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Volume 2









MEDICAL-SURGICAL NURSING

As per the GNM Syllabus

Kochuthresiamma Thomas

2nd Edition

Forewords
Presannakumari Y
Valsa K Panicker

JAYPEE

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CHAPTER

3

Pathophysiologic Mechanism of Disease

CHAPTER OUTLINE

- Stress and Adaptation
- Coping with Stress
- Nursing Interventions
- Cellular Adaptation and Injury
- Defense Mechanisms of the Body
- **Inflammation:** Signs and Symptoms and Pathogenesis
- Nutritional Considerations

INTRODUCTION

Physiology is the study of the normal function of the human body whereas pathophysiology is the study of abnormal or disordered function of the body. Mechanisms are patterns of actions performed by different parts or organs of the body. The pathophysiologic mechanism gives rise to signs and symptoms which can be observed and assessed by the nurse. On the basis of these observations, the nurse can plan for appropriate interventions to deal with the problems.

STRESS AND ADAPTATION

Stress is a universal phenomenon and all people experience stress. Stress is part of everyday living and it requires some sort of adjustment on the part of the individual. It is an unavoidable reality in life.

Stress

- Stress is defined as the process that occurs in response to events that disrupt, or threaten our physical or psychological functioning.
- Stress can be defined as a state of worry or mental tension caused by a difficult situation (WHO).
- Stress is a condition in which human beings respond to changes in its normal balance state. Stress results from the presence of stressors which leads to physiological or behavioral symptoms showing poor physical and mental health.

Eustress

Eustress is a positive form of stress having a beneficial effect on health, motivation, performance, and emotional well-being, e.g., getting job, marriage, etc.

Adaptation

Adaptation is the change that takes place as a response to a stressor.

According to Selye's theory of local adaptation syndrome (LAS), there will be inflammatory response and repair at the site of local trauma injury. Depending on the severity of injury stimulus is sent to the nervous system which results in general adaptation syndrome (GAS).

Sources of Stress

- **Sources within the person:** Illness, hospitalization, frustrations, conflict, pressure, etc.
- **Sources in the family:** Interpersonal conflict, birth of new child or arrival of new member, divorce, illness of family member, disability, death in family.
- **Sources in the community and society:** Occupational stress, competition, physical environment, poor interpersonal relationship, inadequate recognition, loss of job, etc.
- **Sources in the physical environment:** Noise, crowd, exercise, heat, cold, pain, etc.
- **Sources in the job:** Sexual harassment, discrimination, work overload, conflict, performance appraisal.
- **Hassles of daily life:** Irritations and frustration in everyday routines, traffic, bad weather, broken

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plumbing, lost keys, missing a bus/train, unexpected rain, strikes, etc.

According to Coleman, some of the common sources of stress in our life are:

- Unemployment.
- Divorce and separation.
- Death of family member.
- **Natural and manmade catastrophes:** Floods, earthquake, tornado, violence, fire, war.

Adaptation of Stress

The ability to tolerate stress is not same in all the people. Some people can tolerate much greater stress than other do.

Adaptation is the change that take place as a result of the response to a stressor. It is the process by which human body modifies itself to conform to the environment.

Hans Selye, a Canadian physiologist who is known as the father of stress proposed that we react to physical and psychological stress in three stages which he called the general adaptation syndrome (GAS). The stages **(Figs. 3.1 and 3.2)** are:

Stage 1: The alarm reaction: It begins when the body recognize that it must fight off some physical/psychological danger.

During this stage, he becomes more sensitive and alert. Heart rate and respiration become faster, tense, emotions high, etc. In this stage, he uses the defensive coping strategic to deal with stress. If these approaches do not reduce stress, he eventually enters with the second stage.

Stage 2: The stage of resistance: Physical symptom of stress appear, and the person has to struggle against increasing psychological disorganization.

Coping techniques are intensified to reduce the stress. But if the stress is extreme or prolonged, or if we adopt inappropriate coping techniques, it becomes miserable. Physical and emotional resources are further depleted.

Stage 3: Stage of exhaustion: Ineffective defensive mechanism are intensified to bring stress under control, some people lose touch with reality and show sign of emotional disorder. People may show signs of 'burn-out', physical symptom—skin or stomach problem are encountered.

If stress persists irreparable physical or psychological damage may occur to individual.

Responses to Stress

Stress influences our cognitive, emotional and social system.

- **Physical stress responses**
  - Changes in heart rate, respiration.
  - Usually accompanied by emotional stress responses.
  - Feeling of tension, irritability, short temper.
- **Cognitive stress responses**
  - Reduces ability to concentrate, to think clearly, to remember accurately, etc.

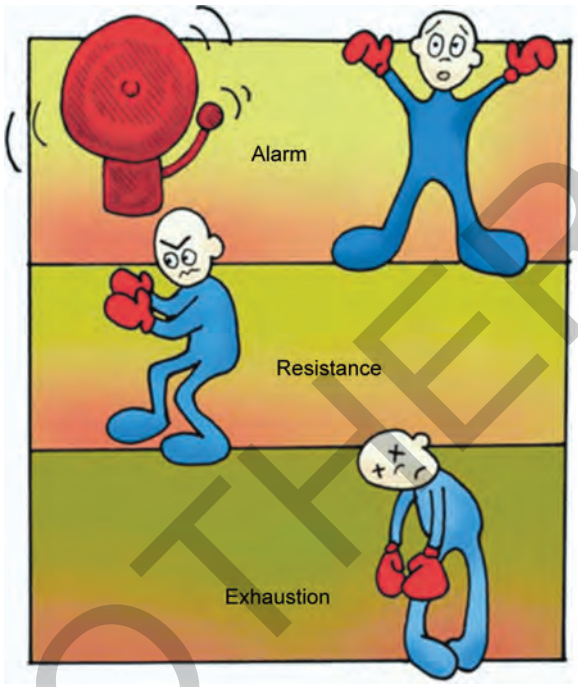


Fig. 3.1: Three stages of stress.
Source: eww.grosser.wikipedia

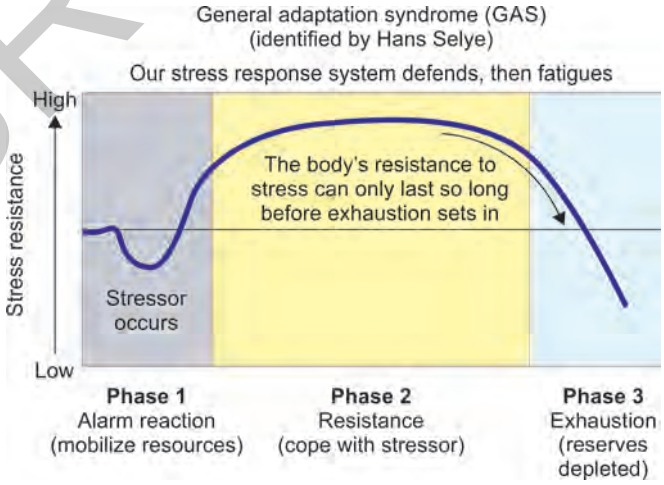


Fig. 3.2: General adaptation syndrome.

  - Affects attention.
  - Hostile attitudes.
  - Decline in performance.
- **Behavioral stress responses**
  - Smoking, drug abuse, alcoholism.
  - Accident proneness.
  - Violence, appetite disorders.
  - Depression, sleeplessness, family problems.
  - Sexual problem.
- **Physiological response**
  - Allergy.
  - Asthma.
  - Cancer.

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- Depression.
- Diabetes.
- Headaches.
- High BP.
- Peptic ulcer.
- Skin diseases.

❖ **Burnout:** The general feeling of exhaustion develop when a person experiences too much pressure and has few sources of adaptation.

Factors causing Stress to Patients in the Hospital

Some of the factors that cause stress in the hospital are:

❖ Unfamiliarity of surroundings.
❖ Having strangers sleep in the same room.
❖ Having to eat cold or tasteless food.
❖ Being awakened in the night by the nurse.
❖ Loss of independence.
❖ Having to eat at different times than usual.
❖ Having to wear a hospital gown.
❖ Not having the call light answered.
❖ Separation from spouse.
❖ Separation from family.
❖ Financial problems.
❖ Isolation from other people. Not having friends visit.
❖ Lack of information.
❖ Not having questions answered by staff members.
❖ Having nurses or doctors who talk too fast. Nervousness and preoccupation often make it difficult to fully concentrate on what is being said.
❖ Not knowing the reasons for (or the results of) treatments.
❖ Threat of severe illness.
❖ Fear that appearance will be changed after hospitalization.
❖ Being hospitalized after an accident and suspecting the worst.
❖ Thinking he/she may have cancer.
❖ Problems with medications.
❖ Having medications which cause discomfort (i.e., chemotherapy).
❖ Not getting relief from pain.
❖ Not getting pain medication when needed.

Reactions to Illness in the Hospitalized Adult

Generally, we react negatively to the signs of even a minor illness. We may feel resentful, angry, disappointed, or frustrated. An illness never occurs when we can afford the time to care for and nurture ourselves. An illness reminds, that we are not in complete and ultimate control of our lives.

The coping tasks of the ill adult are varied and significant. Although each patient will, hopefully, not confront all of them, there are 8 major tasks facing the ill adult. All of these relate to 4 areas of basic human need as identified by Maslow—basic physiological needs, safety, love and belonging, and the need for self-esteem.

COPING WITH STRESS

The efforts to control, reduce or learn to tolerate the threats that lead to stress are known as coping.

The eight coping tasks of ill adults are:

1. Change in body image.
2. Reality of their own mortality.
3. Coping with altered relationships with others.
4. Dealing with an altered level of dependency.
5. Adjusting to physiological changes.
6. Grieving for their losses (self or lifestyle).
7. Fear of recurrent problems.
8. Illness occurs with other stressors.

Stages in Coping with Stress

Most successful stress coping programs move systematically through several logical stages to remove stressors that can be changed and reduce stress resources.

They are:

❖ **Assessment:** Identify the sources and effects of stress.
❖ **Goal setting:** List the stress and stress responses to be addressed. Designate which stressors are changeable, and not changeable.
❖ **Planning:** List the specific steps to be taken to cope with stress.
❖ **Action:** Implement stress coping plans.
❖ **Evaluation:** Determine the changes in stressors and stress responses that have occurred as a result of stress coping methods.
❖ **Adjustment:** After coping, methods to improve results, if necessary.

Stress Management Techniques

WHO stress management guide—aims to equip people with practical skills to cope with stress.

Keep a Daily Routine

Having a daily schedule can help us use our time efficiently and feel more in control. Set time for regular meals, time with family members, exercise, daily chores and other recreational activities.

Get Plenty of Sleep

Getting enough sleep is important for both body and mind. Sleep repairs, relaxes and rejuvenates our body and can help reverse the effect of stress.

Good sleep habits (also known as sleep hygiene) include:

❖ Be consistent. Go to bed at the same time each night and get up at the same time each morning, including on the weekends.
❖ If possible, make your sleeping area quiet, dark, relaxing and at a comfortable temperature.

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- Limit your use of electronic devices, such as TVs, computers and smartphones, before sleeping.
- Avoid large meals, caffeine and alcohol before bedtime.
- Get some exercise. Being physically active during the day can help you fall asleep more easily at night.

Connect with Others

Keep in touch with family and friends and share your concerns and feelings with people you trust. Connecting with others can lift our mood and help us feel less stressed.

Eat Healthy

What we eat and drink can affect our health. Try to eat a balanced diet and to eat at regular intervals. Drink enough fluids. Eat lots of fresh fruits and vegetables if you can.

Exercise Regularly

Regular daily exercise can help to reduce stress. This can include walking, as well as more intensive exercise.

Limit Time following News

Spending too much time following news on television and social media can increase stress. Limit the time you spend following the news if it increases your stress.

Individual Coping Strategies

Coping responses allow individuals to:

- Eliminate or reduce stressors.
- Change their appraisal of the potential harmfulness of their stressors.
- Minimize the extent of stress that they will experience these stress.

The important strategies includes:

- **Reappraisal:** Whether an event is positive, neutral, thrusting or harmful it is based on the thinking pattern of the individual. When one cannot eliminate stressor, they can think about its implication and consequences. Thus, he can treat the situation as a challenge focusing on ways to control it.
- **Social comparison:** A person can compare himself to those who had severe stresses.
- **Avoidance:** Ignoring the stress evoking event.
- **Tumor:** The ability to respond with humor or amuse other people in stressful situation.

Humor is one of the greatest and quickest devices for reducing stress. Humor works because laughter produces helpful chemicals in the brain. Humor also gets your brain thinking and working in a different way—it distracts you from having a stressed mind-set. Distraction is a simple effective de-stressor—it takes your thoughts away from the stress, and thereby diffuses the stressful feelings.

Therefore most people will feel quite different and notice a change in mindset after laughing and being distracted by something humorous.

- **Relaxation:** Meditation, relaxation techniques, yoga, breathing, exercise, etc.
- **Exercise:** Jogging, dancing, swimming, walking, etc., are beneficial.
- **Behavioral self-control:** Controlling the situation, instead of allowing the stressors to control the individual.
- **Cognitive therapy:** Techniques to modify your thought.

NURSING INTERVENTIONS

Stress or the potential for stress is ubiquitous, i.e., it is everywhere and anywhere. Anxiety, frustration, anger, feelings of inadequacies, helplessness or powerlessness are emotions associated with stress. In the presence of these emotions the activities of daily living may be disrupted.

It is important for nurses to know that the optimal point of intervention is during the stage when a person's own compensatory processes are still functioning effectively. Early identification of both physiological and psychological stressors is a major responsibility of the nurse.

Stress management is directed towards reducing and controlling stress and improving coping.

Nursing assessment and interventions include the following:

- **Assess level of anxiety:** Review familial and physiological factors (e.g., genetic depressive factors); psychiatric illness, active medical conditions (e.g., thyroid problems, metabolic imbalances).
- Monitor vital signs.
- Description of feelings (expressed and displayed).
- Conduct interview and observe behavior.
- Assist clients to identify feelings and to deal with problems.
- Establish a therapeutic relationship.
- Be available to client for listening and talking. Assist client to develop self-awareness of verbal and nonverbal behaviors.
- Clarify meaning of feelings and actions by providing feedback and checking meaning with client.
- Promote wellness. Assist client with identifying new methods of coping with anxiety.
- Review happenings, thoughts, and feelings preceding the anxiety attack.

Promoting a Healthy Lifestyle

A healthy lifestyle plays a major role in preventing stress. Unhealthy lifestyle and habits can be identified through a health-risk appraisal.

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Enhancing Coping Strategies

It includes assisting a patient to adapt to perceived stressors, changes or threats that interface with meeting the life demands and roles.

The predominant ways of coping with illness are as follows:

- Trying to be optimistic about the outcome.
- Using social support.
- Using spiritual resources.
- Trying to maintain control over the situation or over feelings.
- Trying to accept the situation.

Relaxation Techniques

Relaxation techniques are very effective to reduce stress and its adverse effects commonly used techniques include progressive muscle relaxation, meditation, breathing techniques, massage, music therapy and the use of humor.

The relaxation techniques have four elements: (1) A quiet environment, (2) A comfortable position, (3) A passive attitude and (4) A mental device—a word phrase or sound on which to focus one's attention.

Promoting Family Health

The family plays a control role in the patient's life. Involvement of family members in the care of the patient is very useful to relieve the stress. Emotional support from family and significant others provides a sense of sharing the burden.

CELLULAR ADAPTATION AND INJURY (TABLE 3.1)

Cells are complex units which dynamically respond to the changing demands and stress of daily life. Any stressor that alters the ability of the cells to maintain the optimum balance of its adjustment process will lead to injury. When body suffers an injury structural and functional damage occurs which may be reversible or irreversible. The cells can adapt to environmental stress by the following adaptations:

- **Hypertrophy** is the increase in the size of the organ due to increased workload.
- **Atrophy** is decrease in the size of the organ.
- **Hyperplasia** is an increase in the number of new cells in an organ or tissue. As the cells multiply the volume increases.
- **Metaplasia** is a cell transformation where one type of cell change the another type.

DEFENSE MECHANISMS (PHYSIOLOGIC) OF THE BODY (FLOWCHART 3.1)

The skin and mucus membrane are the body's ***first line*** of physiologic defense. They act as protective covering and secrete substances that inhibit the growth of microorganisms. The sweat glands secrete lissome an antimicrobial enzyme. Sebaceous gland secretes sebum which has antimicrobial and antifungal properties.

Acidic secretion from the skin and mucosa of the gastrointestinal and genitourinary systems inhibit the growth of many pathogenic organisms. The skin and mucus membrane surfaces are colonized by normal bacterial flora which prevent pathogens from gaining access to the body. The cilia in the respiratory tract and gastrointestinal motility help to remove microorganisms.

The second line of defense involves phagocytosis and inflammation. The white blood cells have the ability to ingest bacteria when they invade the body. This process is called phagocytosis.

The third line of defense provides immunity against specific pathogens natural immunity is acquired from exposure to the disease organism through infection with the actual disease. Vaccine induced immunity is acquired through the introduction of a killed or weak form of the disease organism through vaccination **(Flowchart 3.1)**.

INFLAMMATION

Inflammation is the physiological response to tissue injury. It is a protective mechanism of the body to remove the injurious stimuli and to initiate the process of healing and repair.

Types of Inflammation

Inflammation is classified into two types: Acute and chronic.

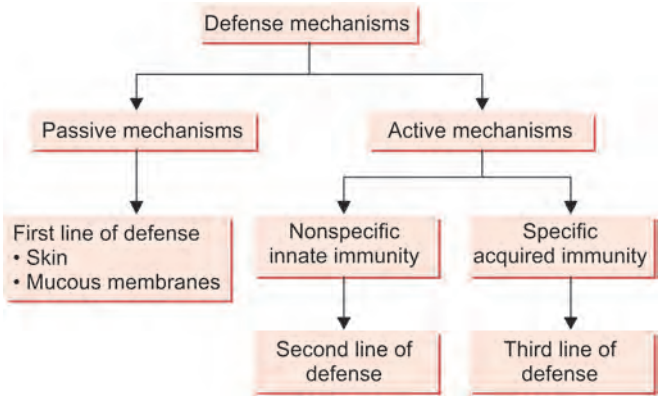
1. **Acute inflammation** is an immediate response to an injurious stimulus, microbe or foreign body. It is of

TABLE 3.1: Cellular adaptation.

Change	*Stimulus*	*Examples*
Hypertrophy Increase in cell size leading to increase in the size of the organ	Increased workload	Leg muscles of an athlete Arm muscles of tennis player Let ventricular hypertrophy in person with hypertension
Atrophy Shrinkage in the size of the cell leading to decrease in the size of the organ	Decrease in use	Secondary sex organs in aging person Extremity immobilized in plaster cast
Hyperplasia Increase in number of new cells	Hormonal influence Removal or destruction of tissue	Breast changes of a girl in puberty Breast changes in pregnancy Regeneration of liver cells
Metaplasia	Stress applied to highly specialized cell	Changes in epithelial cells lining bronchi in response to smoke

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Flowchart 3.1: Defence mechanism.



shorter duration and healing occurs within two to three weeks.

2. **Chronic inflammation** is characterized by gradual onset and longer duration. It may last for weeks or months or even years. Inflammation is terminated when the injurious stimulus is removed or the mediators of inflammation have degenerated.

Causes

- Bacterial, viral, parasitic and other infections.
- Physical injuries due to trauma and exposure to radiation, heat and cold.
- Injury caused due to exposure with chemicals such as corrosive agents, acids, alkalis and bacterial toxins.

Signs and Symptoms of Inflammation

The local inflammatory response involves changes in microcirculation in the area of injury which includes vasodilatation, increased vascular, permeability and leukocytic cellular infiltration. Because of these changes the five cardinal signs of inflammation are produced:

1. **Rubor (redness):** The site of inflammation becomes red due to increased blood supply caused due to dilatation of capillaries.
2. **Tumor (swelling):** Due to increased vascular permeability there is leakage of plasma proteins at the site of injury which results in swelling.
3. **Calor (heat):** There is warmth at the site of inflammation due to increased blood flow.
4. **Dolor (pain):** Pain occurs due to pressure on nerve endings.
5. **Functio laesa (loss of function):** It may be due to pain and swelling.

Systemic Effects

Systemic responses may also occur due to inflammation:

- **Fever:** It is caused by the endogenous pyrogens released from neutrophils and microphages.
- Constitutional symptoms like malaise, loss of appetite, head ache, chills and muscle pain.
- Leukocytosis.
- Elevated ESR.

Pathophysiology (Fig. 3.3)

The pathological changes of acute inflammation are described below:

Vascular Changes

- **Vasodilation:** There is dilation of blood vessels which begins with the arterioles, followed by the capillaries and venules. This leads to a local increase in the vascular flow is which is manifested as redness and warmth.
- **Increased permeability of the blood vessels:** It leads to the escape of protein rich fluids in to the interstitium. The accumulation of fluid in the interstitial space is called edema which gives rise to local swelling. Swelling may also produce pain due to pressure of fluid on nerve endings.
- **Release of chemical mediators:** Chemical mediators namely prostaglandins, histamine, leukotriene, cytokines, etc., are released during inflammation. These mediators cause leucocytes to tear small blood vessel walls near the site of inflammation.

Cellular Changes

Cellular change of acute inflammation can be divided into two phases: Extravasation and phagocytosis.

1. **Extravasation:** Migration of neutrophils from the vascular lumen to the interstitial tissue is called extravasation.
2. **Phagocytosis:** It is a process of engulfment of solid particles by the cells. The leucocytes or phagocytic cells extent pseudopods around the particle to be engulfed.

NUTRITIONAL CONSIDERATIONS

Anti-Inflammatory Foods

Carbohydrates and fiber: Fiber is an important nutritional component, known to have anti-inflammatory properties. Fiber-rich diets are often associated with a high intake of polyphenols and complex carbohydrates, both of which may affect inflammation positively.

Anti-inflammatory foods include lots of fruits and vegetables, whole grains, plant-based proteins (like beans and nuts), fatty fish, and fresh herbs and spices.

Fruits and vegetables: Research shows that vitamin K-rich leafy greens like spinach reduce inflammation, as do broccoli and cabbage. So does the substance that gives fruits like cherries, raspberries, and blackberries their color.

Whole grains: Oatmeal, brown rice, whole-wheat bread, and other unrefined grains tend to be high in fiber, and fiber also may help with inflammation.

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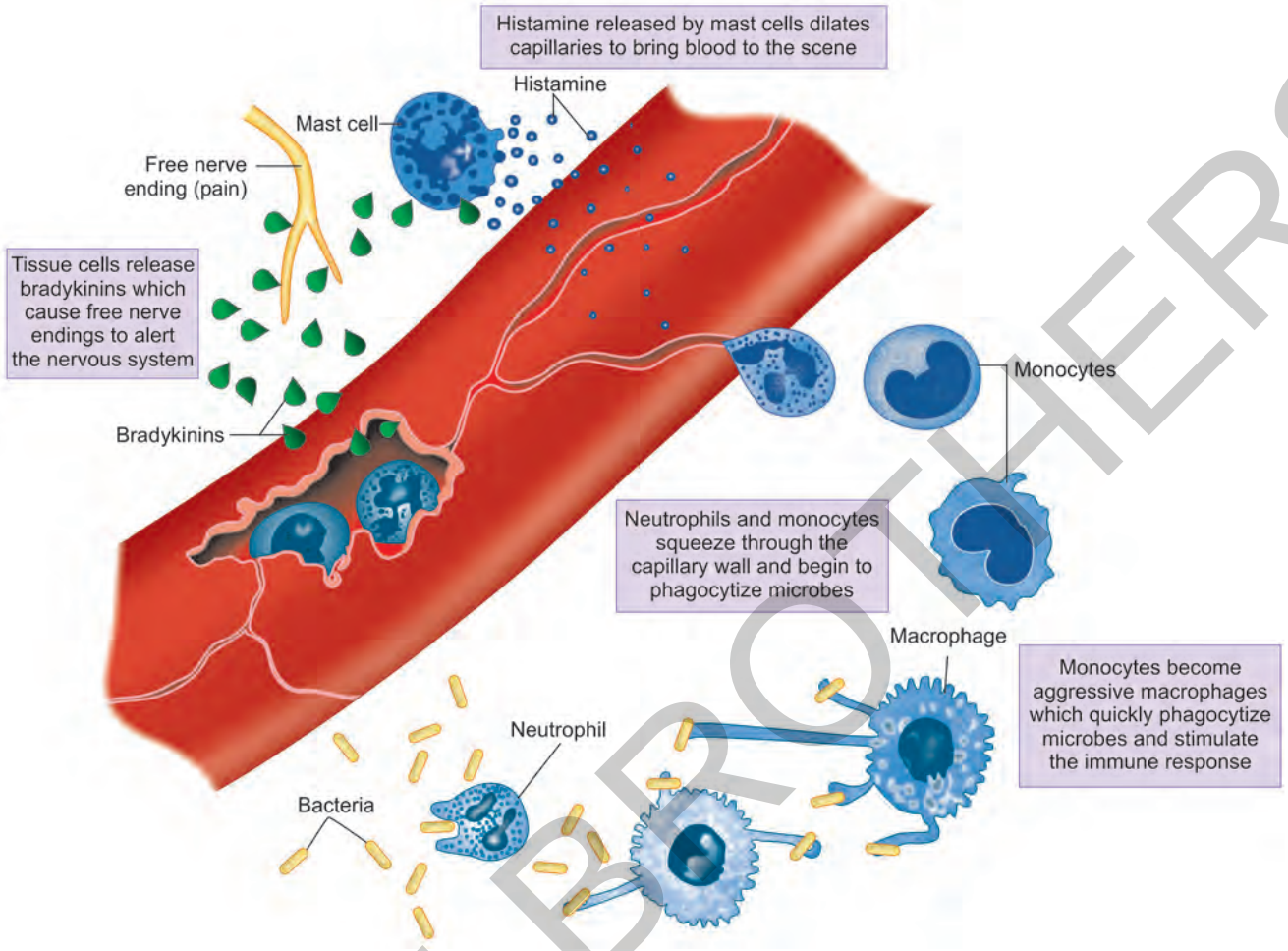


Fig. 3.3: Pathogenesis of inflammation.

Beans: They are high in fiber, plus loaded with antioxidants and other anti-inflammatory substances.
Nuts: They have a healthy kind of fat that helps stop inflammation. (Olive oil and avocados are also good sources.) Stick to just a handful of nuts a day, or otherwise the fat and calories will add up.
Fish: Include fish regularly in the diet. Salmon, tuna, and sardines all have plenty of omega-3 fatty acids, which fight inflammation.
Herbs and spices: They add antioxidants (along with flavor) to your food. Turmeric, found in curry powder, does this with a strong substance called curcumin, and garlic curbs your body's ability to make things that boost inflammation.

Inflammatory Foods

Sweets, cakes and cookies, and soda: They are not dense in nutrients, and they are easy to overeat, which can lead to weight gain, high blood sugar, and high cholesterol (all related to inflammation). Sugar causes your body to release inflammatory messengers called cytokines. Soda and other sweet drinks are the main culprits. Anti-inflammatory diet experts often say you should cut out all added sugars, including honey.
High-fat and processed red meat: These have a lot of saturated fat, which can cause inflammation if you get more than a small amount each day.
Butter, whole milk, and cheese: Again, the problem is saturated fat. Instead, eat low-fat dairy products. They are not considered inflammatory.

Avoid All Fried Items

There are several nutrients known to promote healing following an injury, including vitamins C, D, and E, glycine, polyphenols, and branched-chain amino acids.

Giving the right amount of vitamins and minerals helps to keep the bones strong and at the right density, which reduces the risk of fractures and breaks. In the same way, the right diet helps with strengthening tendons and ligaments. Tendons and ligaments help your muscles to function.

Optimal nutrition can play a key role in controlling inflammation, providing key nutrients for rebuilding injured

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tissue, minimizing muscle atrophy and supporting strength preservation.

Omega-3s are highly anti-inflammatory, making them a necessary post-workout recovery nutrient. By reducing painful inflammation, muscle tissue repair can proceed more efficiently, making the muscles stronger, and faster.

The body needs carbohydrate to replenish stores and to assist with muscle repair and recovery. The body also needs protein for muscle growth and to repair damaged muscle to limit muscle soreness. It also need some good fats and nutrients to help it all come together effectively.

Beyond micronutrients, arginine and glutamine, vitamins A, B, C, and D, zinc, and iron are essential for inflammatory process and synthesis of collagen.

MODEL QUESTIONS

Multiple Choice Questions

1. **The redness and heat of an inflamed area is due to a local hyperemia caused by:**
   a. Vasocostriction b. Vasodilatation
   c. Edema d. Hyperthermia
2. **Who is known as the Father of Stress?**
   a. Sigmund Freud b. Walter Bradford Cannon
   c. Attinson Potter d. Hans Selye
3. **Which of the following is not a sign of inflammation?**
   a. Swelling b. Pain
   c. Clotting d. Redness
4. **What is the first stage of general adaptation syndrome?**
   a. Alarm reaction b. Stage of resistance
   c. Stage of exhaustion d. Stage of acceptance
5. **Increase in the number of new cells in an organ tissue:**
   a. Hypertrophy b. Atrophy
   c. Hyperplasia d. Metaplasia

Answers Key

1. b 2. b 3. c 4. a 5. c

Difference Between

1. Hypertrophy and hyperplasia
2. GAS and LAS
3. Stress and eustress

Short Answers

1. Define inflammation. List the signs and symptoms of inflammation.
2. Explain the pathogenesis of inflammation.
3. Define stress. Explain the stages of stress.
4. Factors causing stress in a hospitalized patient.
5. Physiologic defense mechanism of the body.

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Kochuthresiamma Thomas is currently working as Principal, Sri Sarada College of Nursing and Senate Member, Kerala University of Health Sciences, Thiruvananthapuram, Kerala, India. She did BSc (N) from University of Kerala (1976), MSc (N) from SNDT Women's University (1984) and PhD from University of Kerala (2006). She was awarded by WHO Fellowship to study the recent trends in education and research in Thailand and Indonesia in 1991. She has been deputed by Government of India as Health Consultant to Ministry of Health (MOH), Ethiopia to develop modular curriculum for health extension workers. She was Master Trainer at MOH at Ethiopia for conducting training of trainers' workshop (2008), attended the Linnaeus-Palme Teacher Education Programme at Karolinska Institute, Sweden (2005). She received Trained Nurses Association of India (TNAI) Centenary Award from Dr APJ Abdul Kalam (2008) and the prestigious Florence Nightingale award from President of India (2013). She has more than 35 years of experience and curriculum administration of Diploma, UG and PG programs. She has more than 15 years of experience as a Principal in various government colleges in Kerala state. She was *Former* Registrar of KNME and Deputy Director of nursing education, Thiruvananthapuram. She is PhD Research Guide under University of Kerala and National Consortium for PhD, INC. She has published many articles and research papers in various national and international journals. She was awarded the Lifetime Achievement Award from Venous International Foundation for her contributions to nursing education and research in 2016, served in professional bodies (TNAI) and universities in various capacities.

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