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Pain, Reveling the Knotted Threads about Causes and Management

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Abstract: ***It is said that we live within the world of pain and sufferings, be it spiritual, mental or physical, the pain is usually hurting and results in discomfort. In context to biology, once we get a cut or a burn, what can we feel at that moment or after a while [in some cases] is that the experience of a sensation, called pain. Pain might be considered, in physiology, as any sensation which is unpleasant and may make us uncomfortable in both physical and mental context. The experience of pain or feeling of pain are often thanks to injuries or trauma, so, we will say that injury or trauma is that the phenomenon which provides us the feeling of pain. Is pain only a fitness or is it a state of mind? once we get a cut at fingertip while cutting vegetables or doing stationary work, we quickly desire leaving the work and sit somewhere to sooth down the cut area, but how can we experience pain; that's the pain which don't allow us to continued within the former work. But why can we experience the pain of such a little cut while we don't experience any kind of pain during operation operational theatre. rather than the physical changes that lead us to experience pain like inflammation or could also be the other mechanism of which we are still unknown, this is often the signal that gets to the brain from the affected area that, where we had cut and that we do experience pain. If we got a cut or burn, we do get pain which lets us to get rid of our hand from the place that hurts us and is liable for pain, so can we conclude that pain may be a defensive mechanism or is it something else? The pain is experienced when any quite tissue damage occurs which it's sensed by the neuronal network which is bedded everywhere in our body that connects every a part of body to brain and from there the signal is received and eventually we revisit another signal for response to the stimuli. Stimuli are any quite external changes that cause some kind of signal transduction in our body. Pain are often experienced only we sense in by our senses and when signal from brain comes in response thereto . this is often no way different from any of the reflex action that would cause response against stimuli, so pain also can be a mechanism which is protective so as to urge rid from things that cause pain. Pain can be due to several reasons or some time could be without any specific reason too; it could be due to cut, burn, surgery, internal trauma, disease or it could be due to stress which leads to secretion of several kinds of neurotransmitter which make us feel pain. As we know science is changing day by day it is growing its arm to a great level but science should not be restricted to a person who is an academician, scientist or a researcher, it should be well know by all. Who [anyone whether science associated or not] wanted to know about should be informed as much as possible, in this research paper by taking several references and used easy language for better understanding of everyone who would read it, I had tried my best to make it explained all about pain and the some of the mechanism of pain management, here I have also explained the mechanism of action of pain killers, that can affect us badly.***

Keywords: Pain management, neurotransmitters, synapsis, pain receptors

According to **International Association for the study of Pain**, the pain is defined as ***'unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.'***

The pain is that the feeling which comes from brain thereto affected area where the damage has actually occurred and this sense is really generated by the affected area only, this totally is that the game of nerve action which transfers the message of tissue damage to brain and reciprocally the feeling comes that's called pain. this is often the brain that signals the part to urge alerted about pain, it are often a defensive mechanism to maneuver out of the place or thing.

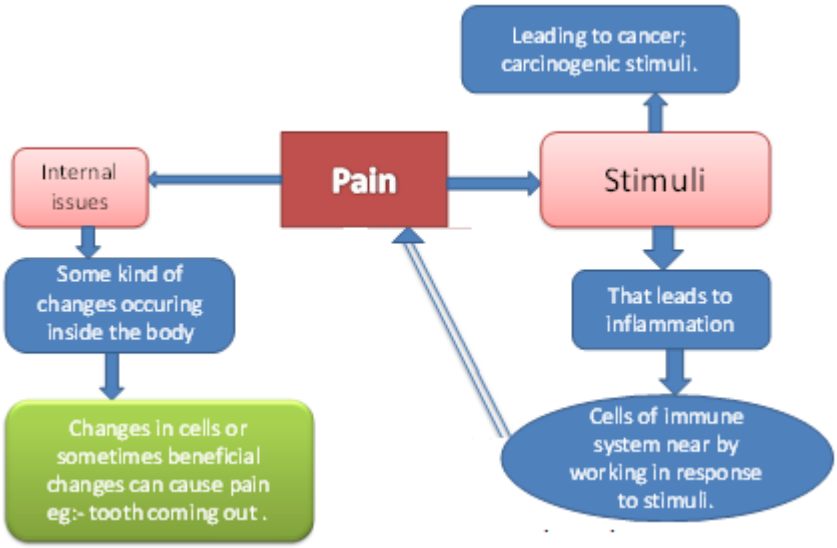

Figure 1: Showing different stimulus causing pain

For the pain to be caused by stimulus needs to have stimulus of noxious, that can cause tissue damage and appropriate inflammation needs to be started for the pain inception. There can be several types of pain which affects different parts of body, they are as follows:-

- Back pain in lower area.
- Spinal pain
- Vertebral pain.
- Sciatica pain.
- Nerve pain
- Head pain, can be in different areas
- Muscular pain
- Rib pain[intercostals neuroglial]
- Diabetic nerve pain
- Neck pain
- Cancer pain in areas like pancrease, lungs, bones, breast, colorectal etc
- Angina pain
- Pelvic pain.
- Knee pain
- Albow pain

These are only some of the common areas where usually people do have pain, it can be other areas too where pain could successfully occur. Let us examine the causes of pain, for this research I had decided not to follow the ongoing trend about the types of pain, although it is highly correct, but I did a small survey within local people who are suffering from pain. I asked the people about their actual feeling about which all the volunteers talked about and what really lead them feel so uncomfortable. I will be explaining about all the examined answers but before that I would like to explain the types of pain.

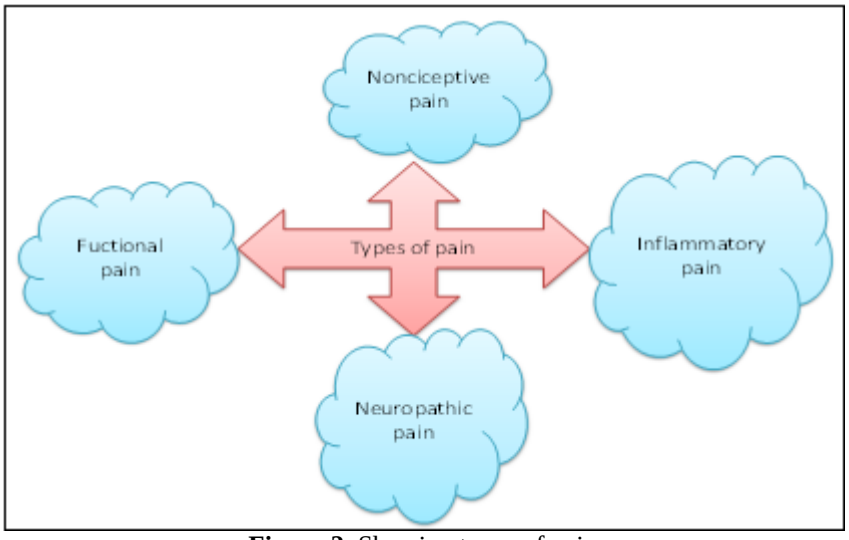

Figure 2: Showing types of pain

The following above fig tells us about types of pain it can broadly be classified as **Chronic pain** and **Acute pain**.

Acute pain is the pain which starts rapidly and ends in short duration or is resolved in small length of time, whereas chronic pain is that pain which is not healed quickly and takes days or years to be end. This chronic pain can be due to many reasons like cancer, peripheral neuropathy or it can be due to rheumatoid arthritis.

Other categorization includes allodynia; which is a pain experienced when painless stimulus is given, it has been seen in case of osteoarheritis. Other then allodynia there is phantom pain; which can be felt by the patients in the amputated part or part from which no longer signal is received by the brain.

Now seeing towards the four types of pain as mentioned in figure; first one is nonciceptive pain, which occurs as a result of tissue injury eg:- mechanical injury anywhere likewise back pain, second is the inflammatory pain meaning the pain is due to inflammation which is a response of immune system in response to pathogen condition of this type includes gaut and rheumatoid arthritis. The third on is the neuropathic pain, this is caused by nerve irritation including conditions like neuropathy, radicular pain and trigeminal neuroglia. The last one, although there are many, is functional pain which have no obvious reason or cause; example includes fibriomyalgia and irritable bowel syndrome. These are some types of pain which are registered by researchers but there can be several other symptoms and several other types that a pain can be of, here some of them are explored.

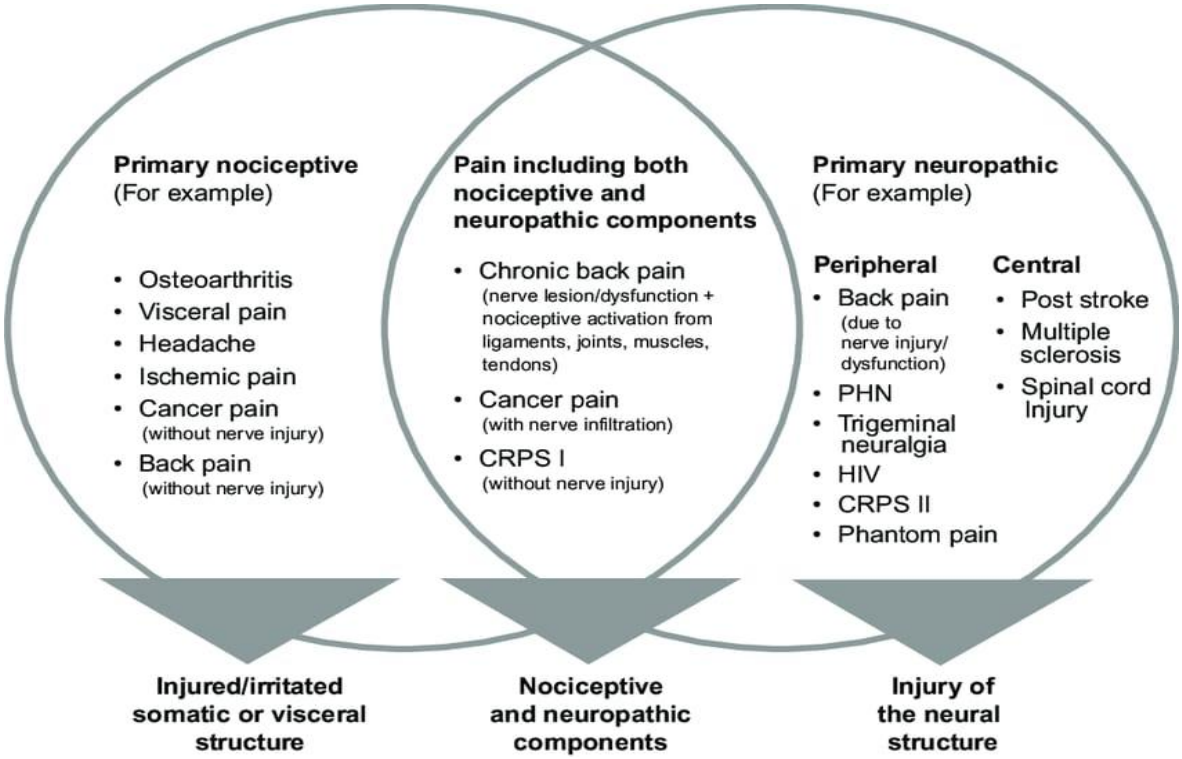

Figure 3: Showing pie chart for types of pain

As mentioned above about a survey, this is the platform to reveal it, which I made on several people suffering from pain, let us now examine their responses. I asked several people and they had one by one stated their response about their pain and painful experience; it was surprising that several people had told about their pain that it was the injurious pain that a person/volunteer had told about was surprising, he had pain in his ribcage and on the right of thoracic region which was due to no known injury the person, but at the same time he reported that once at a small age he had been fall on and some hard object strike him at his ribs. It was notable that how can a person get pain of such a lost injury before years, but it can be true as pain depends upon the sensation of pain when the brain receives it. An another person with pain at his hands told that he never gets pain usually only when wind blows strongly or when he showers; although the volunteer was unknown about his pain that it was dependent over mechanical stress, means the receptors receives the message over touch, this in turn generates signal to brain.

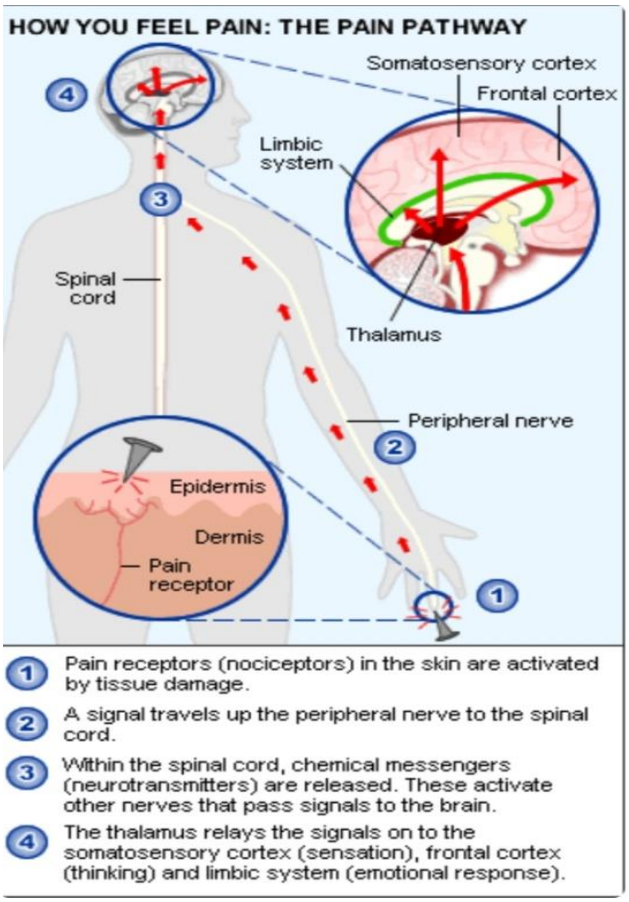

Figure 4: Showing pathway of pain sensation

Here as it is mentioned in the fig regarding that the pain is felt when message from area of injury gets to sensory cortex of the brain from there the signal via motor neurons are returned back to the injured area and this in turn lead to pain sensation which has been till date studied.

This is going to be not at all easy to understand a painful condition of human body, there could be many or no change at the physiological level in response to pain, some time a vigorous response is also noticed. As the signal to pain comes it leads to activation of hypothalamus that leads to the message of its activation to the master gland that is pituitary from where signal divides into three parts ; **adrenal gland, thyroid gland** and **the gonads** from where different kinds of hormones are secreted, it could be clearly seen in the fig below:-

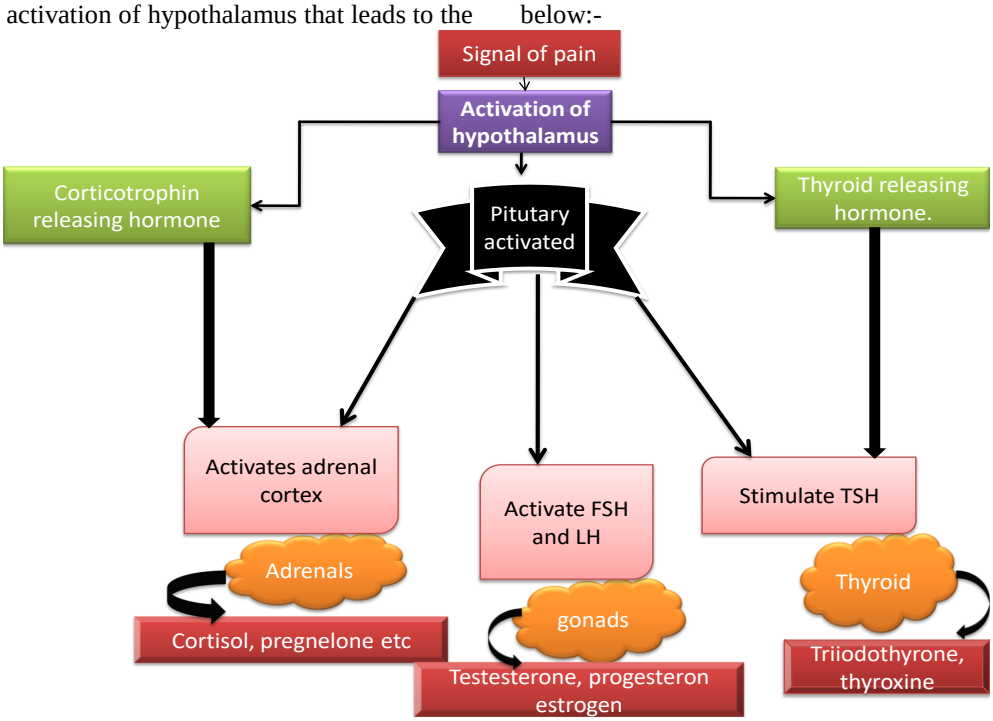

Figure 5: The signal of pain creating a lot of physiological outcomes

There is another change at physiological level, this could be seen as the pain sensing mechanism in case of patients whose response at physiological level is lost, this is unsurprisingly a common phenomenon at old age where it could be beneficial to notify for a doctor or researcher to be well known with the area of pain. This detection is from no other then **endorphin** which is secreated as an analgesic or anti-inflammatory agent in response to pain. For its detection it should be tested via any sort of technique, although its developed, via radiation that could sense the presence of endorphin hormone, a natural pain killer at that site for the healing purpose and by this way place of pain can be successfully identified and then is managed via proper drug administration.

Before moving to pain management and the affect of pain killer let me quickly put some light over the inflammation which could cause pain. Inflammation is an emergency call of the immune cell at the area where something allien is recognized by the innate, surveillance cells at the site of alteration. When injury is notified the immune cells used to secrete several types of enzymes like defensins, granzymes etc that can kill our own cells also, this killing is the root cause of pain.

Let us now check out the inflammatory process which is the most common phenomenon of immune system, what happens in the inflammation is whenever anything is found to be abnormal in the body the immune cells nearby, which is present almost everywhere is found to be against those antigen or any of the invader, this is the most beautiful mechanism of the immune system that it used to boycott all the harmful invaders. As being amazingly protective it can sometime be dangerous too. These protective cells try to kill the invader, although being cellular structure they can either phagocytose or secretes cytotoxic enzymes which have potential to kill those invaders.

The cells of immune system, in protection of our body not only deals with foreign invader alone but also calls off the other cells of immune system as a feedback, this is not always beneficial as inflammation can kill our own cells too which could instead of serving as a protective mechanism, kills or damages our own body tissue and as the mechanism of inflammation was to protect us rather that that it becomes threat for our own body.

Now, there are some images which could depict the inflammatory action.

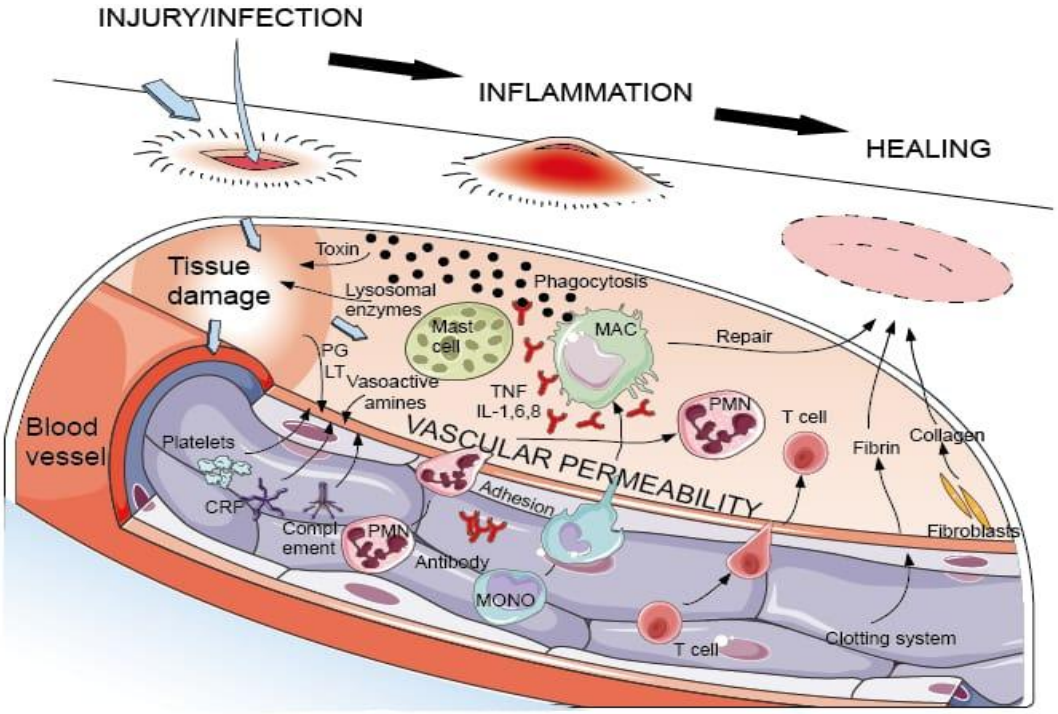

Figure 6: Showing the inflammation caused due to injuries or infection that causes activation of immune cells

The inflammation, where the cells present at the site of infection/inflammation, calls more immune cell to the injured area, it further lead to more inflammation and more and more cell activated to form a protective site, this could be seen as the area or land where cops are to kill the invaders but when the invaders are hiding themselves in the house of people, without being willing the cops attacks the house, in this attack also they do kill the innocent people, similar with our bodily cells which are killed due to inflammation.

There are several types of chemical mediators secreted at the site of inflammation as vascular or cellular response of inflammation leading to cellular damage of our own body, this chemical mediators or cytotoxins leads to pain which could be due to cellular death or massive killing.

An another bigger picture of inflammation can be seen by a figure illustrated bellow where all action of inflammation is shown.

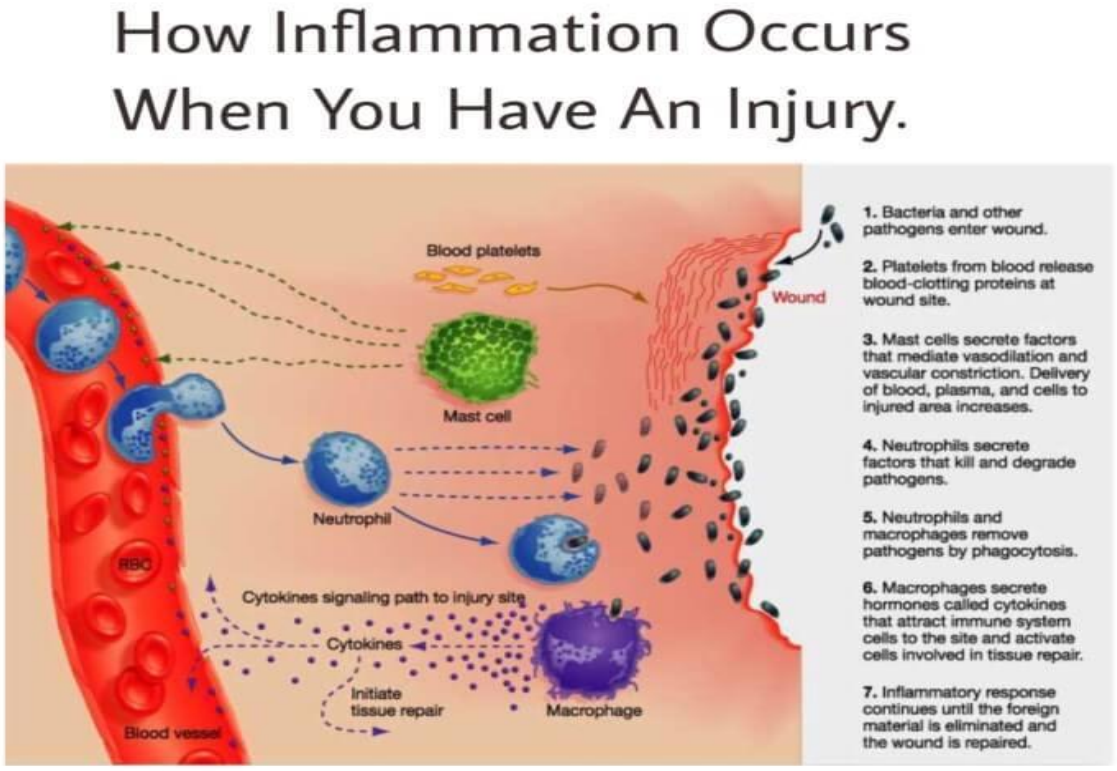

Figure 7: Showing seven step process of inflammation, that how does it occur and its effects over nearby cells.

As we all know there are certain signs of inflammation including fever, or rise in body temperature; this is the time when immune cells becomes more active and attacks more and more pathogens, we know that the fever or rise in body temperature is due to IL-1, secreted from macrophages which are happening to kill the invaders attacking the body.
Not only temperature rise but certain other factors are responsible they are redness, loss of functions; redness, which is due to arteriolar dilation, more and more blood comes to local area causing redness. Swelling also occurs which is caused by increased microcirculation where transudation/exudation occurs due to inflammation. And the last thing is pain which is due to cells killed nearby in the process of killing the invader.

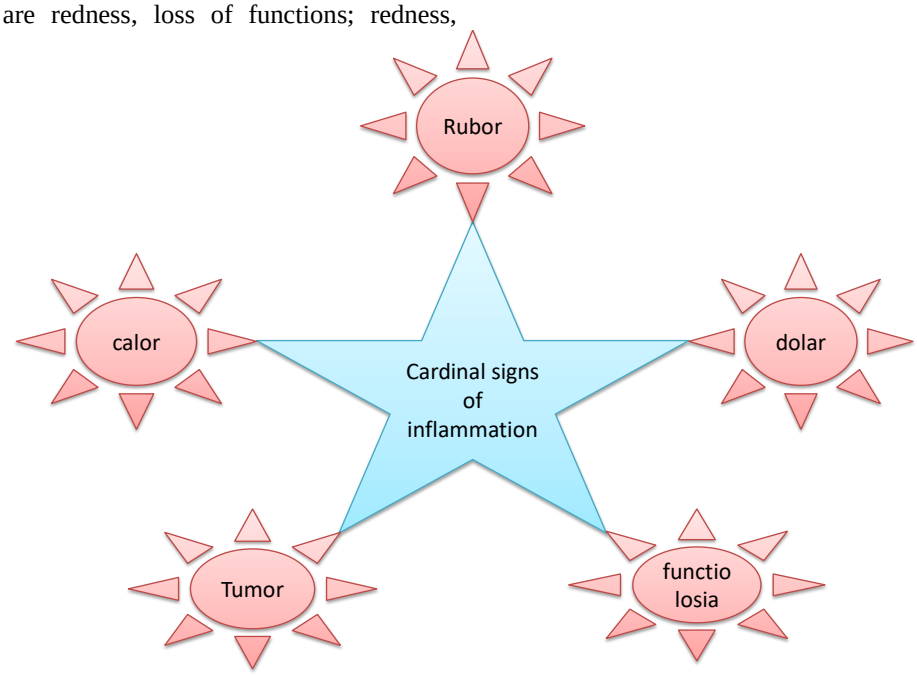

Fig:- Showing five cardinal signs of inflamation.

The above figure depicts the five cardinal signs of inflammation which are as mentioned; **calor** or increasing temperature at local area, **rubor** meaning redness, **functiolossia** meaning loss of function, tumor meaning the swelling of local area and **dolar** meaning *pain*. As we see inflammation is the one which causes these symptoms, when these things becomes intolerable it makes a person helpless to take medicine commonly the *pain killers*.

Here, the story begins all about pain management, since time immemorial different techniques were discovered for to relieve pain that occurs due to various reasons, several masons and labors in China were reported to have *Papaver somniferum* (opium poppy) opium containing in low quantity to get of pain. In India commonly *Cannabis sativa* (bhaang) was taken it can also gives relieve from pain. This opium poppy contains morphine and codeine which has effects over brains which binds to dopamine receptors and lets us have no sentation of pain; this is widely used to cure post-operative pains. The *Cannabis sativa* is a cannabanoid containing agent, it has certain side effects but are not so much dangerous, like other if in any sort of pain a bit amount of cannabanoid could be administered at low dose can relieve the pain pain and also will provide sound sleep.
It was about 2500years ago, people were knowing about willow leaves that were taken to have pain relieve several researches were made in order to know the content of willow leaf, then researcher and people all around the world come to know that willow leaf contains Salicin. This salicin when taken comes to metabolism as salicylic acid (metabolite in body).

When it comes to circulation it used to block the certain inflammatory agents which is cause of pain i.e; prostaglandins, and we get relieve from pain.

Let us see the structure of all these compounds and also the image of the willow leaf.

Figure 9: A typical willow tree, a deciduous tree as well as shrubs, found on moist soils in cold and temperate region all over northern hemisphere

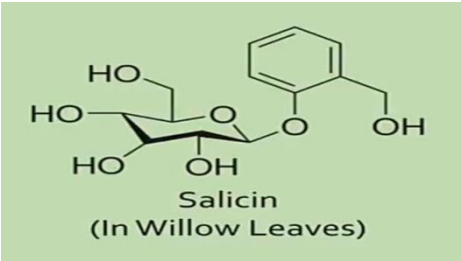

Figure: Showing structure of salicin

It was in 19th centuary when two scientists namely Sir Charles Frederic Gerhardt and Sir Felix Hoffmann, looked upon conversion of Salicin to salicylic acid in metabolism and then they added acetyl group to salicylic acid to make them Acetylsalicylic Acid, as it was less toxic.

This was a revolution as Acetylsalicylic Acid (Aspirin), a widely used drug came to be known, it was in year 1971, when three scientists studied aspirin thoroughly and its metabolic action and they got Nobel prize in medicine and physiology in 1982.

The scientists were John R. Vane, Bengt I. Sammuelsson and Sune K. Bergstrome, who studied the action of aspirin on human body that it does block the prostaglandin and thus anti-inflammatory action is seen that could temporarily releases fever and relieves pain. This was a very notable discovery and is widely used since 1885, when it flooded the world market. Whenever we found anyone having any kind of pain or rise in body temperature the first choice of ours is the aspirin, although it could affect the body badly.

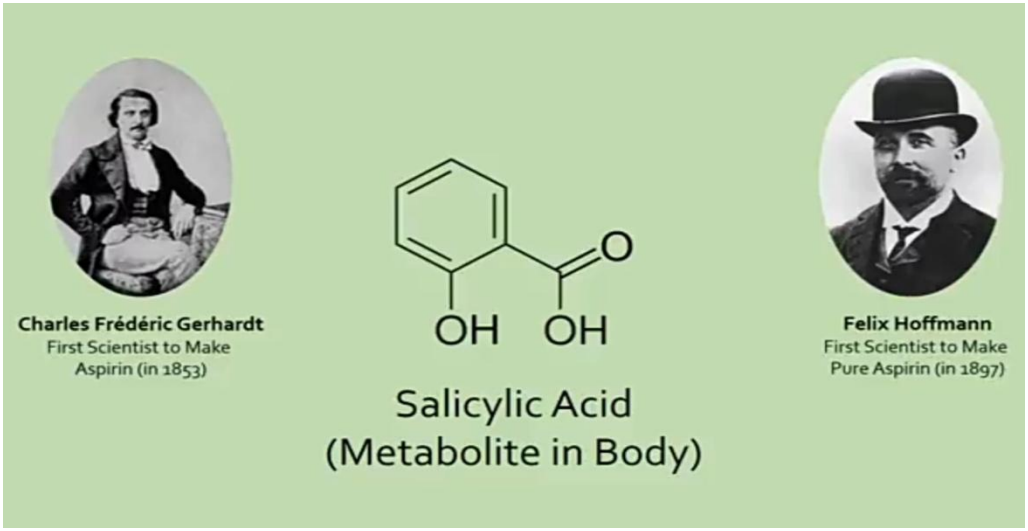

Figure 10: Both the scientists as they studied salcin as salicylic acid in metabolism.

Figure 11: Structure of aspirin (Acetylsalicylic Acid)

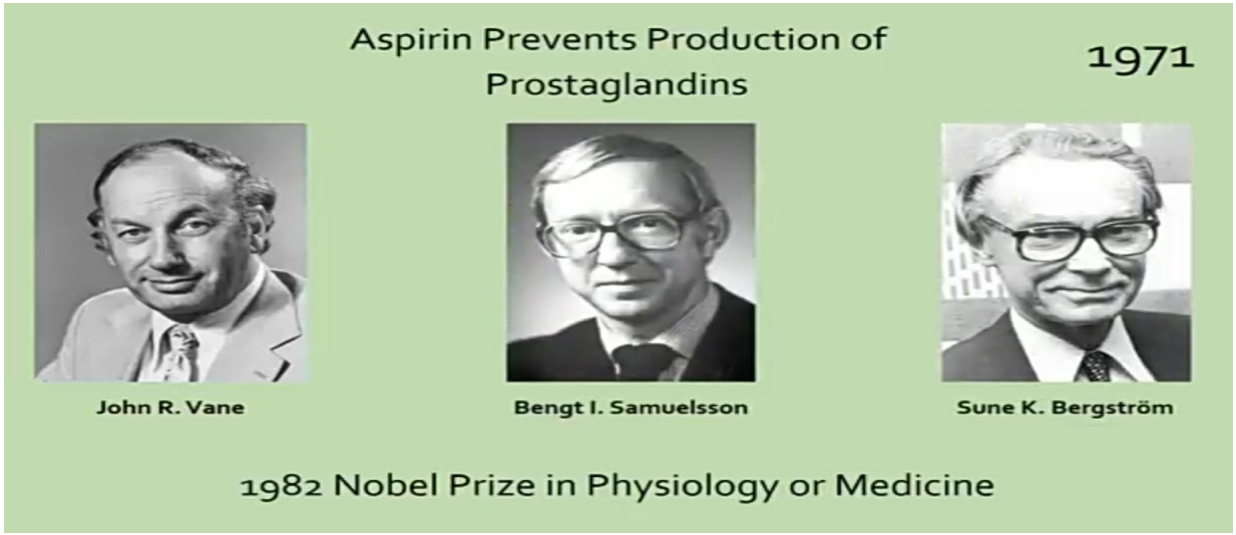

Figure 12: Showing the name of scientists who did studied aspirin role in physiology

Now we will look further the real physiological role of aspirin, aspirin usually blocks the formation of prostaglandin, and prostaglandin have both inflammatory as well as anti-inflammatory action. We will see different roles of prostaglandins via a figure bellow, when aspirin blocks the prostaglandin formation then the parent compound that is a fatty acid, produces more Leukotrienes; can cause allergy and asthma.

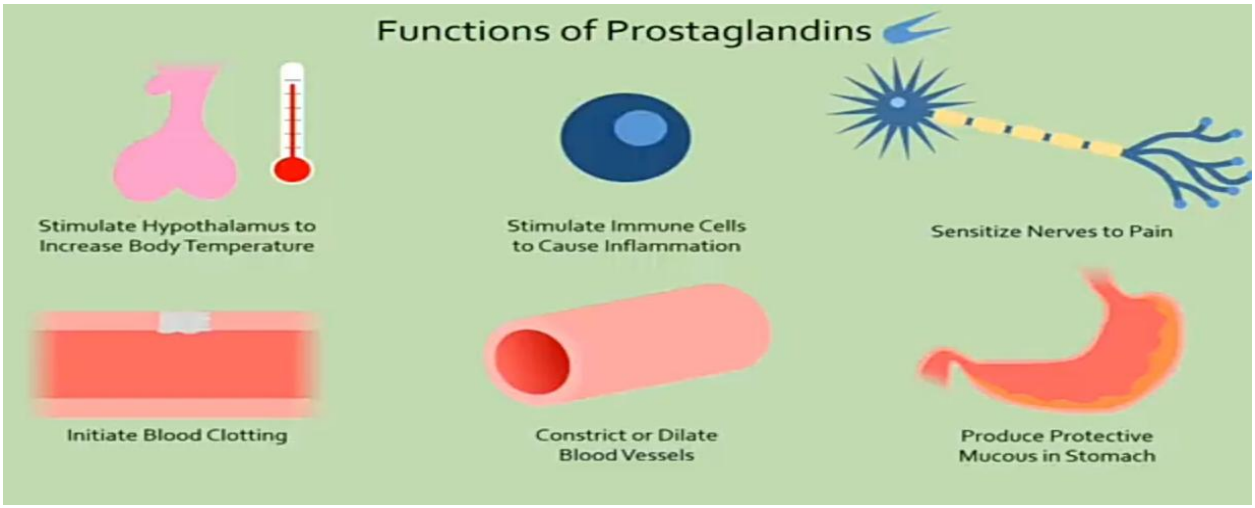

Figure 13: Showing different roles of prostaglandins

One of the most important role is the secretion of mucous and if it is blocked person will suffer from peptic ulcer or high acidity. This could be seen as a side effect of aspirin. In case of blood clotting disease aspirin can prevent clots if low doses of it is taken, but if the disease of clotting is not found then aspirin should be avoided because it can cause severe loss of clotting and when unfortunately a person gets cut then it difficult to have clotting. In case of Heamophilia, aspirin should be prevented.

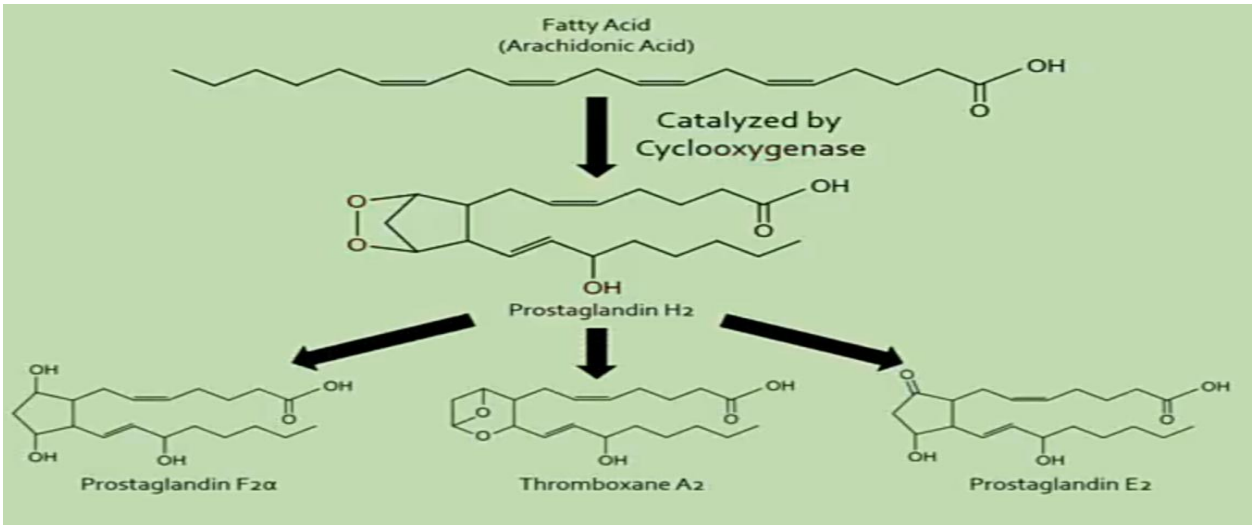

Figure 14: Showing the formation of prostaglandins from Arachiodonic acid catalysed by an enzyme cyclooxygenase

Conclusion

These days the tolerance of pain is totally gone and people are recklessly taking pain killers as the primary medicine but instead of curing pain, which is a symptom of any disease, the disease itself should be cured. We can turn on to the older ways of treating medicine likewise herbs and other things. Surprisingly it is available for babies too, is that safe for babies to have it, it can adversely affect lungs, liver and kidneys.

Figure 15: Often seen on medicine on the chemist shop, is widely used also, for any sort of pain in children

This should be avoided as much as possible, there are certain other things which could lead to reduction in pain likewise gripe water or clove oil or other natural products, we can switch to it.

Conversely we have to look for an alternative where we can switch over and this could be self tolerance and ability of curing disease not pain.

This abstract is concluded by a message, pain is not disease itself it just a symptom of something unusual occurring in our body. *Lets Cure Disease Not Pain.*

Thanking you,

Anandita Jha

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