bacteria. They have also been shown to severely depress lymphocyte function in a susceptible individual and to impair granulocyte-mediated function[15] leading to in vitro diminished anti-bacterial function[14]. NSAID use has been implicated in some cases of necrotising fasciitis[13, 15].

Other side effects include:

Anaphylaxis, rashes, renal, hepato and neurotoxicity, blood dyscrasias, retention of sodium and water and drug interactions.

Analgesics

These can be arbitarily divided into two groups (Fig 2). Those of low to intermediate efficacy and those of high efficacy[16]. Combination drugs which include tranquilliser, sedative or addictive agents such as Benerol and Myoflex (Chlormezanone) and Stopayne (Meprobamate) should be avoided. Paracetamol, with or without codeine or propoxyphene, in adequate dosages "2 tabs four times a day" have the advantages of being cheap, relatively safe and as effective as many of the other of less safe, expensive medications which all doctors have in their drug armamentarium. For those in severe pain immediately following a sports injury, especially if more than soft tissue is involved, the most effective drug is still intravenous morphine. This should be given in 2mg increments every five minutes until adequate analgesia is reached. The maximum intravenous dosage initially in a male should be ± 10mg and in a female ± 5-7,5mg dependent on the lean body mass. It must be remembered that morphine will affect accurate neurological assessment and in cases of head injury must be avoided until transfer to the nearest hospital and a proper assessment has been made.

For severe pain immediately after sports injury, intravenous morphine is the most effective drug

Fig 2. Analgesics

Low to Intermediate Efficacy

- Paracetamol
- Asprin and NSAIDs
- Codeine and Propoxyphene
- Tilidine
- Pentazocine
- Dihydrocodeine
- Etc, Etc

Straughan 1989

Corticosteriods

Considerable controversy surrounds the use of injected corticosteroids in the management of chronic, over-use sporting injuries. Their use in acute soft tissue injuries, however, is not recommended and should be avoided.

Injections of corticosteroids into muscles and ligaments may produce a permanent decrease in tensile strength of the collagen especially with depot forms of steroids[17]. Also by suppressing fibroblastic activity steroids may delay healing[18].

Injections of coricosteroids into joints have an even worse reputation. They have been shown to decrease the synthesis of the articular cartilage matrix and cause permanent destructive changes in the cartilage[16].

Local adverse effects of injected corticosteroids include subcutaneous atrophy, depigmentation, striae and telectangectasia.

The use of corticosteroid injections should be undertaken with circumspection if at all. It is far better to adhere to the dictum of injecting commonsense into the athlete rather than cortisone.

Recommendations for the early treatment of soft tissue injuries

Analgesics:

Paracetamol ± codeine or propoxyphene should be tried in the first instance.

Non-Steriodal Anti-Inflammatory Drugs:

If their use is considered appropriate, they should probably be given in the first three days of injury only.

Corticosteroids:

The injections should be avoided.

There is still much to be said and very little evidence of a better initial management of acute soft tissue injuries than RICE. The acronym standing for Rest, Ice, Compression and Elevation. This should be applied intermittently for the first 48-72 hours and is safe, effective and has very few side effects, if the ice is applied correctly.

Continuing pain and discomfort during the athlete's rehabilitation should be taken as a guide and limit to the speed of mobilisation. They should be treated by exercises, changing training techniques and physical modalities, prior to over-enthusiastic suppression of symptoms with pharmacological agents and all their concomitant problems.

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literature. Med Sci Sports Ex 1986; 18(5): 489-500.

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