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REVIEW ARTICLE

A brief cause of acute inflammation: an overview

Rajesh Asija, Rajesh Prajapat, Pankaj Vyas, Vijay Kumar

[1] Department of pharmaceutics, Maharishi Arvind institute of pharmacy, Mansarovar, Jaipur-302020, Rajasthan, India

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ABSTRACT

The inflammation is a defense biologically action on living body tissue. Acute inflammation mostly causes by bacterial infection, tissue necrosis and some chemical irritant. The visual and sign of inflammation are heat (*calor*), pain (*dolor*), redness (*rubor*), swelling (*tumor*) and loss of function (*functio laesa)*. Some chemical mediators are produce inflammation (e.g. prostaglandins, serotonin).

Key words: Inflammation, Tissue necrosis, Redness, Prostaglandins.

INTRODUCTION:

Inflammation is an enveloping form of defense that is broadly defined as a nonspecific response to tissue breakdown and is engaged by both innate and adaptive immune systems to pathogenic inducers. The individual of the cardial signs of inflammatory responses in relation to other facets of antiparasite barricade is that damage to the self is obvious. Importantly, collateral damage from the inflammation is not the same to immunopathology, which is involves the specific immune-mediated assault on target tissue that is no longer recognized by the immune system as nature. Autoimmune pathology reflects dysregulation of adaptive immune components, such as genetic and environmental influences, antibody and cell-mediated functions.[1]

Inflammation is the protecting response by injury or destruction of the tissues, which serve up to destroy, intensity or both the injury agent and injured tissues. Inflammation is a complex reaction usually necrotic cells that enhance of vascular response, migration and activation of leucocytes and systemic reaction. The inflammatory response is the close to the process of repair. During repair, the injured tissue replace by regrowth of parenchymal cells, from filling of the desert with fibrous tissue. The clinical features of inflammation was express in an Egyptian papyrus, Celsus a roman writer of the first century, first listed the four cardinal signs of inflammation are redness (rubor), heat (calor), swelling (tumor) and pain (dolor). A fifth clinical sign, loss of function (functio leasa) was later explain by Virchew.[2]

Based on visual study, the ancients characterised inflammation by five cardinal signs, namely redness (*rubor*), swelling (*tumor*), heat (*calor*), pain (*dolor*) and loss of function (*functio laesa*). More recently, inflammation was described as "the progression of changes which occurs in a living tissue when it is injured provide that the injury is not of such a degree as to at once destroy its structure and vitality" or the reaction to damage of the living microcirculation and related tissues. Inflammation was view as being an objectionable response that was destructive to the host. The part of inflammation to the body's defensive and healing process was predictable. Furthermore, inflammation is considered the keystone of pathology in that the changes experiential are suggestive of injury and disease.[3]

Inflammation is the physiological response of the body feedback to the tissue injury and irritants. Inflammation is a biological reaction to a disrupt tissue homeostasis.[4] At its basic level; it is a tissue-destroying process that involves the employment of blood-derived products, such as leukocytes and plasma protein into agitated tissue. This migration is facilitated by alteration in the local vasculature that occur vasodilation generate improved vascular permeability and blood flow. Inflammation affects only living tissue. Inflammation is the body challenge reaction at self-protection, the mean be to remove harmfully stimuli, including pathogens, injured cells or irritants. However, it may create disease for the example, plaque in coronary artery disease linked to inflammation, interstitial cystitis and rheumatoid arthritis is a most common chronic and systemic auto immune disorder characterized by inflammation of the synovial joints and concomitant destruction of cartilage and bone.[5]

Inflammation is the essential a biologically response, ultimate goals of the which is to get rid the venomous but sometimes it may be probable harmful and needs pharmacological treatment to the control its symptoms.[6]

***Corresponding author:** Rajesh Asija || **E-mail:** rajupharma6499@gmail.com*

Inflammation is most important compound reaction of the body tissue against infection of tissue injury. Inflammation consists of the make active of leukocytes and plasma proteins at the site of inflamed area to eliminate the contaminate agent. The infect microorganisms, after the grow body access to the site of inflamed tissue area, caused local inflammation. The local inflammatory response is attend by the well-known systemically response known as the acute phase response. These responses is manifest by the generation of the solmonescence, lethargy, fever, anorexia, improve synthesis of hormones such as the adrenocorticotropic hormone and hydrocortisone, better leukocytosis and modify the production of large number of proteins in liver. These proteins whose levels transform during inflammation are called as acute phase proteins. The many bacterial mechanism and products such as lipoteichoic acid, exotoxins, lipoproteins, peptidoglycans and glycolipids can initiation of the local inflammatory process. In the bacterial invasion, many cell types exist in the mucosa or skin is form important molecules in prohibited infections. The most important host cells is the mast cells, popular known for their stores of histamine, serotonin and for containing preformed tumor necrosis factor-α and various cytokines mediator. The exposure to various bacterial products, mast cells release these pro-inflammatory cytokines mediators, which are essential for the recruitment of the neutrophils to the inflamed area. The major three of cytokines are interlukin-1(IL- 1), interlukin-6(IL-6), and TNF-α, which have the found behavioral, neuro endocrine and metabolic effect. The concentration gradient of various tissue products unrestricted improves the vascular system and the cells of inflammation. Furthermore, apart from the cytokine mediated rise of clinical symptoms, the series of changes occur such as change in concentration of several acute phase proteins, activation of complement cascades, increased value of adrenocorticotropic hormone and glucocorticoids, and small serum levels of calcium, zinc, iron, vitamin A, and α-tocopherol. Acute phase proteins distinguish microorganisms and make active complement components system, while others search cellular remnants and free radicals or deactivate proteolytic enzymes.[7]

In the site of injury, pro-inflammatory cytokines are release from dented tissue area. Activate of complement cascade forms complement products that act as the chemotactic agents for the mobilization of neutrophils. Complement anaphylatoxins induce mast cells degranulation with release of histamine, causing vasodilation and smooth muscle contraction response. Leukocytes, kallikrein and bradykinin exit from blood vessels caused swelling. The bradykinin is binds to nearby capillary cells and stimulation of the production of prostaglandins which is binds to free nerve endings making to start pain impulse.[7] Inflammation consists of recruited and establishment of leukocytes and plasma proteins at the site of infection to eliminate the contagious agent. The infectious bacteria after the gaining access to the site of injury area cause local inflammation.[8] The Goals of inflammation are, remove the initial cause of cell injury, Eliminate necrotic cells and tissue, It is initiate the process of repair, Prevents the spread of damaging agents to nearby tissues. Inflammation is the protection response of tissue to injury. The acute phase occurs by augmented blood circulation and vascular permeability of blood vessels with the addition of fluid, leukocytes and inflamed mediators such as prostaglandins, cytokines. In sub acute and chronic inflammation occurs by the development of specific humoral response and cellular immune response to pathogens present at the tissue injury area.[9]

The causes of acute inflammation are: [10]

- Bacterial infections, e.g. fungus, viruses, bacteria toxins
- Hypersensitivity reactions, e.g. parasites, rods, bacilli
- Physically agents, e.g. heat, excess cold, trauma, ionizing irradiation
- Chemical irritants, e.g. alkalis, reducing agents, corrosives agents, acids
- Tissue necrosis process, e.g. ischemic tissue infarction.

Bacterial infections: One of the common sources of inflammation is bacterial infection. Viruses may create death of individual cells by intracellular multiplication. Bacteria release specific exotoxins agents (chemicals synthesized due to which specifically initiate inflammation) or endotoxins (which arise with their cell walls). Sometime organisms cause immunologically-mediated inflammation throughout hypersensitivity reactions.

Hypersensitivity reactions: The hypersensitivity reaction may occur when the changed state of immunological responsiveness causes appropriate or extreme immune reaction which produce the damaged tissues. All have cellular or chemical mediators similar to those involved in inflammation.

Physically agents: The tissue damage may generate result inflammation may occur due to physically trauma, ultraviolet or ionizing radiation, burns, or excessive cooling (frostbite).

Irritant chemicals: The corrosive chemicals (acids, oxidizing agents, alkalis) excite the inflammation due to more tissue damaged. However, noxious agents may be release specific chemical mediators which produce directly to inflammation.

Tissue necrosis: The death of tissues due to lack of oxygen or nutrients resulting by small blood flow is a potent inflammatory stimulus. The edge of a recent shows an acute inflammatory response.

Sign of normal inflammation: [10, 11]

- Calor (Heat),
- Dolor (pain),
- Rubor (redness),
- Tumor (swelling),
- Loss of function (functio laesa).

Redness (rubor): The inflamed tissue appears red, for example sunburn, cellulitis due to bacterial infection or acute conjunctivitis due to dilation of small blood vessels within the damaged tissues.

Heat (calor): The increase in temperature is look only in peripheral parts of the body, such as the skin due to increased blood flow (hyperaemia) due to vascular dilatation and the delivery of warm blood to the inflamed area.

Swelling (tumor): The swelling produce the edema the buildup of fluid in the extravascular space as part of the fluid exudates and to a much extent, by the inflammatory cells migrating into the area.

Pain (dolor): Pain is one of the best features of acute inflammation. It results from the stretching and distortion of tissues due to inflammatory edema and from pus under pressure in an inflamed cavity. Sometime of the chemical mediators produced acute inflammation, including prostaglandins, serotonin & bradykinin.

Loss of function (functio laesa): Loss of function was added by Rudolf Virchow ("father of modern pathology") (1821-1902) to the list of features written by Celsus. The Movement of the inflamed area is conscious inhibited by pain, while the swelling may physically immobilize the tissues.

The various chemical mediators of acute inflammation:

The spread of the acute inflammatory response produce injury to the small area of tissue suggests by chemical mediators are released from damage tissues. These chemicals, is called as endogenous chemical mediators which produce vasodilatation, emigration of neutrophils cells, chemotaxis agents, and induced vascular permeability.[10]

Histamine is the best chemically mediator which produce acute inflammation. Its cause's vascular dilation and the immediate transient phase of the enlarged vascular permeability. The histamine is stored in mast cells granules, basophiles and eosinophils, leukocytes, and platelets. The histamine plays a role in atherosclerosis, neuroinflammation, plasticity, and degeneration and thus likely contributes to the Pathophysiology of brain injury associated with hypoxia, [12] ischemia and stroke, trauma, or neoplasms. In all of these conditions, histamine-mediated recruitment of immune cells into damaged tissue and histamine receptor functions have been reported to be altered.[13] H_1R and H_2R on endothelial cells directly participate in acute hyperemic response to physiological and pathological stimuli that require BBB opening yet without affecting cerebrovascular protein permeability. Glucocorticoids, such as dexamethasone used to treat brain edema, down regulate vascular H_1R and H_2R. Cimetidine, an H_2R antagonist, exhibits unexpected properties as an antitumor agent with potential for the treatment of glioblastoma[14] likely by antagonizing growth-promoting and immunomodulatory histamine effects. Moreover, histamine interferes with neurovascular and BBB functions[12] implicated in aseptic neurogenic inflammation underlying vascular headaches. Histamine acts on both peripheral and central[15] components of the trigeminovascular system, which includes trigeminal nuclei, ganglia and nerve terminals, blood vessel endothelial, and mast cells.[16]

Prostaglandins is the group of the fatty acids derived by arachidonic acid and synthesized by many cells types. Sometime prostaglandins which are induced the vascular permeability caused by other compounds. Others role is include platelet aggregation. The anti-inflammatory activity of drugs such as the aspirin and the non-steroidal anti-inflammatory drugs is to inhibition of one of the enzymes involved in prostaglandin synthesis.[10]

Recent studies have shown that PGF2α also plays a significant role in renal function[17], contraction of arteries[18], myocardial dysfunction[19], brain injury and pain.[20]

5-HT (serotonin) is present in high concentration in mast cells and platelets. It is a potent vasoconstrictor. Serotonin is a vasoconstrictor, low concentrations of which in some species, notably the rat, induce increased vascular permeability. Serotonin is present in many tissues, including brain and intestine and platelets, and, in the rat at least, occurs in the mast cells.[21] In many types of injury, there is a release of serotonin which parallels that of histamine, and, in the rat, some chemical histamine liberators release serotonin too. Although serotonin is present in inflammatory exudates up to 1 hr after injury and absent from samples taken at later times, specific inhibitors of the substance fail to influence the

vascular changes leading to the accumulation of such exudates.[21] On the other hand, the edema provoked in the rat by injection of egg white and dextran is considerably lessened as a result of administration of these compounds. The serotonin antagonist (bromolysergic acid diethylamide tartrate) has been reported also to have some effect on passive cutaneous anaphylaxis in the rat, but the significance of this result is doubtful. Nevertheless, it seems that release of serotonin is likely to be important in certain specialized vascular reactions provoked in the rat by injection of egg white or dextran. The failure of serotonin antagonists to diminish the vascular reaction to chemical and thermal injury need not necessarily exclude its participation, since similar inhibitors fail to influence the syndrome associated with argentaffinoma and thought to be due to excessive production of serotonin. Depletion of histamine and serotonin by repeated injections of compound leads to a longer delay in the onset of vascular changes in the inflamed rat pleura than do dosage with anti-histamine drugs; this observation could be regarded as an indication of a complementary role for serotonin in the early phase of the inflammatory reaction. Similarly, in irradiation injury of the rat intestine, there is profound depletion of the serotonin content of the bowel wall, most marked between 24 and 48 hr, whereas the similar loss of histamine occurs mainly in the initial 24 hr.[22] The effect of prior repeated injections of compound could not be tried in this experimental system, since the substance does not deplete the intestinal wall of serotonin. The above time relationships suggest that if serotonin contributes to the vascular changes of injury in the rat it does so by augmenting and temporarily sustaining the similar effect of histamine. A comparable action of serotonin in species other than rat or mouse seems doubtful, however, since in other species it does not increase vascular permeability to a significant extent.[23]

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