CHAPTER II
REVIEW OF LITERATURE

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2.1 INTRODUCTION

Research studies are undertaken within the context of existing knowledge and review of related literature enables the researcher to gain deeper insight into the research problem and also orients the researcher to what has been done previously.

This chapter presents a brief account of review of the various ideas from experts, citation from books and studies conducted by different investigators which were found to be relevant to different aspects of the present study.

Cardiovascular diseases rank first among the leading causes of death in United States. In India and other developing countries, cardiovascular diseases have emerged as a major public health concern.

Centre for disease control has pointed out that irrespective of medical diagnosis, nosocomial infection develop in 3% to 15.5 % of hospitalized patients each year and of these 16% are lower respiratory tract infections, which account for the third most common type of nosocomial infection. The practice of infection control is the responsibility of the profession of nursing. This is not a new concept. This is the only discipline which is committed to the 24 hrs provision of care for the sick in hospitals. The principles of hygiene, of sanitary
control and of aseptic procedures have always been incorporated into nursing care to ensure the protection of patients from the threat of infection.

Vraciu J. K and Vraciu R.A (1971) studied effectiveness of breathing exercises in preventing pulmonary complications following open heart surgery. They studied 40 patients who underwent open heart surgery. Both high and low risk patients in the experimental group received one preoperative teaching session and treatment twice a day for the first four days post extubation. Routine post operative care was given to all 40 patients. Breathing exercises reduced the incidence of pulmonary complications. This result justify the use of breathing exercises with the high risk open heart surgical patient.

Ruth B. Harris and Ruth B. Hyman (1984) in their study on clean VS sterile tracheostomy care and level of pulmonary infection in New York showed that clean procedure is as good as sterile procedure. One of the reasons to help to explain this trend is that there is economy in cost of equipment for patient and hospital and economy in nursing time. The objective of this research was to test the difference in the level of post operative pulmonary infection between tracheostomized patients receiving sterile tracheostomy care and those receiving clean tracheostomy care.
The study has shown the usefulness of clean techniques in relation to the development of respiratory tract infection.

According to the guidelines published by Center for Disease Control in 1981, handwashing should always occur.

1. before performing invasive procedures
2. before and after contact with wounds,
3. before contact with susceptible patients and
4. after contact with a source likely to be contaminated.

It is necessary to understand and develop insight on other aspects of the study such as criteria for respiratory tract infection and the normal body immune response after surgery and after respiratory tract infection.

Thus the investigator studied the process of immune response and the effect of open heart surgery on patient and distinctive features of respiratory tract infection. It was also necessary to rule out the pathophysiological changes that occur in normal sequence and abnormal pathology.

Open heart surgery constitutes a massive insult to the integrity of the body's internal and external defense mechanisms. The resultant deficits make the patient vulnerable to a number of bacterial infections after operation.
According to Shetty K.R. and Parulker G.B.\textsuperscript{198} "Pulmonary complications are the most commonly reported problems associated with thoracic surgery and the single greatest cause of morbidity and mortality in surgical patients". The combination of anaesthesia, muscle paralysis and the recumbent position, sufficiently affect lung mechanisms. In addition to the intraoperative pulmonary changes associated with the anaesthetized state, the type of anaesthesia might also have an impact on the necessity and length of ventilatory support that is required postoperatively.

Postoperative atelectasis and the resultant secretion retention are of central importance in the development of post operative complications. Other factors like shallow breathing, the lack of spontaneous deep breaths and alveolar collapse all lead to postoperative complications. This helped the investigator to identify the extraneous variables of infections and necessary measures to control them.

Lower respiratory tract infections occur as the bacteria enter the alveoli through the respiratory tract. The inflammation that occurs in the bronchus drains into the alveoli and will produce rusty sputum. This is due to the escape of red blood cells that pass from the inflamed alveoli in the fluid. Later it becomes yellow in colour. Leukocytosis and an increased body temperature will
be there due to infection. A chest x-ray usually demonstrates the presence of infiltrates or diffusion, collapse or non-aerated portion of the lung. Sputum culture will show the growth of organisms.

A study done by Gurevich (1984) points out that even though the classic but nonspecific signs and symptoms of most infection are fever, tachycardiac, tachypnea, and leukocytosis it should be borne in mind that fever and leukocytosis are not always indication of infection, and conversely normal values do not necessarily rule out infection. In the patients who has undergone open heart surgery, a fever of $102^0 F (38.9^0 C)$ is commonly encountered in the first 48 hours after surgery because of the inflammatory response to the extensive tissue damage incurred by the surgery. The fever may rise to $103^0 F (39.5^0)$ if extracorporeal circulation is required. If fever of this magnitude persists for more than 72 hours, however the cause of fever should be investigated. In one study, a temperature of $103^0 F$ or higher was encountered in 80% of patients who did not have an infection. In 37% of these patients (without infection) a W.B.C. of 15,000 % mm or higher was encountered. Conversely 26% of patients who demonstrated fever or elevated W.B.Cs. It must also be remembered that the older population often involved in cardiac
surgery may not develop a febrile response and the administration of steroids is another factor that may blunt the elevation of temperature and/or leukocytes.

In the light of the findings of the above study leukocytosis and fever were eliminated from the criteria of identifying lower respiratory tract infection.

2.2 VALVE DISORDERS

1. Heart valves

Valves are the doorways of the heart. When open, valves only permit blood to flow in one direction. When closed, they form a strong seal both between the different chambers of the heart and between the chambers and the blood vessels.

(a) Mitral valve controls the flow of blood from the left atrium to the left ventricle.

(b) Aortic valve controls the flow of blood from the left ventricle of the heart to the aorta.

(c) Tricuspid valve : controls the flow of blood from the right atrium to the right ventricle

(d) Pulmonary valve : Controls the flow of blood from right ventricle of the heart to the pulmonary artery

Tricuspid valve and pulmonary valve cases were not selected for this study.
Heart Valves – Fig. 1

- Pulmonic valve
- Aortic valve
- Mitral valve
- Tricuspid valve
There are two types of damaged valves (1) leaky or regurgitant valves that allow reverse blood flow, and (2) stenotic valves or valves that do not open fully, restricting the blood flow.

**Mitral stenosis**

The common cause is rheumatic heart disease, resulted from rheumatic fever. This is the most serious sequela of hemolytic streptococcal infection because it results in damage to muscle and valves. Certain strains of group A streptococci contain cell membrane antigens that cross react with human heart tissue antigens. Sera from patients with rheumatic fever contain antibodies to these antigens. The onset of rheumatic fever is often preceded by a group A streptococcal infection weeks earlier, although the infection may be mild and may not be detected. In general, however, patient with more severe streptococcal sore throats have a greater chance of developing rheumatic fever. Typical symptoms and signs of rheumatic fever include fever, malaise, a migratory non suppurative polyarthritis and evidence of inflammation of all parts of the heart (endocardium, myocardium, pericardium). The carditis characteristically leads to thickened and deformed valves and to small peri-
vascular granulonam in the myocardium (Aschoff bodies) that are finally replaced by scar tissue. Erythrocyte sedimentation rates, serum transaminase levels, electrocardiograms, and other tests are used to estimate rheumatic activity. Rheumatic fever has a marked tendency to be reactivated by recurrent streptococcal infection whereas nephritis does not. The first attack usually produces only slight cardiac damage, which, however increases with each subsequent attack. It is therefore important to protect such patients from recurrent hemolytic group A streptococcal infections by prophylactic penicillin administration.

Duration of prophylaxis for persons who have had rheumatic fever. Recommendations of the American Heart Association.

Rheumatic fever without carditis

5yr or until age 21y, whichever is longer.

Rheumatic fever with carditis but no residual heart disease (no valvular disease). 10yr or well into adulthood, whichever is longer. Rheumatic fever with carditis and residual heart disease (persistent valvular disease). At least 10 y since last episode and at least until age 40y; sometimes lifelong prophylaxis.
The commonest cause of mitral stenosis (MS) by far is rheumatic heart disease. While rare in the US today, rheumatic fever is still prevalent in developing nations. As such MS in the US and other developed countries is most often found in immigrants to those countries from areas where rheumatic fever is endemic. MS is 3-4 times more common in women even though rheumatic fever is slightly more common in men. Occasionally severe another calcification may cause non-rheumatic MS.

The rheumatic involvement in mitral valve occurs on the free edges of the valve leaflets; results in thickening, loss of pliability of the leaflets. This in turn results in progressive scarring, deformity and calcification of the valve. Narrowing of the valve orifice is the result of fusion of antero lateral and postero medial mitral valve commissures. Thus valvular function is affected by fusion and contraction of the chorae tendanae.

In mitral stenosis left atrium enlarges as valve stenosis causing pooling of blood in the atrium. This may lead to atrial fibrillation. Because of this, left atrial mural thrombi may form. This results in arterial embolism. The increased left atrial pressure causes back pressure which results in increased pressure in pulmonary circulation. This in turn causes dilatation and hypertrophy of right ventricle.
Symptoms include

a. Dyspnoea: exertional orthopnoea, paroxymal nocturnal dyspnoea due to obstruction of flow across the mitral valve resulting in pulmonary venous congestion and decreased cardiac output.

b. Palpitation: Due to atrial fibrillation

c. Haemoptysis: Due to increased pulmonary venous pressure transmitted to the bronchial vessels, rupture of the bronchial mucosa results. A dry cough, resulting hemoptysis at night can occur.

d. Hoarseness of voice and dysphagia: Secondary to the enlarged left atrium, with compression of contiguous tissue. The compression is caused by the enlarged and engorged vessels.

The signs include classic triad

1. 1st heart sound is loud

2. An opening snap of mitral valve follows the 2nd heart sound

3. A diastolic rumbling murmur is present over the apex.

Investigation

1. X-ray with the following findings
- Left atrium enlargement
- Increased pulmonary venous distention
- Enlargement of pulmonary arteries and right ventricle
- Pulmonary interstitial oedema and
- Calcified valve

2. **ECG** with the following findings

- Enlargement of left atrium
- Right axis deviation
- Right ventricular hypertrophy

3. **Echo** with the following findings

- Prolonged diastolic opening of the valve with

- Excursion of both leaflets in the same direction (normally opposite direction)

- Mitral valve area less than 2.5cm² (normal 4 to 5cm²)

Dense echo shows

- Valve fibrosis or calcification
 ➢ Left atrial increased internal dimension suggestive of enlargement of the atrium.

4. Cardiac Catheterisation with the following findings

 ➢ Increased pulmonary capillary wedge and

 ➢ Increased pressure in the left atrium

 ➢ Increased pulmonary artery pressure indicate pulmonary hypertension.

 ➢ Increased pulmonary vascular resistance indicator changes in the pulmonary vasculature which are often associated with increased post operative morbidity.

Surgery, mitral valve replacement

**Mitral Insufficiency (Regurgitation)**

Due to

1. rheumatic valvulitis leading to scarring, thickening, shortening deformity of the cusps with retraction of their free margins.

2. inflammatory changes with fibrosis causes thickening, fusion and shortening of the chordae tendinae. The commissures become fused and often contain deposits of calcium.
3. Familial mitral valve causes rupture of the papillary muscle or chordae
   tendinae.

4. Coronary artery disease associated with ischemia of papillary muscles.

These result in incomplete closure of the mitral orifice with subsequent systolic regurgitation of blood into the left atrium and volume overload of the left ventricle.

**Symptoms**: symptoms include fatigue, orthopnoea, exertional dyspnoea and palpitations.

**Signs**

- Systolic thrill over the apex
- Apical pansystolic murmur radiating into the axilla
- Loud 3rd heart sound over the apex
- Apical impulse may be displaced laterally.

**Investigations**

1. X-ray: shows cardiomegaly, left atrium and left ventricle enlarged, left atrium bulges to the right of the right atrial border (giant left atrium)
2. **ECG**: Left ventricle enlargement, atrial fibrillation, atrial flutter, left ventricular hypertrophy, left axis deviation.

3. **Echo**: Increased internal left atrial dimensions, increased internal left ventricular dimensions. Mitral valve shows increased excursion, a reflection only of increased blood flow across the mitral valve.

4. **Cardiac catheterization**: Presence of a large regurgitant were in the pressure tracings of the left atrium or pulmonary capillary wedge.

5. **Selective angiography**: Of the left ventricle and by an indicator dye dilution curve between the tracings for the left ventricle and left atrium.

**Aortic stenosis**

The aortic valve orifice narrows, obstructing left ventricular outflow during systole. This increased resistance to ejection or afterload results in ventricular hypertrophy. As the stenosis progresses, cardiac output decreases. The left atrium may be unable to empty completely, and thus the pulmonary system becomes congested. Eventually right sided heart failure can result. Aortic mean gradient is more than 60mm of Hg (normal 10mm of Hg). Aortic valve normal area is 3-4cm$^2$, and it will be less here.
Congenital valvular disease or malformation is the predominant etiologic factor in aortic stenosis. Rheumatic disease of the mitral valve also can cause. The client's age when the condition manifests itself is usually suggestive of its course. Congenital aortic stenosis with a bicuspid or unicuspid valve occurs most frequently in persons younger than the age of 30yrs. Between 30 and 70 years, it is attributed equally to congenital malformation and to rheumatic heart disease. Atherosclerosis and degenerative calcification of the aortic valve are the predominant causative factors in individuals other than 70 years.

**Aortic insufficiency (Regurgitation)**

The aortic valve leaflets do not close properly during diastole, and the annulus may be dilated, loose or deformed. This allows a regurgitation of blood from the aorta back into the left ventricle during diastole. The left ventricle, in compensation, dilates to accommodate the greater blood load and eventually hypertrophies.

Aortic insufficiency constitute less than 5% cases of all rheumatic heart disease. Non rheumatic causes include infective endocarditis, congenital anatomic aortic valvular abnormalities, hypertension and marfan's syndrome (a generalized, systemic disease of connective tissue).
About 1/3rd of the persons having aortic stenosis are likely to develop this also. Here once the blood is pushed into the aorta from the left ventricle as the valve leaflets cannot close tightly due to disease, there is leakage of blood from the aorta to left ventricle. Because of this symptoms are presented. Here also valve replacement is the effective way of treatment.

Valve damage has many possible causes. Stenotic valves are often a natural result of aging. An infection can scar or rupture a valve. A heart attack can create a leaking valve. And congenital defects can cause any of the above. Depending on the extent and location of the damage valves can either be repaired or replaced.

### 2.3 VALVE REPLACEMENT SURGERY

Two types of valves are used for replacement

1) Tissue valve
2) Mechanical heart valve

1. Tissue valves are valves that come from an animal donor. The most common sources of a tissue valve are the aortic valves of pigs, and valves made from the pericardium (the sac surrounding the heart) of a cow. Human organ-donor valves can be used, but are extremely rare. The advantage of tissue valves is that they do not require blood thinners. Blood thinners, or anti-coagulation drugs, are medicines that help prevent the blood clotting caused by the presence of artificial material in the bloodstream).

Mechanical heart valves: The valves currently approved by the United States Food and drug Administration (FDA) and which are in use in our setting are:

1. Caged ball prostheses eg. Starr Edwards Silastic Ball valve prosthesis

Fig. 2
The Starr-Edwards valve is a caged ball prosthesis designed in the 1950s and first used clinically in the early 1960s. The fundamental design has remained unchanged over 3 decades of use. An attempt to reduce thromboembolic complications by covering the valve housing with cloth proved unsuccessful. The current version, brought to market in the early 1980s, is a highly reliable valve with a negligible incidence of valve failure. Flow is directed by an occluding poppet that moves inside the cage. There is no potentially bothersome mechanical valve click, but the presence of the poppet in the center of the valve orifice results in considerable turbulent flow and anticoagulation requirements are somewhat higher than for newer mechanical valves. Additionally, flow around the poppet can generate high transvalvular gradients, especially with smaller diameter sizes. The valve has a relatively high profile because of its cage, which projects into the left ventricle or ascending aorta when used for mitral or aortic valve replacement, respectively. Consequently, its use is limited to patients with larger left ventricular cavities or aortic roots. The Starr Edwards valve is used nowadays in our setting for mitral valve replacement.
2. Tilting disc prostheses: Medtronic – Hall mechanical heart valve omnicarbon cardiac valve prosthesis.

Fig. 3

The valve housing is constructed from one piece of titanium alloy with no introduced welds or bends. The round central disk is made from tungsten-impregnated graphite with a pyrolytic carbon coating and has a central hole that allows the disk to be retained by a curved central guide strut that is part of the housing. It was hoped that its design would be an improvement on previous tilting disk valves in terms of durability, hemodynamic performance, and reduced thrombogenicity. Its design incorporated several new features designed to decrease thrombogenicity. Areas of low flow across the valve are reduced by a relatively larger minor orifice and a disk that lifts out of the housing and rotates with opening, which improves the ability of the valve to wash itself.
3. Bileaflet prosthesis – St.Jude mechanical heart valve

The St.Jude Medical (SJM) valve prosthesis (St. Jude Medical, Inc., Minneapolis, MN) is the most commonly used bileaflet mechanical valve in the United States today. The FDA approved it in 1977, and over 1 million valves have been implanted. It is constructed of pyrolytic carbon and has proven to be extremely durable, with only 20 instances of structural integrity loss being reported. The standard SJM valve is available in sizes from 19-31 mm for aortic valves and sizes from 19-33 mm for mitral valves.

2.3.1 Indications for valve replacement

The reasons for a heart valve replacement vary slightly, depending on which of the following valves is involved. As a general guide, however, you may need a valve replacement for the following reasons:
• You have significant valve narrowing (stenosis) or leaking (regurgitation) that is severe cardiac symptoms, such as angina (chest pain), shortness of breath, syncope (fainting spells) or symptoms of heart failure.

• Although your cardiac symptoms are not yet severe, diagnostic tests show that valve stenosis or regurgitation that is beginning to seriously affect your heart further.

• You have milder valve stenosis or regurgitation, but you need open heart surgery for another reason (such as coronary artery bypass). Your problematic heart valve replaced during this open heart procedure, correcting the situation before it has chance to deteriorate.

• Your heart valve has been damaged severely by endocarditis (infection of the heart valve), or you have endocarditis that is resistant to antibiotics.

• You already have a prosthetic heart valve, but it needs to be replaced because infection or malfunctioning, because you are having recurring blood clots or infection on the valve, or because you are having bleeding problems related to anticoagulants.
2.3.2 Preparation

Your preparation will include a thorough cardiac evaluation with a physical examination X-ray, electrocardiogram (EKG) and echocardiography. In some cases, exercise testing catheterization or a cardiac magnetic resonance imaging (MRI) scan may be necessary. Routine blood tests also will be done to evaluate your kidney function and other blood related problems. Educational interventions also were given peri operatively.

Educational interventions

Preoperative teaching is an important component in the client’s operative experience. Numerous research studies have supported the value of preoperative instruction in reducing the incidence of postoperative complication and the length of stay. The client’s teaching needs (anxieties, and fears) about the surgery must be answered individually.

The timing of preoperative teaching is highly individualized. Ideally, there will be enough time for the client to be given instructions and time to answer questions. If teaching is done too far in advance, the client may forget. On the other hand, clients who are taught immediately before the surgery may be too anxious to comprehend what is being taught. In many cases, the client is admitted 3 to 6 days prior to surgery. Hopefully, they will have received written
or oral instructions prior to this time and the nurse will be able to reinforce instructions and answer questions. A telephone interview is conducted in many ambulatory surgery units. Preoperative teaching alleys anxiety and encourages clients to participate actively in their own care. The basic areas that must be covered in preoperative teaching are the following.

(a) Deep Breathing Exercises

Breathing and coughing exercises help to expand collapsed lungs and prevent postoperative lower respiratory tract infection (pneumonia, atelectasis, bronchitis, bronchiectasis) Demonstrate correct deep breathing by inhaling slowly through the nose, distending the abdomen, and exhaling slowly through pursed lips. After she have demonstrated the method, ask the client to demonstrate the procedure. Ask the client to do the following.

1. Sit on the edge of the bed or lie supine, with knees flexed to relax the abdominal musculature.

2. Place hands on the abdomen

3. Inhale through the nose until the abdomen balloons outward

4. Exhale through pursed lips while contracting the abdominal muscles.
Instruct the client to use this breathing method as often as possible, preferably 5 to 10 times every two hours during the post-operative period of immobilization.

(b) Coughing exercises

For these exercises, the client may be in a sitting or lying position. Show the client how to splint an incision. Splinting minimizes pressure and helps to control pain when the client is coughing. Instruct the client to lace the fingers and hold them tightly across the incision before coughing. A small pillow or folded towel held over the incision also facilitates splinting. Have the client take a deep breath, exhaling through the mouth, before coughing from deep in the lungs. Encourage the client to perform deep breathing exercises before coughing, to stimulate the cough reflex, encourage coughing after steam inhalation.

Incentive spirometers are used to promote lung expansion. They promote alveolar inflation and strengthen respiratory muscles. They also help to prevent atelectasis in the post-operative client. They should be used about 10 times an hour after surgery.
(c) Turning Exercises

The client also needs to practice turning from side to side, using the side rails to assist movements. Turning helps to prevent venous stasis, thrombophlebitis, decubitus ulcer formation, and respiratory complications. Teaching the client to turn every 1 to 2 hours during the post operative period.

(d) Extremity exercises

The client should practice extremity exercises. Ask the client to flex and extend each joint, particularly the hip, knee and ankle joints, keeping the lower back flat as the leg is lowered and straightened. Have the client move each foot in a circular motion. These exercises help prevent circulatory problems, such as thrombophlebitis, by facilitating venous return to the heart.

Antiembolism stocking may be used on the lower extremities preoperatively, intraoperatively and post operatively, combined with turning and leg exercise to prevent thrombophlebitis or thromboembolism. Sequential compression stockings are now being used to massage legs rhythmically for even more effective prevention of clots. This is not advised in our setting.
(e) Ambulation

Encourage ambulation after surgery when appropriate. Ambulation helps to prevent post operative complication deep vein thrombosis. Projected schedule for post operative ambulation is included in preoperative teaching program. Teach the client proper methods of arising to decrease pain and the risk of hypotension. Do not bear weight on the hands while getting up. Always have the client sit up slowly and pause before attempting to stand. Show the client how to support the incision to decrease pain on arising. After standing allow him or her to walk a few steps with support. Check the vital signs, diaphoresis, fatigue, vertigo before and after ambulation. If it is present during the time of ambulation it should be discontinued. After walking with support allow him or her to walk without support and then slowly and gradually increase the task to above the maximum capability to do his previous job.

Pain will the minimized by administering medications and supporting the incision site by a towel.

(f) I.C.U Orientation

On the previous day of the operation the patient will be taken to the ICU, Introduce the patient to the sister incharge of ICU and other staff in the ICU. Tell to the patient that where you will be put after the operation eg. in which
cot, show the patient how will be, when the patient wake up. When the patient wake up there will an endotracheal tube in the patient's mouth, which is attached to a ventilator. This ventilator will provide the patient with the necessary air and oxygen for the lung to function till the lung is capable for function effectively by its own. Till that time do not bite the tube in the mouth. Do not try to speak. Do not ask for drinking water. Co-operate with the staff advices. If the patient have any difficulty the patient can write down in a piece of paper with the help of the sister in the I.C.U. When the patient are asked to take deep breath do it. Once the endotracheal tube is removed, the patient will be put on oxygen mask. Do not remove it, till the oxygen level in the patient's blood is satisfactory take deep breath. There will be two or three chest tubes, from the pericardium, pleural cavity and mediasternum. Do not try to remove it. There will be blood transfusion, I/V infusion, through infusion pump. Do not disturb those. There will be a continuous bladder drainage tube in situ. Do not try to pull out. There will be other lines like arterial line, central venous line for checking the blood gas analysis and blood pressure, also monitoring the C.V.P. Do not disturb those. ECG leads will be placed in the chest for monitoring the ECG and heart rate. Do not remove those.

The patient will get an idea when the patient is opening his eyes after recovering from anaesthesia because he will be familiar to the ICU, the patient
should trust in God and have good faith. This will keep the patient develop confidence. Always be optimistic.

Try to be relaxed rather than anxious and depressed. Do not become irritable and restless for simple things. Do not get frightened by seeing all the machines, I/v lines and being in such a situation. Again there will be no relatives are allowed to stand with the patient, the staff act as messenger. If there is severe pain tell the sister she will give you medicine.

When the patient is asked to sit up in the bed do not try to bear the weight on his upper extremities. After sitting up take deep breath and cough out the sputum. While coughing splint the incision with a towel or pillow firmly to avoid getting pain and to relieve tension on the sutures.

Take steam inhalation and do the exercises of deep breathing and coughing and turning, extremity exercises and ambulation as instructed.

Relatives will be allowed to visit you after extubation. Clear fluid will be given after 6 hours of extubation. Gradually fluids of others or semisolid food, solid food and normal food with less amount of salt will be given as tolerated. Ambulation will be started gradually Co-operate with it.

When the patient is in the ICU for 2-3 days the patient can achieve homeostasis physiologically and mentally sound and stable.
(g) Activities of daily living

There is a chance of blood clotting on the prosthesis valve after surgery. So after surgery to prevent clotting anticoagulant usually Tab Acitrom is started on the 2nd P.O. day. This has to be continued life long. The prothrombin time (P.T) and INR are to be checked every 3-4 weeks after going home and the result have to be brought while coming for follow up. If the result is more than 28/14 there is chance for bleeding hence the dose of Acitrom need to be decreased. If the result is below 14/14 Acitrom has to be increased. Hence consult the doctor. The control value may not be 14 always. For more accurate anticoagulant level detection INR is also tested. If INR is between 2.5 & 3 medicine need to be continued as prescribed. If it is below 2.5 the dose of acitrom is to be increased. If it is more than 3.5 the dose of acitron is to be decreased. However in the case of AVR, if the INR is 2 the same dosage is adequate because the chance of clotting is less due to increased blood flow rate. In the case of MVR the range of INR is 2.5 to 3 as the blood flow rate is less. Then more amount of anticoagulation is needed.

When taking anticoagulant the following medicines should be omitted.

1. Medicine containing aspirin (Aspirin, APC etc)
2. Phenobarbitone (Luminol)
3. Antiinflammatory drugs

4. Antibiotics like tetracycline, septran etc

5. Oral contraceptives

It is essential to consult the physician before taking any drugs which is not prescribed by the surgeon. International Normalized Ratio (INR) has to be checked every 3 weeks.

Try to avoid any cut or injury. If there is bleeding from any site apply pressure for 5mts. If still bleed consult the doctor. If there is increase in the dose of Acitrom the following manifestations will be there.

- Bleeding while sneezing
- Bleeding while brushing the teeth
- Bleeding from wound site
- More bleeding during menstruation
- Blood in the sputum

Use chappels all the time. Use soft bristled tooth brush for brushing. Keep adequate number of tablets all the time in hand. Pregnancy is an important event in Indian society. During the first 3 months of pregnancy the
Acitrom has to be continued and then take Heparin instead of Acitrom. In this study pregnancy patients were not selected.

Pregnancy in a patient with valve replacement poses additional problems. Oral anticoagulants are teratogenic. Hence switch over to Inj. heparin is done in the first trimester. Mid trimester oral anticoagulant. During delivery back to heparin for better control of bleeding complication.

Prosthetic valve patients should take infective endocarditis prophylaxis for any surgical or dental procedure.

Graded exercise and resume the previous occupation as early as possible and can continue sexual relationship between 3 months to 6 months. Take sleep for 6-8 hours. If there is fever, sputum, chest pain, cough and dyspnoea inform the doctor. Check for valve click sound to make sure its effective functioning. When there is prolonged chills, general weakness to you consult the doctor.

Moringa Colefera leaves and cabbage should be avoided as these have got procoagulant effect. Come for check up (follow up) every 3-4 weeks.
2.3.3 Procedure

**Mitral valve replacement (MVR):** After median sternotomy, thymus is hemisected. After this midline pericardiotomy is done. After total body heparinisation gone to cardiopulmonary bypass with aortic and bicaval venous cannulation. Core cooling to $28^\circ c$ is done. Superior venacava and inferior venacava are looped. Cardioplegia cannula is introduced into the aortic root. Aorta cross clamped cardioplegia arrest achieved by infusing cold blood cardioplegic solution into the aortic root. Left atrium opened parallel to inter atrial groove, then mitral valve is inspected. Diseased valve excised. Valve sizing is done with sizer and adequate sized valve sutured into place, using 2-0 ethibond interrupted mattress sutures. Left atrium closed after putting vent. Rewarming started. Aortic cross clamps released with aortic vent and left atrial vent on suction. De airing done vent removed. Temp brought back to $37^\circ c$. Off bypass in stages with ionotropic support. Haemodynamic stability achieved. Decannulation after heparin reversal with protamine. Haemostasis achieved and closure after putting mediastinal and pericardial drains.
Fig. 5
Native valve being excised
Mitral valve replacement
LA closure being started  LA closure being completed with vent in situ

Fig. 6

Mitral Valve Replacement
**Aortic Valve Replacement (AVR):** After median sternotomy thymus is hemisected. Midline pericardiotomy is done. After total body heparinisation went into cardiopulmonary bypass with aortic and two stage cavo atrial cannulation after putting purse string sutures. Core cooling to 26°C. Aorta cross clamped oblique aortotomy direct coronary ostial cardioplegic arrest, aortic valve excised and replaced with adequate sized valve, aortotomy closed. Rewarming started. Aortic cross clamp released with aortic root vent and left atrial vent on suction. De-airing procedure done. Temperature back to 37°C, off bypass in stages. Haemodynamic stability is achieved. Decannulation after heparin reversal with protamine hemostasis achieved and closure after putting mediastinal and pericardial drains.
Fig. 7

Aortic valve replacement

• Valve excised
Fig. 8

Size of the valve being measured

Aortic valve replacement
Fig. 9

Sutures being put
Aortic valve replacement
Fig. 10

Valve being seated

Aortic valve replacement
Fig. 11

The artificial heart valve is in place

Aortic valve replacement
The aorta is closed by a running suture, the heart deaired and the operation finished.

Aortic valve replacement
Double Valve Replacement


Now aortic valve replacement done using adequate sized aortic valve using 2-0 ethibond interrupted mattress sutures.

After valve replacement surgery complications can occur. These complications are classified and given in the list below.

1. Haemorrhage
2. Arrythmia
3. Hypo or hypervolemia
4. Electrolyte imbalance
5. Pneumothorax
6. Wound infection
7. Urinary tract infection
8. Respiratory tract infection
9. Renal failure
10. Deep vein thrombosis
11. Psychological maladjustment
12. Anti coagulant related complications
13. Cardiac tamponade
14. Convulsion
15. Hemiplegia
16. Subacute bacterial endocarditis
17. Valve related complications
18. Pleural cavity infection
Those under study which could be prevented by educational interventions are as follows.

1. Lower respiratory tract infection
2. Pleural cavity infection
3. Psychological maladjustment
4. Deep vein thrombosis
5. Wound infection
6. Subacute bacterial endocarditis

2.3.4 Follow up

After your heart valve replacement, you will need to take anticoagulant medication in the rest of the life if you have a mechanical valve, or for about three months if you have a biological valve. Doctor, or your doctor’s assistant, will work with you to determine the anticoagulant dose adequate enough to prevent thromboembolism but low enough to prevent bleeding problem for the rest of your life. You will need to take antibiotics prior to having certain high risk or medical procedures. These antibiotics will help to prevent infection of your prostheses if the high risk procedure allows bacteria to stray into your blood stream.
After discharge, your doctor will ask you to return for a follow up visit within 3 to 4 weeks. If you are feeling well at that visit, and the results of your repeat echocardiography are okay your doctor will schedule future visits at 3 month or 12 month intervals.

2.4 STUDIES RELATED TO VALVE REPLACEMENT AND SPECIFIC POST OPERATIVE COMPLICATIONS

Garver et al (1995) studied about the epidemiology of prosthetic heart valves in the U.S.A. The report is as follows. The center for Devices and Radiological Health of the Food and Drug Administration, in collaboration with the National Centre for Health Statistics, conducted the medical Devices implant supplement to the 1988 National Health Interview Survey, generating the first available population based estimates of the use of prosthetic heart valves in the United States. The 1988 National Health Interview survey was a massive, nationally representative cross sectional survey that encompassed 47,485 households and 122,310 individuals. Data from the medical device implant supplement indicate that an estimated 253,283 persons with 279,125 heart valves were present in the civilian, non institutionalized U.S population (population prevalence of 1.1/1,000 95% CI 0.8-1.3). Age stratified prevalence of valve prostheses ranged from 0.2 per 1,000 in those age 44 and under to 5-3 per 1,000 in those 75 years of age and older. Age adjusted prevalence of
valve prosthesis did not differ significantly according to sex, race, region of residence, education or income of recipients. Two third of aortic valve recipient identified by survey were male, compared with only one third of both aortic and mitral valve implant were reported as mechanical. Reported use of anticoagulative agents was significantly more common in recipients of mechanical than of bioprosthetic valves. The single most common reported reason for prosthetic valve implantation was rheumatic heart disease. These data provide useful epidemiologic and public health planning information on prosthetic heart valve use.

Gortner et al (1988) in their study to enhance individual and family health during recovery from heart surgery employed nursing intervention based on self efficacy and family stress theory during the hospitalization period and for 3 months thereafter. The efficacy of the interventions were assessed through randomized trial in which 67 prospective bypass and valve surgery patients, aged 30-77 years, and their spouses, were allocated either to the experimental interventions or to usual care and followed for 6 months. At 3 months post surgery, the only statistically significant difference between the experimental and controls were on perceived self-efficacy for lifting and tolerating emotional distress were noticed. At 6 months no significant difference were found on individual and family measures. Analysis revealed that age,
gender, and pre-operative cardiac status significantly affected individual recovery. The study is continuing with a larger sample in order to explicate the recovery process and to better determine whether a low intensity nursing intervention can effect changes in individual and family recovery.

Finkelmeir et al (1989) studied about implication of prosthetic valve implantation. It revealed that nurses in cardiovascular critical care settings routinely care for patients with implanted valvular prostheses. The presence of an artificial valve substitutes a new disease state for the pre-existing valvular disease. Five hundred and nine patients who underwent valve replacement with porcine bioprosthesis and who were followed for a total of 1633 patient-years provide the data base for discussion of long-term survival, functional capacity, and morbidity associated with valvular prosthesis. Seventy-two percent of patients survived 5 years after operation. New York Heart Association functional class was improved in 84%. Three major types of morbidity were documented, thromboembolism, endocarditis and valve failure. Cardiovascular nurses should be familiar with the implications of valvular prosthesis to provide appropriate patient’s education and facilitate the prompt detection and treatment of valve-related complication.

Davies (2000) study reported that the recent joint position statement made by the RCN critical care and Rehabilitation Nursing Forms, high lights
the need for rehabilitation to commence early. This paper reports the findings of a descriptive survey of 59 cases of cardiac rehabilitation. Data were obtained by postal questionnaire during early recovery (one week following discharge) and six weeks later. The questionnaire explored carers perceptions about the timing of discharge from hospital, opinions of the information provided by hospital staff, and anxiety and depression measured on the Hospital Anxiety and Depression scale. The result indicated that carers assumed a heavy burden once the patient had left the specialist cardiac center. Carers responding at one week were less satisfied with the timing of discharge than those questioned at 6 weeks. Information provided by nurses was rated more highly than that provided by doctors or physiotherapist. However there was scope for improving the input, the findings suggest that cardiac rehabilitation needs to be given early and commence during the earliest stage of the patients recovery.

Halm et al (1999)\textsuperscript{73} studied about women and cardiac rehabilitation. The report is as follows. Heart disease is the primary killer among American women. Difference in referral for cardiac rehabilitation, as well as compliance rates, have been reported between male and female cardiac patients. This study explored the use of phase I and Phase II cardiac rehabilitation programs by male and female patients. In particular the study aimed to investigate the relationship between eligibility and subsequent referral to phase II cardiac
rehabilitation in both men and women, as well as their compliance rates in completing phase II. In addition, for those patients who never started a phase II program, their reason for non participation were explored. Structured patient interviews and chart audit were used to explore cardiac rehabilitation eligibility criteria, referral and completion rates. The sample consisted of 87 patients (46 women and 41 men) who were admitted with a medical diagnosis of angina, myocardial infarction, coronary artery bypass grafting, or valve replacement surgery. Men had higher eligibility rates for phase II; more men received as referral for phase II from their physician than women did. Men had a higher completion rates with phase II compared with women. For those patients who chose not to start a phase II program the most common reasons cited included transportation problems, insurance issues, and having exercise equipment at home. Although women are being referred for cardiac rehabilitation, fewer complete the programme. Continued education is essential to teach women the importance of cardiac rehabilitation to overall recovery and adaptation to an acute cardiac event. In addition, cardiac rehabilitation program must be structured to meet the unique need of women and thereby remove obstacles that have prevented higher participation rates by women in the past.
Linde B.J and Janz. N.M (1979) studied the effect of teaching program on knowledge and compliance of cardiac patients. This study was designed to look at the effect of a comprehensive teaching programme on patient knowledge and compliance. Thirty patients who had had valve replacement surgery and 18 patients who had had coronary artery bypass surgery were included in the study. Twenty five of these patients were taught by masters prepared clinical specialist and 23 by nurses with less than masters preparation. Measurements of knowledge and compliance were obtained preoperatively, at discharge and during the first two postoperative visits. Findings included significant changes in knowledge scores from the preoperative test to the discharge test and stability in most scores from discharge to both postoperative visits. Compliance percentages were significantly higher than those reported for cardiac patients in a previous study. Patients taught by masters prepared nurses had significantly higher test scores at discharge than did patients taught by nurses with less than masters preparation.

Bashour C.A et al (2000) studied about longterm survival and functional capacity in cardiac surgery patients after prolonged intensive care. That is to determine whether hospital discharge alone represents a good outcome for patients who had prolonged intensive care after cardiac surgery by studying their post discharge survival and functional outcome. The secondary objective is
to estimate the proportion of intensive care unit (ICU) resources used by the long stay (>or=10 initial consecutive ICU days) patients and to identify preoperative patient characteristics that are associated with a prolonged ICU stay and hospital and long term survival. It is a cohort study. The Cleveland Clinic Foundation, a tertiary care, academic teaching institution was the setting. Cardiac surgery patients with an initial ICU stay of 10 or more consecutive days were utilized. Data were collected daily during hospitalization in every adult who underwent coronary artery bypass graft and/or valve surgery at one institution in 1993. Discharged patients who spent >10 initial consecutive days in the ICU after surgery were contacted by telephone to determine vital status and functional capacity using the Duke Activity Status Index. Total ICU and total hospital direct costs were obtained for each patient. Measurements and Main results are as follows. The primary outcome measurements were ICU length of stay, hospital mortality, after surgery and post discharge mortality and functional capacity, and relative resource utilisation. Of the 2618 cardiac surgery patients who met the inclusion criteria, 142 (5.4%) had an initial ICU length of stay of 10 or more consecutive days. Of these, 47 (33.1%) died in the hospital, ninety four of the 95 discharged patients were followed up (median follow up, 30.6 months), and 44 of the 94 (46.8%) died during the follow up period. The median Duke Activity status index for the 50 survivors was 26 out of a possible 58.2. The 14.2
long stay patients used 50% of the total ICU days and 48% of the total ICU direct cost for all 2,618 patients. Conclusions: Many survivors of prolonged intensive care die soon after hospital discharge and many longer term survivors have a poor functional state. Therefore, hospital discharge is an incomplete measure of outcome for these patients, and longer follow up is more appropriate. The relatively small number of patients who require prolonged intensive care consumes a disproportionate amount of the total ICU and total hospital direct cost.

Dafoe, W and Huston, P (1997) described about current trends in cardiac rehabilitation in this article. Cardiac rehabilitation can reduce mortality and morbidity for patients with many types of cardiac disease cost-effectively, yet is generally underutilized. Rehabilitation is helpful not only for patients who have had a myocardial infarction but also for those with stable angina or congestive heart failure or those who have undergone myocardial revascularisation procedures, a heart transplant or heart valve surgery. The beneficial effects of rehabilitation include a reduction in the rate of death from cardiovascular disease, improved exercise tolerance, fewer cardiac symptoms, improved lipid levels, decreased cigarette smoking, improvement in psychological well being and increased likelihood of return to work. Rehabilitation involves a multidisciplinary team that focuses on education,
individually tailored exercise, risk factor modification and the optimization of financial status and mental health. Current research trends in this area include the evaluation of new secondary prevention modalities and alternative program options, such as home based rehabilitation.

Savage L.S and Grap. M.J (1999) done a follow up study on telephone monitoring after early discharge for cardiac surgery patients. Monitoring the post operative course of cardiac surgery patients remains essential but requires creative strategies now that length of hospitalisation has been shortened to 5 days or less. To determine patients concerns in the early recovery period after open heart surgery and to describe the impact of advanced practice nurses on this phase of recovery. A cardiovascular clinical nurse specialists conducted follow up by telephone for 342 cardiac surgery patients 7 to 14 days after discharge. Results showed that The major problems were leg oedema. (48%) appetite disturbance (35%) dyspnoea (29%), sleep disturbance (12%) and wound drainage (9%). The nurse's interventions over the telephone included assuming the patient about post operative progress (86% of the sample), giving diet information (31%) instructing about activity (29%), providing emotional support (25%), referring for medical treatment (16%) and explaining medications (13%). In response to these findings, the nursing practice council revised post operative teaching to emphasize wound healing, sleep and appetite issues.
Telephone monitoring of cardiac surgery patients after early discharge can alleviate the often stressful transition to post operative recovery at home. A cardiovascular clinical nurse specialist can provide patients and patient's family members with reassurance and ongoing reinforcement of the discharge information.

Myken. P et al (1995)\textsuperscript{149} published an article on similar quality of life after heart valve replacements with mechanical or bioprosthetic valves. The goal of the study was to determine whether there was a difference in the quality of life (QOL) between patients receiving bioprosthetic (Biocor, BIO) or mechanical (St.Jude Medical, (SJM) valve prosthesis. In January 1993 they assessed the psychological outcome of heart valve surgery among 183 (87 Bio, 96 SJM) of 220 survivors in a selected and matched cohort of 140 BIO and 140 SJM recipients who had their valve replacement between 1983 and 1989. The BIO and SJM groups were equal in terms of mean age, gender, valve position, educational level, marital status and follow up time. Questions concerning QOL, in terms of coping capacity, social support, and general emotional status as well as emotions concerning valve related complications, were answered by the patients marking a non graded visual analogous scale, ranging from total agreement to total disagreement. They found no significant difference between patients receiving BIO and those receiving SJM prosthesis regarding coping
capacity (62+/-2Vs 65+/-2), social support (77+/-3Vs 76+/-2), or emotional status (63+1-3Vs 65+/3) after subdividing patients by age below and above 60 years, gender functional class, valve position and complication, they found several significant differences, but the two prosthetic groups were largely similar. Females had a significantly lower level of coping capacity and emotional status than males. Coping capacity and emotional status were significantly correlated with functional class. While social support affected was less the coping capacity tended to be lower among patients who had experienced complications and this was more pronounced with BIO.

Speziale. G et al (1995)201 published an article on quality of life in patients undergoing mitral valve substitution. The aim of this study was to evaluate the quality of life after mitral valve replacement through the analysis of behavioural, psychological, functional, economic and working changes, as well as alterations in social and sexual life after surgery. The study was performed before and after surgery. The population studied included 206 patients undergoing mitral valve replacement surgery. Results were compared with a control population of patients suffering from mitral valve disease and receiving medical therapy. All patients were asked by medical staff to compile a series of five self evaluation questionnaires. General well being schedule, physical symptoms, distress index B, social participation, sexual satisfaction unified test
and work performance and satisfaction. This results showed a significant improvement in the perception of quality of life after mitral valve replacement. In particular, the state of general well being improved significantly with a clear reduction in symptoms. This was accompanied by a reduction in sexual activity and no change in social life or working capacity. Data obtained in the group of patients operated showed a significant improvement in the perception of the quality of life and psycho-physical well being compared to patients receiving medical treatment alone. From this study it can be seen that patients undergoing mitral valve replacement surgery experience a marked improvement in the quality of life compared to pre operative conditions and to the group of patients receiving medical therapy for mitral valve diseases. The use of specific working and social rehabilitation programmes can certainly optimize the results also with regard to affective relations.

Mortality was high, and even higher among the patients with valvular heart diseases, with negative psychological and social repercussions.

2.4.1 PREVENTION OF LOWER RESPIRATORY TRACT INFECTION

Pneumonia (pneumonitis) is an inflammatory process in lung parenchyma usually associated with a marked increase in interstitial and alveolar fluid. Advances in antibiotic therapy have led to the widespread
perception that pneumonia is no longer a major health problem in the U.S. However, pneumonia is presently the 6th most common causes in the elderly. Among all nosocomial (hospital-acquired) infection, it has the highest fatality rate. Because of its prevalence, prevention at all levels is very important.

Etiology and risk factors

There are many causes of pneumonia, including bacteria, viruses, mycoplasmas, fungal agents, and protozoa.

The risk factors and levels of prevention feature with preventive measures

Risk factors

Smoking, air pollution, upper respiratory infection, altered consciousness, tracheal intubation (by-passing the upper airway), prolonged immobility, immunosuppressive therapy, non functional immune system, severe periodontal disease, prolonged exposure to especially virulent organisms, malnutrition, dehydration, chronic diseases, prolonged debilitating diseases, inhalation of noxious substances, aspiration of oral or gastric material, aspiration of foreign material, residing in group living situations where there is an increased probability of respiratory disease transmission.
Pneumonia may also result from

1. Aspiration of food, fluids and vomitus or
2. Inhalation of toxic or caustic chemicals, smoke, dust or gases.

Pneumonias may complicate immobility and chronic illnesses. It often follows influenza.

3. Improper handwashing, improper aseptic technique use of contaminated equipment or tubing, displacement of nasogastric tube.

Levels of prevention

a) Primary prevention

• Promote adequate nutrition and fluid intake and proper hygiene measures to help maintain normal defenses.

• Discourage cigarette smoking

• Advise high risk clients to avoid exposure to infected persons

• Deep breathing and coughing out sputum effectively after steam inhalation.

b) Secondary prevention

• Promote effective airway clearance and mobilization.

• Advocate rigorous handwashing by medical personnel in the hospital to reduce the transmission of infectious agents.
• Maintain proper infection control measures during respiratory procedures

• Maintain a high index of suspicion for the common clinical manifestation in risk clients, especially the elderly.

• Assess high risk clients for other subtle, non specific manifestation such as change in cognition (confusion or lethargy), anorexia, tachypnea, and exacerbation of pre-existing disorders (eg. Heart failure, chronic airflow limitation).

c) Tertiary prevention

• Instruct the client and family in the techniques of deep breathing and coughing

• Teach the importance of completing antibiotics as prescribed

• Discuss a plan for rest and gradual resumption of activity

• Instruct the client and family about manifestations that should be reported to the physician (ie fever, chills, chest pain, hemoptysis).

Pathophysiology

The feature common to all types of pneumonia is an inflammatory pulmonary response to the offending organism or agent. The defense mechanisms of the lungs lose effectiveness and allow organisms to penetrate
the lower airways, where inflammation develops. Inflamed and fluid filled alveolar sacs cannot exchange oxygen and carbondioxide effectively. Bacterial pneumonia may be associated with significant ventilation perfusion mismatch. Alveolar exudates tends to consolidate and becomes difficult to expectorate.

Clinical manifestations and diagnostic findings

The onset of all pneumonias is generally marked by any or all of the following: fever, chills, sweats, pleuritic chest pain, cough, sputum production, hemoptysis, dyspnoea, head ache or fatigue.

The elderly client, however may present not with fever or respiratory manifestations but with altered mental status and volume depletion. Chest auscultation reveals bronchial breath sounds over areas of consolidation (ie dense areas on the chest film. Consolidated lung tissue transmits bronchial sound waves to outer lung fields. Crackling sounds (from fluid in interstitial and alveolar areas) and widespread pectoriloquy may be heard over affected areas. Tacticle fremitus is usually increased over areas of pneumonia, while percussion sounds are dulled. Unequal chest wall expansion may occur during inspiration if large area of lung tissue is involved. This is due to decreased distensibility in the affected area.
Definitive diagnosis is mostly determined through sputum culture and sensitivity or serologic testing. At times, fibroptic bronchoscopy or transcutaneous needle aspiration or biopsy may be necessary for confirmation. Additional diagnostic testing may include (1) skin testing if tuberculosis or coccidioidomycosis is suspected (2) blood and urine cultures to assess systemic spread; and (3) arterial blood gas (ABG) or transcutaneous oxygen levels analysis to assess the need for supplemental oxygen.

Chest X-ray examination provides information about the location and extent of pneumonia. On the chest film, areas of pneumonia appear as white opacification, known as consolidation.

Pneumonia may involve one or more lobe segments of the lungs (segmental pneumonia) on the basis of location and radiologic appearance, pneumonias may be classified as bronchopneumonia, or necrotizing pneumonia. Bronchopneumonia (bronchial pneumonia) involves the terminal bronchioles and alveoli. Interstitial (reticular) pneumonia involves inflammatory responses within lung tissue surrounding the air spaces or vascular structures rather than the passages themselves. In alveolar or acinar, pneumonia, there is fluid accumulation in the lung's distal air spaces. Necrotizing pneumonia causes the death of a portion of lung tissue surrounded by viable tissue; X-ray examination may reveal cavity formation at the site of necrosis. Necrotic lung
tissue, which does not heal, constitutes a permanent loss of functioning parenchyma.

**Acute and subacute care**

Medical management: Clients who are ambulatory but have an ongoing health problem may require hospitalization. Similarly, clients who are already hospitalized for other reasons are at risk of developing nosocomial pneumonias because of their decreased ability to combat infection and their potential exposure of resistant strains of organisms.

The primary treatment for most form of pneumonia is antibiotic therapy according to sensitivity of identified organisms. However, initial therapy usually consists of broad spectrum antibiotics.

**Nursing management of the medical client**

The following should be determined through the nursing history

- Contact with other clients experiences and similar manifestations (suggests viral or mycoplasmal pneumonia)
- Factors suggesting the presence of non infectious diseases that produce manifestations similar to those of pneumonia (eg. Pulmonary embolism, allergic reaction to drugs or other substances, neoplasm).
• Presence of tuberculosis or contact with others who have active tuberculosis.

• Presence and character of any chest pain

• Presence and character of cough and sputum production

Physical assessment should include rate and character of respiration, auscultation of breath sounds, and assessment of skin and nail beds to determine the degree of hypoxia.

Diagnosis, Planning, Implementation

1. Ineffective airway clearance: The inflammation and increased secretions seen with pneumonia make it difficult to maintain a patent airway. Use the nursing diagnosis ineffective airway clearance related to excessive secretions to express this client problem.

Planning expected outcomes

The client will maintain effective airway clearance, as evidenced by maintaining a patent airway and effectively clearing secretions.
Implementation

Measures should be taken to promote airway patency. These may include increasing fluid intake, teaching and encouraging effective coughing and deep breathing techniques, and frequent turning. Clients with an altered level of consciousness should be turned at least every 2 hours and should be placed in side lying positions, unless contraindicated, for prevention of aspiration. Administer bronchodilators, if prescribed. If indicated chest physiotherapy, suctioning, artificial airway may be required to maintain airway patency.

(2) Ineffective breathing pattern: Many clients develop compensatory tachypnea because of an inability to meet metabolic demands. This occurs because affected alveoli cannot effectively exchange oxygen and carbon dioxide. Increased respiratory rates can also develop from chest pain and increased body temperature. In effective breathing pattern related to tachypnea is the best nursing diagnosis to describe this problem.

Planning expected outcomes: The client will have improved breathing patterns, as evidenced by a respiratory rate within normal limits, adequate chest expansion, clear breath sounds and decreased dyspnoea.
Implementation

Position the client for comfort and to facilitate breathing (eg. At 45 degrees). Teach the client how to splint the chest wall with a pillow for comfort during coughing. Administer prescribed cough suppressants and analgesics. Be cautious, however, because narcotics may depress respirations more than desired. Routinely monitor respiratory rate, and transcutaneous oxygen levels, auscultate the chest and document findings. Monitor blood gas analysis and deserve for signs of hypoxemia, hypercapnia or acid base imbalance.

3. Activity intolerance related to decreased oxygen levels for metabolic demands: - Depleted energy reserves due to not eating during periods of dyspnoea and impaired oxygen and carbon dioxide transport leave little oxygen to meet metabolic demands.

Planning  Expected outcomes : The client will have improved activity tolerance, as evidenced by ability to perform activities of daily living and demonstrating progressively increasing physical activity without excessive dyspnoea and fatigue.

Implementation : Assess the client's baseline activity level and response to activity. Note how will the client tolerates activity by assessing for changes in respiratory and pulse rate, marked dyspnoea, fatigue, pallor or cyanosis and
dysrhythmias, scheduled activity after treatments or medications. Use oxygen as needed. Gradually increase activity on the basis of tolerance. Balance activity with adequate rest periods.

Teach the client to avoid conditions that increase oxygen demand, such as smoking, temperature extremes, weight gain, and stress. Pursed-lip and diaphragmatic breathing, as well as techniques to lower energy use, should be reinforced. Activities that are tiring should be interspersed with rest.

Provide psychological support and a quiet environment to reduce anxiety and promote rest. Regulate nursing care and visitors, as warranted by the clients condition.

Other nursing diagnosis may include altered nutrition – less than body requirements related to dyspnoea, pain related to frequent coughing, and altered oral mucous membranes related to mouth breathing and frequent cough.

Evaluation

The degree of expected outcome attainment is monitored every 2 to 3 days. Pneumonia should resolve quickly once the client is on antibiotics, provided there are no immune disorders. Elderly clients may require additional time to fully recover.
Community and Self care

Hospitalisation is not always necessary for clients with pneumonia. If the client has intact defense mechanisms and good general health, recuperation can often take place at home with rest and supportive treatment. The term walking pneumonia is sometimes used to describe this situation.

Chest physiotherapy may be continued for a period of time. The client is followed in a clinic setting until the chest clears as demonstrated on X-ray and clinical manifestation abate. The client is encouraged to plan for influenza immunization the next winter. People who live with the client are also monitored for the onset of pneumonia.

Wang D et al (1995)²²⁰ studied about multiple organ dysfunction (MOD) after valve replacement in a period of 1980-1991. The incidence of MOD involving 2, 3 and 4 organs were 17.1%, 5.6% and 4.3% with corresponding mortalities of 12%, 18.5%, and 76.2%. They focused on dysfunction of more than 3 organs, the dreadful complication, which can be divided clinically into three types; acute (type I), deteriorating (type II) and pulmonary infection (type III). In MOD, the function of heart and lung is primarily depressed after surgery. So the predisposing factors of MOD are acute pump failure and hypoxemia, and the triggering factor is infection, especially pulmonary infection, which re-
endangers the organs recovering from the primary blows. Thus prevention of pulmonary infection is of same importance as treatment of pump failure and hypoxemia.

So cure of pre-operative pulmonary infection and prevention of postoperative pulmonary infection are important to prevent post operative dreadful complications.

2.4.2 PREVENTION OF PLEURAL CAVITY INFECTION

Pleural effusion

A pleural effusion is an accumulation of fluid in the pleural space. Pleural fluid normally seeps into the pleural cavity and it is absorbed by capillaries and lymphatics. Anything that interferes with either secretion or drainage can cause pleural effusion.

Causes of pleural effusion can be put under 4 categories

1. Increase systemic hydrostatic pressure (eg. Congestive heart failure)

2. Reduce capillary oncotic pressure (eg. Liver or renal failure)

3. Increase capillary permeability (eg. Infection or trauma)

4. Impaired lymphatic function (eg. Lymphatic obstruction due to tumour)
Clinical manifestation of pleural effusion will depend on the amount of fluid present and the degree of lung compression. If the effusion is small (ie. <250ml) its presence may be discovered only by chest x-ray examination. With large effusion, lung expansion may be restricted and the client may experience dyspnoea, primarily on exertion and a dry, non productive cough caused by bronchial irritation or mediasternal shift. Tactile fremitus may be decreased or absent and percussion notes may be dull or flat.

Thoracentesis is used to remove excess pleural fluid. The fluid is analysed to determine if it is transudate or exudates. Transduates are substances that have passed through a membrane or tissue surface. They occur primarily in condition in which there is protein loss and low protein content (eg. Hypo albuminemia, cirrhosis, nephrosis) or increased hydrostatic pressure (eg. Congestive cardiac failure) Exudates are substances that have escaped from blood vessels. They contain an accumulation of cells, have escaped from blood vessels. They contain an accumulation of cells, have a high specific gravity, and a high lactate dehydrogenase (LDH) level, and occur in response to malignancies, infectious or inflammatory processes. Exudates occur when there is an increase in capillary permeability. Differentiating between transudates and exudates helps establish a specific diagnosis. Diagnosis may also require
analysis of the fluid for (1) white and red blood cells (2) malignant cells (3) bacteria (4) glucose content (5) PH and (6) LDH.

Pleural fluid may be (1) haemorrhagic or bloody (eg.) if tumour is present, after trauma, or after pulmonary embolus with infarction) (2) ahyalous, or thick and white coloured (eg. After lymphatic obstruction or trauma to the thoracic duct) or (3) rich in cholesterol (eg. Chronic recurrent effusion due to tuberculosis or rheumatoid arthritis).

If there is a high WBC count and the pleural fluid is persistent, the effusion is called an empyema. An empyeme of any amount requires drainage and treatment of the infection. If the pus is not drained, it may become thick and almost solidified or loculated (containing cavities). This is called fibrothorax. Fibrothorax may significantly restrict lung expansion and may require surgical intervention. By decortication, the restrictive mass of fibrin and inflammatory cells are removed. After the procedure, closed chest drainage with suction is used to reexpand the lung rapidly and fill the pleural space. If the fibrous material has restricted the lung for sometime, the lung may not reexpand effectively, and further intervention (usually thoracoplasty) may be needed.
Diagnosis and management

The pain of pleurisy requires to be differentiated from that due to chest wall causes, such as rib fracture, intercostal muscle pain etc. The presence of a pleural rub is helpful, though this may be heard sometimes following rib fractures. A chest radiograph is frequently useful in showing the primary lung condition. If this is normal, or if it only shows a small amount of fluid in the costophrenic angle, it is important to consider the possibility of pulmonary embolism, and further examination of the legs together with screening may help in coming to a therapeutic decision. If this diagnosis is considered unlikely, it is reasonable to treat the patient with adequate analgesics and await developments, in most such cases, the pleurisy settles within a week. Paired blood samples taken in the acute and convalescent phases may be tested for viral antibodies. When the chest film is abnormal, further investigation or treatment may be necessary; for example pneumonic change would indicate bacteriological investigation and antibiotic treatment, while evidence of bronchiectasis may lead to consideration of surgery if it is giving rise to recurrent episodes of infection and pleurisy.

The pain of pleurisy is often controlled by simple analgesia, together with the patient adopting a comfortable posture (often lying on the affected side). Severe pain may require opiates, but dramatic relief may often be obtained by
raising intradermal wheels of local anesthetic in four or five places around the site of maximum pain. This relief is often prolonged and the procedure, if successful, may be repeated periodically, it is particularly useful when the patients respiratory conditions makes the use of opiates inadvisable.

2.4.3. Prevention of Psychological Maladjustment

Psychological maladjustment can be due to sleep disturbance, anxiety and depression. Sleep can be defined as a normal state of altered consciousness during which the body rests and from which a person can be aroused by external stimuli.

Sleep pattern disturbance also contributes to sensory disorders such as intensive care unit psychosis.

Physiology of sleep and arousal

The timing of the sleep wake cycle and other circadian rhythms, such as body temperature, is controlled, at least in part, by the super chiasmatic nucleus in the anterior hypothalamus. Located above the optic chiasm, this area receives input from the retina, which provides information about darkness and light. The superchiasmatic nucleus controls and production of melatonin, which is believed to be a potent sleep inducer.
Sleep is a naturally occurring, readily reversible altered state of arousal, characterized by a decreased responsiveness to the environment. The mediator of arousal and of sensory stimulation in the reticular activating system (RAS). The RAS is located in the brain stem and contain projections to the thalamus and cortex. The diffuse network of neurons in the RAS is in a strategic position to monitor ascending and descending stimuli through feedback loops.

Although the RAS provides the anatomic framework for arousal, it is the neurotransmitters that serve as the chemical messenger. The onset of sleep and each subsequent sleep stage is an active process involving delicate shifts in the balance of several of these neurotransmitters.

The transition from the awake state to non rapid eye movement (NREM) sleep is marked by decreases in the concentration of serotonin, norepinephrine, and acetylcholine. The later transition to rapid eye movement (REM) sleep is marked by a dramatic increase in acetylcholine and further drops in serotonin and norepinephrine. As REM sleep continues, the concentration of serotonin and norepinephrine increases, eventually stopping REM sleep. Cholinergic activation with the release of acetylcholine seems to reestablish REM sleep. The continuous interaction of those two systems is thought to produce the normal alterations between NREM and REM sleep. Other neurotransmitters, such as
gamma aminobutyric acid (GABA) and dopamine, are also believed to have a
part in the reciprocal processes involved in shifts in sleep state.

All of these neurotransmitters are actively involved in waking process as
well. For example, neurons that produce serotonin and norepinephrine play a
role in the modulation of sensory input, mood, energy and information
processing, including attention, learning and memory. Thus, it can be seen that
imbalances in these neurotransmitters induced through sleep pattern
disturbances, medications, or diseases may reciprocally affect not only sleep
but also aspects of sensory processing, mood, and cognition.

By considering the normal physiology nurse can play a pivotal role in
environmental modification and client teaching to minimize the impact of sleep
and sensory disturbances.

**Nursing management**

Assessment has to be carried out. It includes client's usual sleep habits
and recent sleep quality. Sleep pattern was subdivided into normal sleep, sleep
disturbed, no sleep at all, sleep after with medicine, daily sleeps partially with
drugs.

Secondary sleep disorders are of particular relevance in considering
problems common to medical –surgical clients. Whereas some clients have a
pre-existing sleep disorder of dyssomnia or parasomnia type, other clients
develop a sleep disorder secondary to disease or its manifestations. By
remaining aware of the physiology of normal sleep, the nurse can anticipate the
risk of sleep pattern disturbances in medical surgical clients.

Numerous other disorders seems to have some impact on or association
with sleep. Any condition that results on pain, discomfort, or impaired mobility
has the potential to disturb sleep. Heart valve replacement patients will have
their problems during immediate post operations period. Thus Inj. Morphine may
be given.

Anxiety: Anxiety also will be there as a causative factor for sleep disturbances.
Pre operative teaching will help in preventing such complications.

Sleep deprivation is of particular concern for clients in critical care unit.
The noise level, 24 hour lighting and frequency of care giver interruptions create
a situation of sensory overload and sleep deprivation, which is thought to be a
major contributing factor to post operative psychosis.

Clients who have had surgery are also at risk for sleep pattern
disturbance due to disruption in circadian rhythm. The cause is unclear, but it
may be related to the length and type of anaesthesia, post operative analgesia,
or mechanisms associated with the procedure itself. REM and slow wave sleep
are suppressed. It may take 4 to 6 weeks for the client's sleep patterns to return to normal after open heart surgery with cardiopulmonary bypass.

Anxiety is a common experience among the general population, with physical manifestation being easily identified by the individual and others observing the anxious person. The DSM-11-R categories, indicates that anxiety disorders are those most frequently found in general population, with simple phobia the most commonly occurring and panic disorder the most common anxiety disorder in those people seeking treatment. Avoidance behaviours usually develop as a form of coping or mastery of the fears.

Biological, psychoanalytical, interpersonal, learning theorists and existential frameworks provide definitions of anxiety and identify the source, dynamics, and observational cues of anxiety and the role of the nurse.

Physical characteristics of anxiety includes

Musculo skeletal : Increased tendon reflexes, Rigid, tense muscles

Knee and ankle clonus, muscular tremors

Increased, generalized fatigue, increased weakness

Clumsiness, jerking of limbs, tics, unsteady voice,

tightening of throat, unsteadiness, inability to move
Cardiovascular

Palpitation

Throbbing sensations

Increased pulse, respiration, blood pressure

Flushing and heat sensations

Cold hands and feet sweating

Gastrointestinal

Nausea

Heart burn

Cramps

An empty stomach feeling

Bad taste in mouth

Others

Difficulty in sleeping

Dilated pupils

Urinary urgency

Urinary frequency

According to severity of anxiety they are divided into minimal, mild, moderate, severe and panic. Valve replacement patients will have anxiety
which may lead to postoperative psychosis if proper explanation and orientation is not given

Depression

Feelings of hopelessness generate depressed behaviour. The main theories supporting this stage are

1. Biological

Depression is associated with disruptions in circadian rhythms, brain dysfunction, limbic seizure activity, neuroendocrine dysfunction, biogenic amine deficiencies, defects in the immune system and genetics.

2. Psychoanalytical by Freud: Depression originates as a response to a loss, disappointment, or failure. Anger is displaced and turned inward on the self. Inability to mourn or grieve for a loss results in depression.

3. Behavioural Lowinsohn: Failure to receive positive reinforcement from others and from the environment predisposes one to depression.

4. Cognitive:

   1. Beck: A negative conception of self, experiences, others and world contributes to depression.
2. Seligmon: The belief that one has no control over a situation contributes to depression.

3. Bowlby: has during childhood predisposes one to adult depression.

5. Sociological -Becker:- Loss of power, status, identify, values and purpose of existence creates susceptibility for depression.

6. Holism: Depression is the result of genetic, biological, psychoanalytical, behavioural, cognitive and sociological experiences.

Guidelines for primary prevention

1. Have pleasure
2. Adapt to loses
3. Adopt a positive attitude
4. Maintain high self esteem
5. Share safe feeling to supportive person
6. Develop faith in God
7. Develop assertive skills

Significant advances and new drugs have brought new hope for sufferers of psychiatric illness. In depression, the ability to develop compounds with very specific target actions has led to the development of selective serotonin
reuptake inhibitors (fluoxetine and paroxetine), noradrenaline reuptake inhibitors (reboxetine) and selective nor adrenergic and serotonin reuptake inhibitors (ventafaxine). It is becoming clear that the serotonin system in a crucial element in depression and along with other biogenic amines, forms a long and complex chain of neurological deficiencies that cause depression.

According to author Paul Bowden (1975)\textsuperscript{166} the post cardiotomy state is typically delirious and although organic factors are important it is multidetermined. Cerebral ischaemia has been implicated in the development of psychological disorder after resuscitation but longer term neurotic disorders also occur. Affective disturbances, particularly depression, are associated with the coronary care experience. The following conditions are directly related to an increased incidence of psychological disorder; age, loss of sleep, sensory deprivation, stressful experiences, pre operative morbidity (both physical and mental), the severity of both surgical trauma and the post operative medical state. For both the staff who administer intensive therapy and the patient who receives it there are unique psychological hazards, the management of which depends largely on mutual understanding and support.

Post operative psychological maladjustment can be prevented by proper teaching and orientation to I.C.U.
2.4.4 PREVENTION OF DEEP VEIN THROMBOSIS (D.V.T)

Deep vein thrombosis, the formation of a thrombus in one of the deep veins of the body, is the single most preventable thrombo-embolic disorder, and is asymptomatic in many cases. DVT risk assessment tools can provide systematic data on which to base nursing care plans. Structured patient teaching and the attainment of an optimum safe lifestyle are paramount. Responsibilities and promotion of self-care strategies are integral to the respective intracollaborative roles of patients with DVT, their families and the healthcare professionals who provide hospital and home outreach services.

DVT poses a threat to many hospitalized patients (Grace 1993); medical and surgical patients can be at risk up to six weeks post discharge (Scurr et al 1988). Research showed that 24 per cent of all patients with DVT died of a pulmonary embolism (PE) within seven days of having an operation (Sandler and Martin 1989). Conversely, 45 per cent of DVTs arise on the day of operation (Nicolaides and Gordon-Smith 1975). It is estimated that only one in nine cases of DVT is clinically proven (Turner and Turner 1982). DVT can lead to the fatal complication of PE, estimated to cause 33,600 deaths a year (Ishak and Morley 1981) and is thought to be responsible for 10 per cent of all hospital deaths (Sandler and Martin 1989). It should be acknowledged that DVT is usually preventable within collaborative DVT care pathways (Cheater 1996), and
practitioners can use a recommended protocol within professional nursing practice (ECS 1997, NIH 1986). Such DVT prophylaxis protocols can be examined and used in combination with DVT risk assessment tools.

**Predisposing factors to DVT**

The formation of a DVT can be due to one or a combination of three predisposing factors, known as Virchow’s triad. Several conditions can contribute to the factors identified.

**Trauma:** Localized trauma and direct vascular damage caused by, for example, surgical procedures, intravenous (IV) injection or therapeutic interventions might cause serious endothelial damage to veins and vein dilation, which predisposes to DVT formation (Arcelus et al 1991). Patients undergoing surgery might be placed at high risk. Patients receiving multiple IV injections/infusion medication therapy, as in chemotherapy and systemic antibiotics, might be at increased risk (Hoyt 1991).

**Blood coagulation factors:** Hyper coagulation due to blood dyscrasia, dehydration, malignancy or oral contraceptives – has the potential to alter normal blood haemostasis mechanisms (Sartwell and Stolley 1982). Research has shown that women who take contraceptives and smoke double their risk to DVT (Fahey 1988).
Stasis of venous circulation: Circulatory problems can be caused by bed rest, frailty and immobility in older patients, cardiovascular disorders and post-operative immobilisation (Arcelus et al 1991). Long-haul flights are thought to predispose to thrombi formation due to restricted mobility, but recent research indicates that the risk might be due to the reduced air pressure in airplanes (Bendz et al 2000). Patients who are obese or immobile are at high risk of developing venous circulatory problems. Immobility can deprive the deep veins of the lower limbs of the pumping action of the calf muscles (calf muscle pump), leading to stasis of venous blood, which can predispose to thrombus formation.

Formation of a DVT

DVTs often originate around the venous valve cusp site, leading to a reduced blood flow and thus stasis of venous blood in the affected vein. Localised blood coagulation ensues, with a thrombus composed of erythrocytes, thrombocytes and fibrin. The thrombocytes and fibrin can detach and travel to the lungs, forming a pulmonary embolism (Clark and Kumar 1994).

A DVT can develop in any deep veins, but will develop in the lower limbs in an estimated 60 per cent of cases (Love 1990a); there is a higher incidence in the left leg than in the right (Havig 1977).
In the venous circuit of the lower limbs, the most likely site of a DVT is in the deep leg veins (60 per cent of cases), with other sites including the femoral veins (22 per cent) and popliteal veins (7.8 per cent) (Love 1990a, Tyco Healthcare).

**Signs and symptoms of DVT**

There are up to six signs and symptoms that might demonstrate a DVT episode. However, it should be acknowledged that in up to 50 per cent of cases, there are few or no significant physical abnormalities or clinical signs to be detected (Barnes et al 1978, Turner and Turner 1982). If signs are present, any resolution of the DVT might be demonstrated by a reduction in signs and symptoms.

**Abnormal swelling of the affected limbs**

This can be due to localised oedema resulting from:

- Thrombosis occlusion of the affected deep vein, which impedes venous blood return and can also affect the efficiency of collateral venous drainage
- Capillary damage, causing leakage of intravascular fluid into the surrounding tissues (extravasation), distal to the thrombosis site.
Bilateral baseline limb-girth measurements should be performed daily, and form an important part of ongoing patient monitoring.

**Warmth of the affected limb**

In some cases, the affected limb feels warm to the touch. This might be due to localised venous congestion and accumulation of tissue metabolites in the affected limb (Clark and Kumar 1994).

**Localised pain:** Lower limb pain might be experienced in the calf muscle region during dorsiflexion movements of the foot – this is referred to as a diagnostic positive Homan’s sign. Pain is not always present, for example, in cases where there is a small sized thrombus with few localised inflammatory activities (Game 1989). However, in cases of iliofemoral vein thrombosis, extreme pain can present (Clark and Kumar 1994).

**Dilatation of veins:** Due to the venous thrombus occlusion of the respective vein, a distal dilation of veins might occur as a result of systemic and peripheral venous circulatory stasis obstruction (Tortora and Anagnostakos 1996).

**Pyrexia:** A systemic increase in body temperature to 39-40°C can be caused by the accumulation of tissue metabolites at the site of the thrombosis formation, and intravascular thrombophlebitis occurs.
Asymptomatic in 50 per cent of cases the DVT has no initial observable symptoms and, of patients with a PE, up to 75 per cent might have no sign of a preceding DVT (Clark and Kumar 1994, Sandler and Martin 1989). As it is estimated that only one in nine cases will present clinically, all patients who are identified to be at risk should be carefully assessed, examined and monitored.

Specific diagnostic assessment

Clinical diagnosis might be confirmed by the following techniques.

Ultrasound Doppler testing

This measures venous flow by placing a Doppler probe over veins, and the procedure can be performed with the patient standing. This test is useful for differentiating between a DVT and muscle strain or haematoma (Lewis and Collier 1992).

Venography

This can detect a thrombus using a radiopaque intravenous (IV injection technique via the dorsal foot vein. It is suggested that many below knee thrombi can be detected only by venography (Clark and Kumar 1994).
Haematology screening

There are numerous haematology screening methods that detect the fibrin degradation product, D-dimer, which is released into the circulation during a DVT episode (O'Shaughnessy and Thomas 1999).

Raised D-dimer levels can indicate the presence of DVT/PE in patients up to the age of 40, but the test can be less specific in older patients (O'Shaughnessy and Thomas 1999).

Therapeutic interventions

A tripartite regimen of prophylaxis should include subcutaneous heparin (short term prescription), anti embolism stockings and specific pre-and post operative physiotherapy for surgical cases. Specific regimens for medical cases might include subcutaneous heparin (five days) and oral warfarin anticoagulation (long term prescription), anti embolism stockings and specific physiotherapy exercise programmes.

Research supports the advantages of early anticoagulation programmes following medical assessment and diagnosis of DVT, reducing the risk of PE to less than 1 per cent (Levine et al 1996). It must be acknowledged that while a clinical improvement of a complete clot breakdown via the natural fibrinolytic
system occurs at a very low rate, as anticoagulants have no pharmacological action in lysing existing thrombi (Haslett et al 1999).

The cumulative incidence of recurrent DVT as a result of a single DVT episode is 5 per cent after three years and 30 per cent after eight years (Prandoni et al 1996). The patient with a DVT has the added risk of developing post phlebitic syndrome (PPS). This chronic disorder occurs as a consequence of previous venous damage and circulatory disruption. Chronic venous circuit damage includes venous valve incompetence due to thrombosis, and a slow endogenous fibrinolysis preceding venous hypertension. The potential of incomplete clot lysis and development of venous vascular reflux is also well recognised (Havig 1977). PPS presents as a brown discolouration of the lower limb with localised redness, stasis-dermatitis and hollow ulceration occurring over the medial and lateral malleoli. While the disease-free period of PPS can be more than 20 years, reported cases rate at 30 per cent with a previous history of DVT (Havig 1977).

**Anticoagulant therapy**

Heparin therapy promotes the action of antithrombin and factor III, which inhibits factor X and XI in anticoagulant doses. It also slows the clotting time by
inhibition of prothrombin thrombin, and further prevents fibrinogen to fibrin conversion (Brooker 1998, Downie et al 1999, Rang et al 1995).

In conjunction with heparin, oral anticoagulant therapy is initiated, using warfarin as a first choice anticoagulant. Phenindione oral anticoagulant should be used if the patient is allergic to warfarin (BNF 2000). Warfarin inhibits the vitamin K-dependent clotting factors and some naturally occurring proteins C and S (anticoagulants). Warfarin therapy should be overlapped with heparin therapy for four to five days.

Initial therapeutic doses, such as 10mg warfarin per day, might be given for two days, with subsequent doses adjusted according to the international normalised ratio (INR).

For DVT patients receiving anticoagulant therapy, an INR in the range 2.5-3.0 is desirable unless the patient has experienced a recent thrombosis. Treatment is usually maintained for approximately three to six months (BNF 2000, Fennerty et al 1988, Pout et al 1999).

However, in cases of recurrent thromboembolic episodes, a more prolonged or lifelong therapy might be advocated (BNF 2000, Downie et al 1999).
The nurse's role in fitting anti-embolism stockings: In conjunction with professional and clinical judgment, and the chosen risk assessment tools, practitioners also need to undertake specific holistic assessment strategies to ensure efficacy and safe wearing of the stockings. It is necessary to include localised physical assessment of the lower limbs and systemic assessment of the patient's health status.

To encourage safe use and optimum patient compliance, it is important to demonstrate the correct fitting technique of the stocking. This should be supported by a follow-up discussion session, to elicit the do's and don'ts when wearing the stocking. Fitting guides on individual patient assessment, practical fitting, wearability, and maintenance are supplied with the stockings. In our setting stockings are not used.

Koertke H et al (2003)\textsuperscript{106} did a study on anticoagulation self management after mechanical heart valve replacement. It showed that this decrease complication rates by maintaining INR level closer to the target range than International Normalised Ratio (INR) home doctor management. The therapeutic range for the INR in that study was between 2.5 and 4.5 for all positions of prosthetic valves. ESCAT II should find out whether lowering the target range for INR self management would further reduce complication rates. This study results were in the conventional group, 74% of INR values measured
were within the therapeutic range. In the low dose group, 72% of the values were within that range. The linearised thromboembolism rate (% per patient year) was 0.21% for both groups. The bleeding complication rate was 0.56% in the low dose regimen group versus 0.91% in the conventional group.

The conclusion was early onset INR self management under oral anticoagulation after mechanical heart valve replacement enables patients to keep within a lower and smaller INR target range. The reduced anticoagulation level resulted in fewer grade III bleeding complications without increasing thromboembolic event rates.

Kortke H et al (2001) studied about INR self management after mechanical heart valve replacement. ESCAT (Early self controlled anticoagulation trial). The result is as follows. Severe thromboembolic and hemorrhagic complications following mechanical heart valve replacement essentially occur due to intense oral anticoagulation and fluctuating individual INR values around the target range. INR self management can help to minimise these fluctuations. Beginning this therapeutic control immediately after mechanical heart valve replacement further reduce anticoagulant induced complications. Included in the study were 1200 patients. The quality of oral anticoagulation also improved through INR self management. Over an observation period of two years, nearly 80% of INR values recorded by the
patients themselves were within the target therapeutic range of 2.5-4.5. This corresponds to a high significance of $P=<0.001$ in favour of INR self management. Only 64.9% of INR values monitored by family practitioners were within the desired range. The results differed slightly in quality between patient groups with different levels of training (comprehensive, secondary, modern, grammar with or without university). Of patients trained in INR self management following mechanical heart valve replacement, 91.7% maintained their competence in this technique throughout the entire follow up period. Only 8.3% of those trained immediately after surgery were unable to continue with INR self management.

Koertke H et al (2000)$^{107}$ did a study on INR self management following mechanical heart valve replacement. Beginning anticoagulation therapy immediately in the post operative period further reduces anticoagulant induced complications. Data were collected from the first 600 surviving patients (from a total study sample of 1200 patients) who completed follow up of atleast 2 years. Patients were randomly divided into a self management group and a control group. INR self management reduced severe haemorrhagic and thromboembolic complications ($p=0.018$). Nearly 80% of INR values recorded by patients themselves, regardless of educational level, were within the target therapeutic range of INR 2.5-4.5, compared with 62% of INR values monitored
by family practitioners. Only 8.3% of patients trained in self management immediately after surgery were unable to continue with INR self management. The results differed slightly between patient groups with different levels of education. They concluded that all patients for who anticoagulation is indicated are candidates for INR self management regardless of education level.

Harenberg J (1987)\textsuperscript{74} studied about ambulatory long term prevention of thromboembolism with low molecular weight heparin. Patients with severe bleeding complications and other side effects on conventional anticoagulants and strong indication for further anticoagulation were treated with a low molecular weight heparin fragment (Tedelparin). In this report they reported the experiences in 30 patients, who were anticoagulated 1-11 months with this compound. All patients injected themselves a dose ranging from 1x2,500 to 1x20,000 antifactor $\times$ a units per day. Within 132 months of treatment one patient with good compliance developed thromboembolism. Four patients had compliance. Two of them experienced rethrombosis 1 and 8 weeks after starting therapy. Severe haemorrhages did not occur. Two patients had one minor bleeding complication each. Both patients developed several times per year severe haemorrhages with conventional anticoagulants. All excessive subcutaneous haematomas and indurations of the adipose tissue at the injection site of conventional heparin disappeared completely. Low molecular
weight heparin can be regarded as an alternative anticoagulant in patients with severe bleeding and other complications an oral anticoagulants and conventional heparin.

Schreiber C et al (2001)\textsuperscript{193} reported a case study of acute thrombosis of a mechanical heart valve caused by inadequate anticoagulation with low molecular weight heparin. The case report was as follows. A 55 year old woman with a mechanical aortic prosthesis was admitted with pulmonary oedema and suspect of valvular malfunction. The patient had an anticoagulation therapy at the time with low molecular weight heparin only. Echocardiography confirmed a failing mobility of a prosthetic valve leaflet. Emergency aortic valve replacement was performed. Conclusion: According to international approved guidelines an adequate anticoagulation after mechanical prosthetic heart valve replacement is provided either by oral anticoagulants, or in the case of pregnancy or surgical procedures, by unfractioned heparins. The use of low molecular weight heparin as sole anticoagulant remains a matter of controversy in the literature. In recent years low molecular weight heparin were mainly administered for prevention and treatment of deep vein thrombosis, pulmonary embolism, stroke and unstable angina.

including foeto maternal mortality and morbidity for different anticoagulation regimens. The rates of embolism anticoagulation related bleeding and mechanical valve thrombosis were 4.5%, 3.2% and 2.6% per patient year respectively. Among 30 patients receiving uninterrupted low-dose oral warfarin + aspirin throughout pregnancy, 3 had normal deliveries, 2 had premature birth, 1 had low birth weight, 7 had spontaneous abortion and 17 had therapeutic abortions. By contrast, among 8 patients had discontinued anticoagulation despite medical advice, 7 had normal term deliveries without thromboembolic complications and spontaneous abortion occurred in one patient. Of the 5 women taking low molecular- weight heparin regimen, 3 had normal delivery, 1 had a premature birth and 1 an abortion. 2 patients taking warfarin replaced by Heparin in the first trimester and in the last two weeks, had term deliveries. One of these women developed left atrial thrombus in the third trimester while receiving heparin; after switching back to warfarin, thrombus dissolved spontaneously. Another patient on heparin throughout the gestation had an uneventful gestation period that resulted in term delivery. There were 4 cases of prosthetic valve thrombosis during the post partum period; All of these developed in women who ceased anticoagulation during pregnancy. The study concluded stating that there were no congenital malformations or maternal mortality/ morbidity during pregnancy in this series of 20 live births, probably
due to the low dose anticoagulation regimen used. However, anticoagulation cessation was associated with high prosthetic valve thrombosis rate in the post partum period, even when new generation prosthetic valve of unique design and expected low thrombogencity was implanted.

2.4.5 PREVENTION OF WOUND INFECTION

Wound healing has been defined by the wound healing society (W.H.S) as a complex and dynamic process that results in the restoration of anatomic continuity and function of the skin. Regardless of the cause of the wound, wound healing follows a predictable course. Events can be described in four phases (i) vascular response (2) inflammation (3) proliferation or resolution, and (4) maturation or reconstruction. At the time of injury, many actions occur simultaneously.

Wound infection is a serious consequence and delays wound healing. Topical antimicrobial can be used as the primary treatment. In addition, it is important to be certain that infected tissues are adequately perfused and oxygenated. This assists with delivery of WBC's to the area. Clinical manifestations of wound infection included increased drainage, erythema around the entire wound (not just the edges), development of purulent drainage, pain, fever, leukocytosis, and general malaise. The infected wound is slow to
heal and may open (such as evisceration or dehiscence). Cultures can be used to diagnose wound infection. A swab culture can be obtained of wound drainage. A quantitative culture (an actual sample of tissue) is usually needed to study open wounds. All open wounds are colonised and using a swab culture on these wounds will reveal the true offending organisms, only organisms growing harmlessly in the wound's surface. In cardiovascular system the wound infection is due to improper handwashing, improper aseptic technique during dressing changes, during and following cardiac surgery with contaminated equipment or dressing postoperative accidental touch in the area with unclean hand or fomites.

The ideal antimicrobial would be broad spectrum and preserve the regenerating tissues. But all of the antimicrobials compromise wound healing to some degree by being low in effectiveness against a particular organism or by interfering with healing. A team of health care providers may include in wound care as chronic non healing wounds are a challenge. The team may include physician, vascular or orthopaedic surgeons, wound care nurse, nutritionist, physical therapist, hyperbaric medicine specialists and social workers and psychologists.

The wound care nurse has to teach the patient certain principles of asepsis like not to touch the wound with anything which is contaminated. Never
touch the open wound even with clean bare hands. Apply firm pressure over the wound while sneezing and coughing. Take drugs and nutritious diet to enhance wound healing.

Bogomolova N.S. et al (1993)\textsuperscript{24} described current approaches to the prevention of infectious complications is heart surgery. Due to changes of humoural immunity, patients with rheumatic heart disease present, even before the operation are a high risk group with regard to the development of infectious complications. Contamination of intraoperative material was revealed in 61.7\% of cases during the operation.

Extracorporal circulation increases the cefotaxime half life period which is in direct proportional dependence of the period of time between the beginning of the administration of the agent and the beginning of extracorporal circulation. Immunoreaction by means of myelopid in the early post operative period accelerates restoration of cellular and humoral immunity, and reduces the frequency of pneumonia occurrence and suppuration of the post operative wound. Therefore, the prevention of infectious complications after operations on an open heart should be complex and should include broad spectrum antibiotics and immunocorrective therapy.
2.4.5 PREVENTION OF SUBACUTE BACTERIAL ENDOCARDITIS

Infective endocarditis is a microbial infection of the endocardial tissue, which frequently involves the heart valves. Patients admitted to the hospital with infective endocarditis may have subtle influenza like symptoms or may be in acute distress. As early as 1885, Osler noted that infective endocarditis was a difficult disease to diagnose and treat, and modern medicine has not altered this situation.

Infective endocarditis remains a serious complication of valvular heart disease, before and after surgery and is associated with a considerable morbidity and mortality.

Etiology

Infective endocarditis is caused by a variety of organisms. Staphylococcus aureus causes most cases of acute endocarditis. It is a highly virulent organism that generally infects normal heart valves, causing rapid and debilitating valvular damage. The enterococcus, such as streptococcus faecalis, is a more virulent strain found in the gastrointestinal and genitourinary tracts which also can cause it.
Gram-negative bacilli and fungi also are known to cause endocarditis. Gram negative organisms include Escherichia coli and Klebsiella, Pseudomonas, Salmonella, Bacteroides, and Proteus organisms. Fungi include Candida Histoplasma, and Aspergillus organisms. Mixed infections occasionally have been reported.

Streptococcus viridans is the organism responsible for most cases of subacute endocarditis. It is a group of a hemolytic bacteria commonly found in the oral cavity. S.viridans, an organism of low virulence, classically becomes engrafted on deformed or damaged heart valves to cause endocarditis. Other organisms causing subacute endocarditis include nonhemolytic and microacrophilic streptococci, commonly found in the oral cavity and gastrointestinal, female genitourinary, and respiratory tracts.

Pathogenesis

The pathogenesis of acute endocarditis is related to the presence of bacteremia caused by a highly virulent organisms. Because 50% to 60% of acute infections occur in patients without previous cardiac valvular deformities. Several theories have been formulated to explain why some types of bacteria affect normal heart valves. One explanation is that S.aureus and other gram positive bacterium exhibit a unique property that permits them to adhere to the
endothelial surface of the heart valve. Although the reason for the localization of infection on normal heart valves is not clearly understood, it appears that only a few highly virulent organisms are necessary to establish the infection.

Pathology

Infections forming on heart valves produce endothelial lesions called vegetations. Microscopically, the vegetations contain three layers (i) an inner layer of collagen and elastin, fibrin, neutrophils, lymphocytes, platelets and red blood cells (2) a middle layer composed of microorganisms and (3) an outer layer composed of fibrin and microorganisms.

Nursing assessment

The patient's nine human response patterns are thoroughly assessed. The knowing, exchanging, feeling and choosing patterns are particularly important to evaluate in this group of patients with data collection focused on the following areas.

1. Knowing pattern
   a. Elicit information to determine whether the patient is at high risk for developing infective endocarditis, identify possible portals of entry for the infecting microorganism.
2. Exchanging Pattern

a. Assess the patient's response to the infection

b. Assess cardiac manifestations

c. Assess for embolic manifestations

d. Assess for immunologic derangements

e. Assess laboratory and diagnostic tests

3. Feeling and Choosing Patterns

a. Assess the patient’s and family’s response to the acute illness and coping behaviours.

Conditions that place patients at high risk for developing infective endocarditis

Infective endocarditis

Prosthetic heart valves

Surgically constructed systemic pulmonary shunts

Congenital heart disease

Degenerative heart disease
Mitral valve prolapse

Valvular lesions, cardiac defects

Heart murmurs

Cardiac surgery

Chronic debilitating disease

Nonbacterial thrombotic endocarditis

Intravenous drug abuse

Immunosuppression related to cancer, collagen, vascular disease, hepatitis, a burn injury, diabetes mellitus, radiation therapy, prolonged drug therapy (antibiotic, cytotoxic, or steroid medications).
<table>
<thead>
<tr>
<th>Possible portals of entry for the infecting organism</th>
<th>Possible portals of entry for the infecting organism</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Oral Cavity</td>
<td>I. Infections, Surgeries or invasive procedures or therapies.</td>
</tr>
<tr>
<td>1. Recent dental procedures (within 3 to 6 months)</td>
<td>1. Skin</td>
</tr>
<tr>
<td>2. Extractions</td>
<td>2. Respiratory tract (pneumonia)</td>
</tr>
<tr>
<td>3. Teeth cleaning</td>
<td>3. Gastrointestinal tract</td>
</tr>
<tr>
<td>4. Root canal procedures</td>
<td>4. Genitourinary tract (endometritis, septic abortion, use of intrauterine devices)</td>
</tr>
<tr>
<td>5. Bridge work, inlays</td>
<td>5. Central nervous system (meningitis)</td>
</tr>
<tr>
<td>6. Denture procedures</td>
<td>6. Ears, nose, and throat (tonsils and adenoids)</td>
</tr>
<tr>
<td>7. Gingivectomy</td>
<td>7. Respiratory tract (bronchoscopy)</td>
</tr>
<tr>
<td>8. Recent dental disease or trauma (within 3 to 6 months)</td>
<td>8. Gastrointestinal tract (colon, rectal or hemorrhoidal surgery, endoscopy, and sigmoidoscopy)</td>
</tr>
<tr>
<td>9. Gingivitis</td>
<td>9. Genitourinary or obstetric procedures (uterine dilation and curettage, cesarean section, therapeutic abortion, sterilization procedures, cystoscopy, and indwelling urinary catheterization)</td>
</tr>
<tr>
<td>10. Caries</td>
<td>10. Cardiovascular procedures (arteriovenous shunt or fistulae for hemodialysis, cardiac pacemaker electrodes, arterial catheters, or intravenous catheterization (peripheral, central venous, or pulmonary artery catheters) Prosthetic valve replacement</td>
</tr>
<tr>
<td>11. Periodontal disease</td>
<td>11. Cardiovascular procedures (arteriovenous shunt or fistulae for hemodialysis, cardiac pacemaker electrodes, arterial catheters, or intravenous catheterization (peripheral, central venous, or pulmonary artery catheters) Prosthetic valve replacement</td>
</tr>
<tr>
<td>12. Periapical abscess</td>
<td></td>
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<tr>
<td>13. Recent oral trauma</td>
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</tbody>
</table>

II. Skin

<table>
<thead>
<tr>
<th>Possible portals of entry for the infecting organism</th>
<th>Possible portals of entry for the infecting organism</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rashes</td>
<td>I. Infections, Surgeries or invasive procedures or therapies.</td>
</tr>
<tr>
<td>2. Lesions</td>
<td>1. Skin</td>
</tr>
<tr>
<td>3. Lacerations</td>
<td>2. Respiratory tract (pneumonia)</td>
</tr>
<tr>
<td>4. Trauma</td>
<td>3. Gastrointestinal tract</td>
</tr>
<tr>
<td>5. Puncture site from intravenous injections</td>
<td>4. Genitourinary tract (endometritis, septic abortion, use of intrauterine devices)</td>
</tr>
<tr>
<td>6. Abscesses</td>
<td>5. Central nervous system (meningitis)</td>
</tr>
</tbody>
</table>

Prevention of infection of various sites by prophylactic antibiotics. Treatment of any sort of infection at any site in the body before surgery is needed. Avoid continuous use of any site for invasive procedure. Take precautions when using devices. Use of antibiotics before surgery or any procedures by which bacteria can be prevented. The above mentioned preventive measures have to be followed.
Clinical Manifestation of infective endocarditis

<table>
<thead>
<tr>
<th>Response to Infection</th>
<th>Embolic manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>Central nervous system</td>
</tr>
<tr>
<td>Anorexia</td>
<td>Transient ischemic attacks</td>
</tr>
<tr>
<td>Chills and diaphoresis</td>
<td>Cerebrovascular accidents</td>
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<tr>
<td>Weight loss</td>
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Petechiae are one of the most common signs of infective endocarditis and occur in up to 50% of all patients. They occur around the conjunctivae, neck, clavicles, wrists, ankles, and mucous membranes. Petechiae are 1 to 2 mm in diameter, flat, red and nontender lesions with a white or gray center. They appear in crops and then fade away to brown spots within a few days. However, they are not specifically diagnostic of infective endocarditis. Patients undergoing cardiopulmonary bypass for cardiac surgery for example, can develop conjunctival petechiae from lipid microembolisation.

Splinter haemorrhages (linear subungual haemorrhages) may occur in patients with infective endocarditis on the distal third of the nailbed as black longitudinal streaks. They are not a specific sign of endocarditis and also may occur with age, occupational trauma (such as from typing) or normal stenosis without endocarditis, hemodialysis, or peritoneal dialysis.

Osler’s nodes occur in 10% to 20% of patients with infective endocarditis. They are erythematous, painful lesions with a white center that vary in size from 1 to 10mm. There are located typically on the pads of the fingers or toes, palms, soles, or thighs. Osler’s nodes are not a specific indicator of endocarditis and may occur with a variety of other illnesses.

Janeway lesions occasionally are found in patients with infective endocarditis. In contrast to Osler’s nodes, Janeway lesions are nontender and
hemorrhagic lesions 1 to 5 mm in diameter. They occur on the arms, legs, palms, and soles and are accentuated when the extremity is elevated.

**Nursing Diagnosis**

The most common human responses anticipated for a patient with infective endocarditis are indicated by the following nursing diagnoses.

1. Cardiac valve infection related to (include name of infecting organism)

2. Anxiety related to acute illness, diagnostic tests, lengthy hospitalization and treatment, or fear of impending surgery (if indicated)

3. High risk for infective or phlebotic vascular complications related to prolonged intravenous therapy

4. High risk for complication of impaired physical mobility related to prolonged intravenous therapy and restricted activities.

5. High risk for valvular reinfection related to insufficient knowledge about illness and future prophylactic care.

Moll M and Ferrer M (1998) in their article on 'Is prophylaxis needed? Is it really effective? Risk of endocarditis after heart surgery' the following details are dealt with. Infective endocarditis (IE) still has an important morbidity and mortality in the acute phase and also in the following years. Because of this, the
development and use of preventive strategies have been an important target in
developed countries. Until we have some prospective studies their use will be
only initiative and based on the following criteria: endocarditis frequently follows
a bacteremia; the germs are habitually predictable in each procedure and are
sensitive to specific antibiotic against the micro organism prophylactically before
it enters the blood stream during the procedure. Although available data are
inconclusive and sometimes even contradictory, most-authors recommend the
indication of prophylactic measures whose efficacy depends on three basic
points: (a) Identification of patients with a high risk of endocarditic, especially
those with a prosthetic cardiac valve; (b) knowledge of procedures that need
chemoprophylaxis, especially dental and oral procedures, and (c) selection of
the best prophylactic policy in each specific case. In summary, it is necessary to
know to “whom”, “when”, and “how” to apply prophylactic measures. There are
some special situations that must be considered carefully; patients treated with
anticoagulant drugs or with a cardiac pacemaker or with an implanted
defibrillator, patients with renal insufficiency and an arteriovenous fistula, and
some patients needing open heart surgery. In conclusion, the prevention of
bacterial endocarditic using antibiotics is currently practiced in clinical settings,
especially in some specific groups of patients. It is necessary to recommend this
treatment in high risk patients (i.e. in those with prosthetic cardiac valves) before
a high risk procedure (i.e. dental procedures known to induce gingival or dental bleeding, including professional cleaning) and in medium risk patients the indication must always be based on an individual analysis according to American Heart Association guidelines.

Lemay S et al (1995)\textsuperscript{126} studied about patients with heart valve prosthesis; dental procedures and prevention. The report was as follows. Patients with birth or rheumatic heart defects, or wearing prosthetic cardiac valves, are at high risk of developing bacterial endocarditis following dental treatment. Two hundred patients with cardiac valves were surveyed with respect of their oral hygiene habits and their last visit to the dentist. More than half of the respondents (112) were fully edentulous, and most of them had not seen a dentist for many years. Of the 88 respondents who had natural teeth, 23 had not been to dentist since surgery. For the purpose of this study, focus was placed primarily on the answers given by the 65 patients who reported having been to a dentist after surgery. Only 41 of them (63\%) reported having received a prophylactic antibiotic therapy whole being treated with a risk of bacteremia. If the 24 others who did not receive prophylactic antibiotic therapy, 20 were given dental treatments with a risk of bacteremia. In light of this study, there should be recommendations to improve the health care given to patients predisposed to bacterial endocarditis.
A study on prosthetic valve endocarditic resulting from nosocomial bacteremia was conducted in University of Pittushurgh, pennsylvania by Fang G et al (1993). The objective of this study was to determine the incidence of endocarditis in bactermic patients with prosthetic heart valves and the risk factors for and the effect of duration of antibiotic therapy on development of endocarditis in such patients. A multi center prospective observational study design was used. The selected setting was a six university teaching hospitals with high volume cardiothoracic surgery. The participants were one hundred and seventy one consecutive patients, with prosthetic heart valves who developed bacteremia during hospitalization. The measurements and main results are as follows. Patients were evaluated when they were identified as having bacteremia and 1,2,6 and 12 months after its occurrence. The main results were as follows. Out of the 171 patients, 74 (43%) developed endocarditis. Fifty six (33%) had prosthetic valve endocarditic at the time bacterermia was discovered ("endocarditis at outset"), whereas 18 (11%) developed endocarditic a mean of 45 days after bacteremia was discovered ("new endocarditic"). Mitral valve location and staphylococcal bacteremia (staphylococcus aureus or s.epidermidis) were significantly associated with the development of "new" endocarditic. All 18 cases of new endocarditis were nosocomial, and in 6 of these cases (33%) bacteremia was acquired via intravascular devices. Twenty-
one patients without evidence of endocarditis at the time of bacteremia received short-term antibiotic therapy (<14 days); 1 patient (5%) developed endocarditic (p>0.2). The conclusion was as follows bacteremic patients with prosthetic heart valves were at notable risk for developing endocarditis, even when they received antibiotic therapy before endocarditis developed and regardless of the duration of such therapy. Intravascular devices were a common portal of entry.

Wallace S.M et al (2002)\textsuperscript{219} in their descriptive study, reported about mortality from infective endocarditis: clinical predictors of outcome. The objective is to identify clinical markers available within the first 48 hours of admission that are associated with poor outcome infective endocarditis. A Retrospective cohort study conducted in a teaching hospital selecting 208 patients out of 220 patients with infective endocarditis was carried out.

Consecutive patients with infective endocarditis presenting between 1981 and 1999 to a tertiary centre were studied. Clinical, echocardiographic, and haematological data recorded within 48 hours of admission were obtained. Data were analysed using logistic regression models. Main outcome measures were mortality at discharge and at six months. Data were obtained for 93% of patients who were eligible for inclusion. 194 (93%) were positive for Duke criteria. Mean age was 52 (1.2) years, and 138 (66%) were men. 82 (39%) were
transferred from other hospitals. 161 (87%) were blood culture positive and 47 (23%) infections were staphylococcus aureus. The infection was located on aortic (n=85, 41%), mitral (n=77, 37%), tricuspid (n=18, 9%) and multiple valves (n=20, 10%) 67 (32%) had prosthetic valve endocarditis. 48% of the cohort were managed with antibiotics alone. Mortal at discharge was 18% and at six months 27%. Duration of illness before admission, age, sex, valve infected, infecting organism, and left ventricular functions were not predictors of adverse mortality. However, abnormal white cell count, serum albumin concentration, serum creatinine concentration, or cardiac rhythm, the presence of two major Duke criteria, or visible vegetation conferred a poor prognosis.

The authors concluded that conventional prognostic factors in this study did not appear to predict outcome early during hospital admission. However, simple clinical indices, which are readily available are reliable, cheap and potentially powerful predictors of poor outcome.


Prosthetic valve endocarditis (PVE) is an important cause of the morbidity and mortality associated with heart valve replacement surgery. Once established, it carries a mortality rate that may be as high as 70%. The only
treatment for established PVE is rigorous intravenous antimicrobial therapy, although this had extremely limited success. The majority of cases require surgical removal and replacement of the infected prosthesis. At present, the only means of preventing PVE are scrupulous asepsis and prophylactic perioperative antibiotic therapy. If another strategy could be developed that is effective and safe, the incidence of this disastrous complication of valve replacement would be reduced. Such strategies have been extensively investigated from a variety of different perspectives for several years. The understanding of biofilms appears to be pivotal to the development of a successful approach.

Vlessis et al (1991) reviewed the risk, diagnosis and management of prosthetic valve endocarditis. Prosthetic valve endocarditis (PVE) emerged approximately 37yrs ago when the first human heart valve replacements were performed. PVE can be classified as early or late with the pathophysiology and etiologic organisms varying between the two subgroups. The incidence of PVE ranges upto 0.5% per patient year for mechanical mitral valves and upto 1.0% per patient year for other valves. The clinical presentation is similar to that of native valve endocarditis, with fever being the most prevalent sign. Diagnosis is based on a constellation of clinical signs and symptoms as well as echocardiographic evaluation of the valve and perivalvular tissues. An algorithm
is set forth for diagnosis and management of patients with suspected PVE based on our personal experience and the published literature. Indications for surgery, the surgical approach and methods of PVE prophylaxis and prevention are discussed.

Lacassin F et al (1995) studied procedures associated with infective endocarditis in adults. A case control study. The objective of the study was to assess the relative risk of infective endocarditis associated with various procedures and the protective efficacy of antibiotic prophylaxis. The results recommendations for the prevention of infective endocarditis are based on the hypothesis of a relationship between procedures and infective endocarditis which is supported by anecdotal reports and data from experimental models. Cases meet the Von Reyn's diagnostic criteria modified with echocardiographic and macroscopic findings controls were recruited from cardiology or medical wards. Cases (n=171) and controls were matched as regards sex, age and underlying cardiac condition. They were requested to indicate all the medical, surgical or dental procedures within the previous 3 months. Among potential confounding factors, infections episodes and skin wounds in the previous 3 months were reported. Antibiotic prophylaxis administration was documented for type, dosage, duration and administration schedule. The results were as follows. Cases significantly more frequently than controls had undergone at least one
procedure (matched odds ratio 1.6; 95% confidence interval, 1.01 to 2.53). Dental procedures considered as a whole were not associated with an increased risk, although scaling and root canal treatment showed a trend towards a higher risk of infective endocarditis (p=0.065). Among non dental procedures, only surgery appeared to be at risk (matched odds ratio 4.7, 95% confidence interval, 1.02 to 22). Considering all procedures, the risk of infective endocarditis increased significantly with the number of procedures. While general co-morbid conditions did not differ between the two groups, cases significantly more frequently than controls had experienced an infectious episode or skin wound. In multivariate analysis, only infectious episodes and skin wounds significantly increased the risk of infective endocarditis. Scaling was the only independent risk factor for viridans streptococcal infective endocarditis. The 46% protective efficacy of antibiotic prophylaxis was not significant.

Procedures do increase the risk of infective endocarditis. The interpretation of the apparent low risk associated with dental procedures may be as a result of the current practice of antibiotic prophylaxis. Our data suggest that surgery should be more clearly mentioned in future guidelines, and reemphasize that a rigorous treatment of any focal infection in cardiac patients is mandatory.
From the efficacy rate of antibiotic prophylaxis, it can be reduced by 5 to 10% in France by appropriate use of antibiotic prophylaxis in cardiac patients.

Segwin P and Malledant Y (1998)\textsuperscript{195} published an article on curative and preventive antibiotic therapy in infective endocarditis also pointed out the source of infection. Infective endocarditis with negative blood cultures requires special techniques to obtain the causal microorganisms. In about half of the cases, a nosocomial bacteremia results in infective endocarditis in patients with a prosthetic valve. Surgery is mandatory in infective endocarditis with complications and/or caused by particular microorganisms; surgery is essential in most patients with a prosthetic valve.

Krennmair G et al (1996)\textsuperscript{113} they studied about dentogenic sources of infection in patients with awaiting heart valve replacement. The detection of all teeth with periapical pathological conditions and optimal treatment of the affected teeth are a part of the evaluation program for patients who are scheduled to undergo cardiac valve replacement. 48 patients (50 valve replacement operations) were evaluated for the incidence of periapical pathological condition, as well as for the different kinds of oral surgical interventions. A periapical pathological condition was present 28-48 patient (58.3%) In general the incidence of a dental focus was significantly higher in
patients awaiting aortic valve replacement than in patients undergoing mitral valve replacement (69.7% vs 23.1%; P<0.01). Patients for aortic valve replacement presented significantly more periapical pathological conditions than patients for mitral valve replacement (1.7 vs 0.8). Optimal timing of dental consultation is helpful in the oral rehabilitation of patients about to undergo a valve replacement procedure. Furthermore, close interdisciplinary cooperation is necessary to minimize the social and psychological problem following unexpected tooth extraction. Cardiologists and heart surgeons have an important role in the organisation of the oral rehabilitation of patients undergoing valve replacement procedures.


They wanted to describe the epidemiological aspects of infective endocarditis (IE) in a French hospital and identify the prognostic factors. They reviewed the clinical, endocardiographic and microbiological features, and the outcome of 89 patients (90 episodes, median age 60 years) with IE over 18 months. Logistic regression analysis was used to identify prognostic factors for death. A native valve was involved in 68 cases (75.5%): in 7 of these the
patient was an intravenous drug user. A prosthetic valve was involved in 22 cases (24.5%); 5 of these were of early onset. Diagnosis was definite in 87% of cases. Median time to diagnosis was 3 days twenty five patients (28%) were immunocompromised. A portal of entry usually cutaneous, was identified in 65% of cases. Sixty two percent of patients had an underlying heart disorder, usually degenerative. The infection involved the left heart is more than 75% of cases. One or more vegetations were detected in 75% of cases. The median size of vegetation was 15mm. Isolated agents were mainly staphylococci (n = 40, 44% including 12 coagulase–negative isolates), and streptococci (n=23(25%), including 7 enterococci). In illness (12%), cultures remained negative. Nineteen episodes were nosocomial and staphylococcus aureas was implicated in 11 of them. 50% of patients had atleast one complication: heart failure (n=42). Kidney failure (n=44), embolism (n=35), septic shock (n=19). Surgery was performed in 49 cases (54%) due to heart failure (n=19), cerebral embolism (n=12) and/or severe valve lesions (n=27). 18 patients died, 10 of whom were infected with S.aureus. Nosocomial IE (p=0.0008), heart failure (p=0.004) and prosthetic valve (p=0.01) but not s.aureus were independently associated with death.

The authors concluded that S.aureaus was the main microorganism isolated in our patients. However, it was not independently predictive of fatal outcome.
Nosocomial infection can be prevented thus hospitalization period can be reduced. Cost effective will be possible. More over all resources can be saved. Health status improvement is possible.

Literature related to this study especially case studies in Indian scenario is a few, on google, medline and pub med. Still whatever available were included. Moreover some of the studies were not complete so could not be included in the bibliography.

In this chapter she had covered literature related to valve diseases which required replacement surgery, valve replacement surgery and its specific complications postoperatively and also its prevention.