# The Pain and Inflammation

***Resources come from Microsoft Copilot***

We all have chances of suffering pain. But not everyone knows how to deal with it. Pain is a mechanism that is a built-in alarm system inside your body that’s both **physical and emotional**, designed to **protect you from harm**. Before describing the mechanism of how pain works, we need to know a term call **nociceptor**. Nociceptors are your body's **pain detectors**—specialized sensory nerve endings that respond to **harmful or potentially harmful stimuli** like extreme heat, sharp pressure, or chemical irritation. Also, nociceptors **Send electrical signals** through nerves to your spinal cord and brain which trigger the **perception of pain**, prompting you to react—pull away, protect, or treat the injury.

Nociceptor can be categorized into 4 categories:

1. **Thermal nociceptors**: Respond to extreme heat or cold
2. **Mechanical nociceptors**: Detect sharp pressure or cuts
3. **Chemical nociceptors**: React to irritants like acid or inflammatory molecule
4. **Polymodal nociceptors**: Can detect multiple types of harmful stimuli

Also, Nociceptors are located **throughout your body**: **skin**, **muscles and joints**

and **organs**. Without nociceptors, you wouldn’t feel pain—and that’s dangerous. They help you: Avoid injury, Heal properly and detect internal problems (like inflammation or infection. Besides nociceptors, pain isn’t just one thing—it’s a **multidimensional experience** that can be triggered by **chemical**, **mechanical**, or **emotional** factors. Each type activates different pathways in your body and brain, but they often overlap in surprising ways, below describes:

* **Chemical Pain**
  + This type of pain is triggered by **chemical irritants** or **inflammatory molecules** released during injury or infection.
  + **Examples**: **Bradykinin**, **histamine**, **prostaglandins**, and **lactic acid** released during inflammation
  + Acid burns or exposure to environmental toxins
  + Pain from infections or allergic reactions
* **Mechanical Pain**
  + These chemicals stimulate **nociceptors** (pain receptors) directly or make them more sensitive. That’s why inflamed tissue feels sore even with light pressure.
  + **Common Conditions**:
    - Arthritis
    - Infected wounds
    - Muscle soreness after intense exercise
* **Emotional Pain**

This is pain that arises from **psychological or social distress**, and it’s just as real as physical pain.

* **Examples**:
  + Grief, heartbreak, rejection
  + Anxiety, depression
  + PTSD or chronic stress
* **Mechanism**:  
  Emotional pain activates the **same brain regions** as physical pain—especially the **anterior cingulate cortex** and **insula**. That’s why heartbreak can feel like a punch to the chest.
* **Term**:  
  Researchers call this **algopsychalia**—pain without a physical cause but deeply rooted in emotional processing.
* **Neuropathic Pain**

Caused by nerve damage (e.g., sciatica, diabetic neuropathy)

* **Central Pain**

Originates in the brain/spinal cord (e.g., fibromyalgia)

* **Nociplastic Pain**

No clear tissue or nerve damage, but pain persists (e.g., chronic back pain)

Pain is often mixed. Many types of pain involve **multiple mechanisms**. For example:

* A wound might cause **mechanical pain** from tissue damage, **chemical pain** from inflammation, and **emotional pain** from trauma or anxiety.
* Chronic pain often shifts from nociceptive (physical) to **nociplastic** (central sensitization), where the brain amplifies pain signals even without ongoing injury.

To deal with pain doctors will subscribe painkillers for you. Different painkillers have different way to deal with pain, below describes:

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| --- | --- | --- | --- |
| **Type of Painkiller** | **How It Works** | **Best For** | **Examples (Brands)** |
| **NSAIDs** (**Non-Steroidal Anti-Inflammatory Drug**)  (e.g., ibuprofen, naproxen, Aspirin) | Block COX enzymes → reduce prostaglandins → lower inflammation and pain | Inflammatory pain (wounds, arthritis, muscle strain) | Advil, Aleve, Bayer’s Aspirin**\*** |
| **Acetaminophen** (paracetamol) | Acts in the brain to reduce pain perception (possibly via COX-3) | Fever, mild pain, headache | Panadol, Tylenol |
| **Opioids** (e.g., morphine, codeine) | Bind to opioid receptors in the brain/spinal cord → block pain signals | Severe pain (post-surgery, cancer) | Tramadol, Oxycodone |
| **Antidepressants** (e.g., amitriptyline) | Modulate neurotransmitters like serotonin and norepinephrine → reduce nerve pain | Neuropathic pain, chronic pain | Cymbalta, Elavil |
| **Anticonvulsants** (e.g., gabapentin) | Calm overactive nerves → reduce abnormal pain signaling | Nerve pain (sciatica, shingles) | Neurontin, Lyrica |
| **Topical Agents** | Block pain locally at the skin or joint level | Localized pain (joint, muscle, nerve endings) | Diclofenac gel, capsaicin cream, Salonsip patch |
| **Corticosteroids (Steroids)** | 1. **Reducing inflammation**: They block the production of inflammatory chemicals like prostaglandins and cytokines. 2. **Suppressing the immune system**: Useful for autoimmune diseases where the body attacks itself. 3. **Managing hormone imbalances**: In conditions like Addison’s disease, where the body doesn’t produce enough cortisol. | Inflammatory Joint Pain, Tendon & Soft Tissue Pain, Spinal Pain, Autoimmune Pain, Allergic Inflammatory Pain | **Oral (tablets/liquids)**   * Prednisone, Dexamethasone   **Injectable**   * Methylprednisolone   **Topical (creams)**   * Hydrocortisone, Clobetasol   **Inhaled**   * Fluticasone   **Nasal spray**   * Beclomethasone   **Eye drops**   * Prednisolone |

Below describes each pain type which matches the treatment strategy:

|  |  |
| --- | --- |
| **Pain Type** | **Treatment Strategy** |
| **Mechanical Pain** (injury, strain) | NSAIDs, rest, Topical Agent, physical therapy |
| **Chemical Pain** (inflammation, infection) | NSAIDs, corticosteroids, wound care |
| **Emotional Pain** (grief, anxiety) | Therapy, mindfulness, antidepressants |
| **Neuropathic Pain** (nerve damage) | Anticonvulsants, antidepressants, nerve blocks |
| **Central Pain** (brain/spinal cord sensitization) | Multimodal therapy, exercise, CBT |

**Note**: Although ibuprofen, naproxen and aspirin is type of NSAID painkiller but be caution in use when you have a wound:

Can Impair Wound Healing

* Promotes Bleeding  
  NSAID inhibits platelet aggregation, which means it thins the blood and slows clot formation. Since clotting is the first step in wound healing, this can delay the formation of a protective scab and increase the risk of bleeding.

1. Disrupts Skin Cell Migration  
   Recent studies show that aspirin interferes with keratinocyte migration—the movement of skin cells that rebuild the outer layer of skin. This is crucial for re-epithelialization, the process of sealing the wound.
2. Reduces 12-HHT Production  
   Aspirin lowers levels of a molecule called 12-HHT, which activates the BLT2 receptor on keratinocytes. This receptor is essential for guiding skin cells to the wound site. Without it, healing slows down significantly.
3. NSAIDs Cause Swelling
   * **Fluid retention**: NSAIDs interfere with prostaglandins, which help regulate kidney function. This can lead to **sodium and water retention**, especially in the lower limbs.
   * **Vascular effects**: They may increase blood vessel permeability, allowing fluid to leak into tissues.
   * **Kidney strain**: Long-term use can reduce kidney efficiency, making it harder to eliminate excess fluid.