A STUDY OF CATHETER RELATED INFECTION IN HAEMODIALYSIS PATIENTS

DISSERTATION SUBMITTED

In partial fulfillment of the requirement for the degree of

(Branch-I) M. D. (GENERAL MEDICINE)

of

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CHENNAI- 600032

DEPARTMENT OF GENERAL MEDICINE

TIRUNELVELI MEDICAL COLLEGE

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MAY 2019

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled **"A STUDY OF CATHETER RELATED INFECTION IN HAEMODIALYSIS PATIENTS"** submitted by **Dr. K. JAYAPRAKASH** to the Tamilnadu Dr. M.G.R Medical University, Chennai, in partial fulfillment of the requirement for the award of M.D. Degree Branch –I (General Medicine) is a bonafide research work carried out under his direct supervision & guidance.

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CERTIFICATE

This is to certify that the Dissertation **"A STUDY OF CATHETER RELATED INFECTION IN HAEMODIALYSIS PATIENTS"** presented herein by **Dr. K. JAYAPRAKASH** is an original work done in the Department of General Medicine, Tirunelveli Medical College Hospital,Tirunelveli for the award of Degree of M.D. (Branch I) General Medicine. Under my guidance and supervision during the academic period of 2016 -2019.

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DECLARATION

I solemnly declare that the dissertation titled **"A STUDY OF CATHETER RELATED INFECTION IN HAEMODIALYSIS PATIENTS"** is done by me at Tirunelveli Medical College Hospital, Tirunelveli Under the guidance and supervision of Prof. Dr. R.Periyasamy M.D, the dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University towards the partial fulfilment of requirements for the award of M.D. Degree (Branch I) in General Medicine.

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PROTOCOL TITLE: STUDY OF CATHETER RELATED INFECTION IN HAEMODIALYSIS PATIENTS
PRINCIPAL INVESTIGATOR: Dr.K.JAYAPRAKASH, MBBS.,
DESIGNATION OF PRINCIPAL INVESTIGATOR: PG STUDENT
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Dear, Dr.K.JAYAPRAKASH,, MBBS., The Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during the IEC meeting held on 10.03.2017

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1.	TIREC Application Form	☐
2.	Study Protocol	☐
3.	Department Research Committee Approval	☐
4.	Patient Information Document and Consent Form in English and Vernacular Language	☐
5.	Investigator's Brochure	☐
6.	Proposed Methods for Patient Accrual Proposed	☐
7.	Curriculum Vitae of the Principal Investigator	☐
8.	Insurance /Compensation Policy	☐
9.	Investigator's Agreement with Sponsor	☐
10.	Investigator's Undertaking	☐
11.	DCGI/DGFT approval	☐
12.	Clinical Trial Agreement (CTA)	☐
13.	Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA)	☐
14.	Clinical Trials Registry-India (CTRI) Registration	☐

THE PROTOCOL IS APPROVED IN ITS PRESENTED FORM ON THE FOLLOWING CONDITIONS

1. The approval is valid for a period of 2 year/s or duration of project whichever is later
2. The date of commencement of study should be informed
3. A written request should be submitted 3weeks before for renewal / extension of the validity
4. An annual status report should be submitted.
5. The TIREC will monitor the study
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7. The PI should report to TIREC within 7 days of the occurrence of the SAE. If the SAE is Death, the Bioethics Cell should receive the SAE reporting form within 24 hours of the occurrence.
8. In the events of any protocol amendments, TIREC must be informed and the amendments should be highlighted in clear terms as follows:
   a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
   b. The PI must comment how proposed amendment will affect the ongoing trial. Alteration in the budgetary status, staff requirement should be clearly indicated and the revised budget form should be submitted.
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   e. Approval for amendment changes must be obtained prior to implementation of changes.
   f. The amendment is unlikely to be approved by the IEC unless all the above information is provided.
   g. Any deviation/violation/waiver in the protocol must be informed.
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CERTIFICATE – II

This is to certify that this dissertation work title**"A STUDY OF CATHETER RELATED INFECTION IN HAEMODIALYSIS PATIENTS"** of the candidate **Dr.K.JAYAPRAKASH** with registration Number **201611355** for the award of **M.D.**Degree in the branch of **GENERAL MEDICINE (I).** I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion page and result shows 5 **percentage** of plagiarism in the dissertation.

Guide & Supervisor sign with Seal.

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CONTENTS

INTRODUCTION

The kidneys are highly differentiated organs in our body system. They perform a variety of complex process in our body to maintain the normal homeostasis. The kidneys change the concentration of urine ,maintain the water balance thereby the acid base balance and electrolytes in our body. The Nitrogeneous products from the protein metabolism and other waste products produced in the body are excreted by the kidneys. They also produce hormones like erythropoietin to maintain the haemoglobin concentration and has a major role in mineral metabolism. Added to the above function, kidneys play a significant role in elimination of the toxins and drug metabolites. The most commonly used parameter to assess the renal function is serum creatinine.The correlation between GFR and creatinine is confounded by several factors.Normal GFR range from 90 to 120ml/min/1.73sq.m.

Acute kidney injury is characterised by sudden and rapid impairment of renal function occurring over a period of hours to days ,resulting in accumulation of toxic, nitrogeneous substances. Acute Renal Failure term is restricted to patients presenting with acute kidney injury who needs renal replacement therapy. Chronic kidney disease is a spectrum of pathological process characterised by abnormal kidney function and progressive decline in

glomerular filtration .End stage kidney disease results in accumulation of toxic metabolites resulting in uremic syndrome. Renal Replacement Therapy is required when the renal function deteriorates leading to accumulation of metabolic waste products that interfere with the normal homeostasis. Haemodialysis is an extracorporeal procedure to remove extra salt ,fluids and toxins through a dialysis machine. The population of patients undergoing dialysis is increasing day by day due to high incidence of chronic kidney disese and AKI. Central venous catheters are frequently used to initiate the dialysis before the arteriovenous fistulas are mature and starts functioning.

Sepsis related death is more common in dialysis patients than the general population. Bacteremia complicates the central venous catheter use in haemodialysis patients. Catheter related infection is suspected based on the clinical profile of the patients like fever, chills, rigor, unexplained hypotension, altered mental status, local catheter site abscess, induration around the exit port site. Catheter related blood stream infection is the most common indication for the catheter removal. Contamination of skin flora, unsterile handling of catheter by the training personnel, malnutrition, Diabetes, malignancy, hypoalbuminemia, increased duration of catheter all predispose to the high chances of catheter related infection.

AIM OF THE STUDY

1) To study the incidence of temporary vascular catheter related infections in haemodialysis patients

2) To study the most common risk factors for catheter infection and to study about the bacteriological profile of catheter related infection.

REVIEW OF LITERATURE

Dialysis is a treatment that filters and purifies the blood. Dialysis has been used since 1940s to treat people with kidney disease. Dialysis is a process whereby the solute composition in solution A, is altered by exposing solution A to a second solution B, through a semipermeable membrane. The semipermeable membrane can be viewed as a sheet perforated by holes or pores. Water molecules and low molecular weight solutes in the two solutions can pass through the membrane pores, but larger solutes like proteins cannot pass through the semipermeable barrier, and the high molecular weight solutes on either side of the membrane will remain unchanged.

There are two types of dialysis

1)Peritoneal dialysis

2)Haemodialysis

Goals of Dialysis:

The haemodialysis procedure consists of pumping heparinized blood through the dialyser at a flow rate of 300-500ml/min, the dialysate flows in opposite counter current direction at 500-800ml/min.

Dialysis dose is defined by the fractional urea clearance during the dialysis treatment. It also depends on the patient size, residual renal function,protein intake and other co-morbidities.

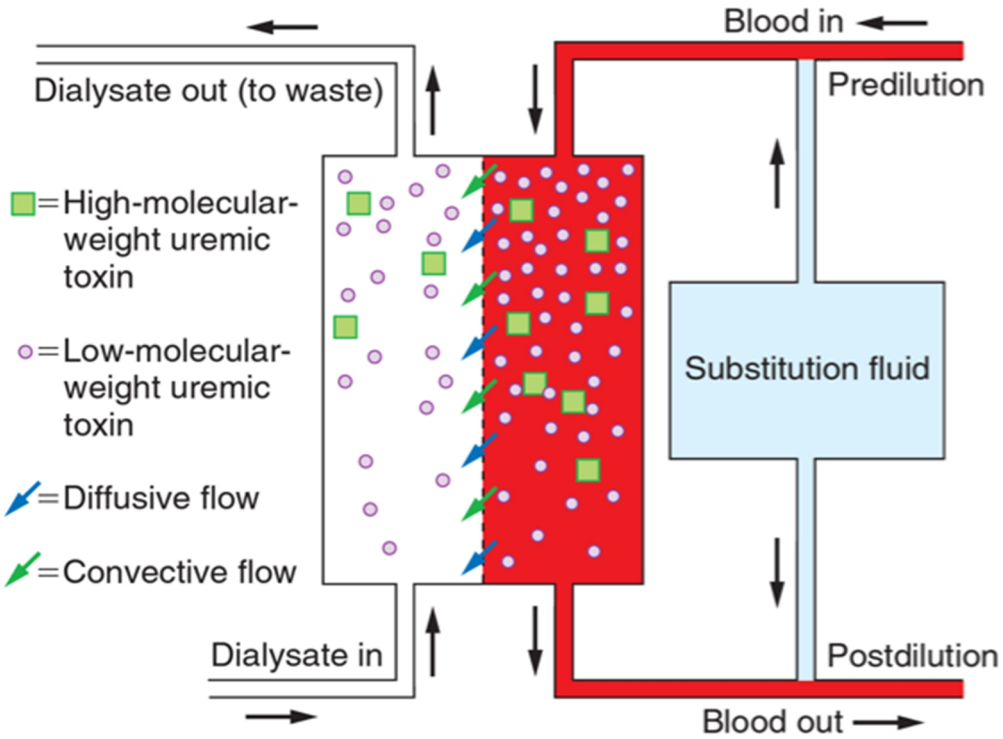
Principles of haemodialysis

Haemodialysis is based on the principles of diffusion and ultrafiltration across the semipermeable membrane.

Diffusion:

The movement of solutes by diffusion is the result of random molecular motion. The larger the molecular weight of a solute the slower its rate of transport across a semipermeable membrane small molecules, (eg urea 60 Da) moving about at high velocity, will collide with the membrane and their rate of diffusion transport through the membrane will be high .Large molecules (e.g creatinine 113 Da) those that can fit easily through the membrane pores will diffuse through the membrane slowly because they will be moving about at low velocity and colliding with the membrane infrequently.

DIFFUSION

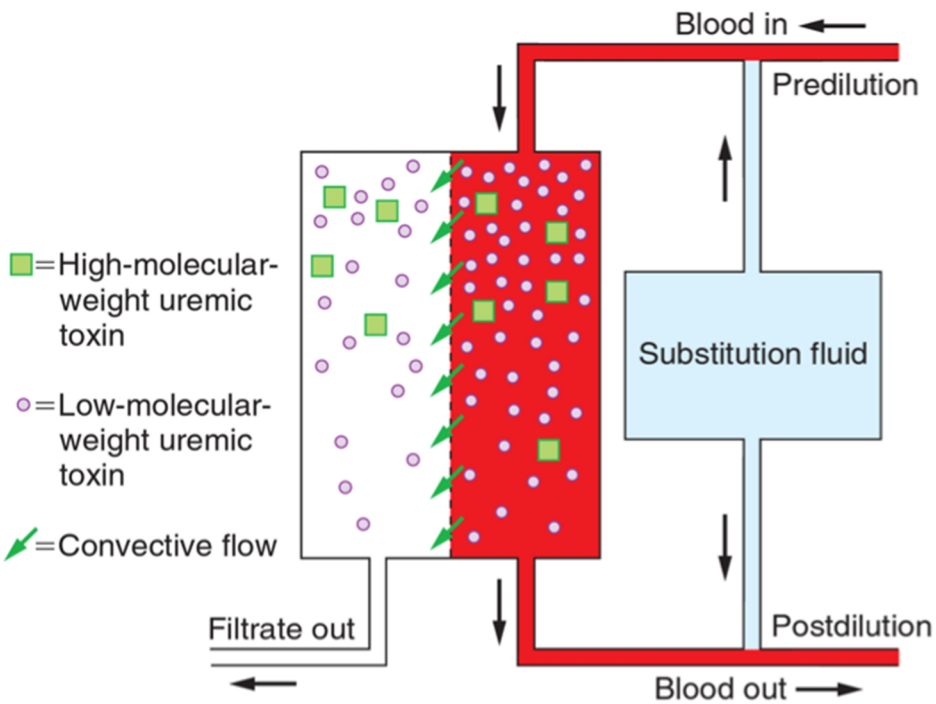


ULTRAFILTRATION

The second mechanism of solute transport across semipermeable membrane is ultrafiltration (Connective transport). Water molecules are extremely small and can pass through all semipermeable membranes. Ultrafiltration occurs when water driven by either a hydrostatic or an osmotic force is pushed through the membrane. Those solutes that can pass easily through the membrane pores are swept along with the water a process called 'solvent drag'. The water being pushed through the membrane is

accompanied by such solutes close to their original concentrations. Larger solutes, especially those that are larger than the membrane pores are held back. For such large solutes the membrane acts as a sieve.

ULTRA FILTRATION



Components haemodialysis

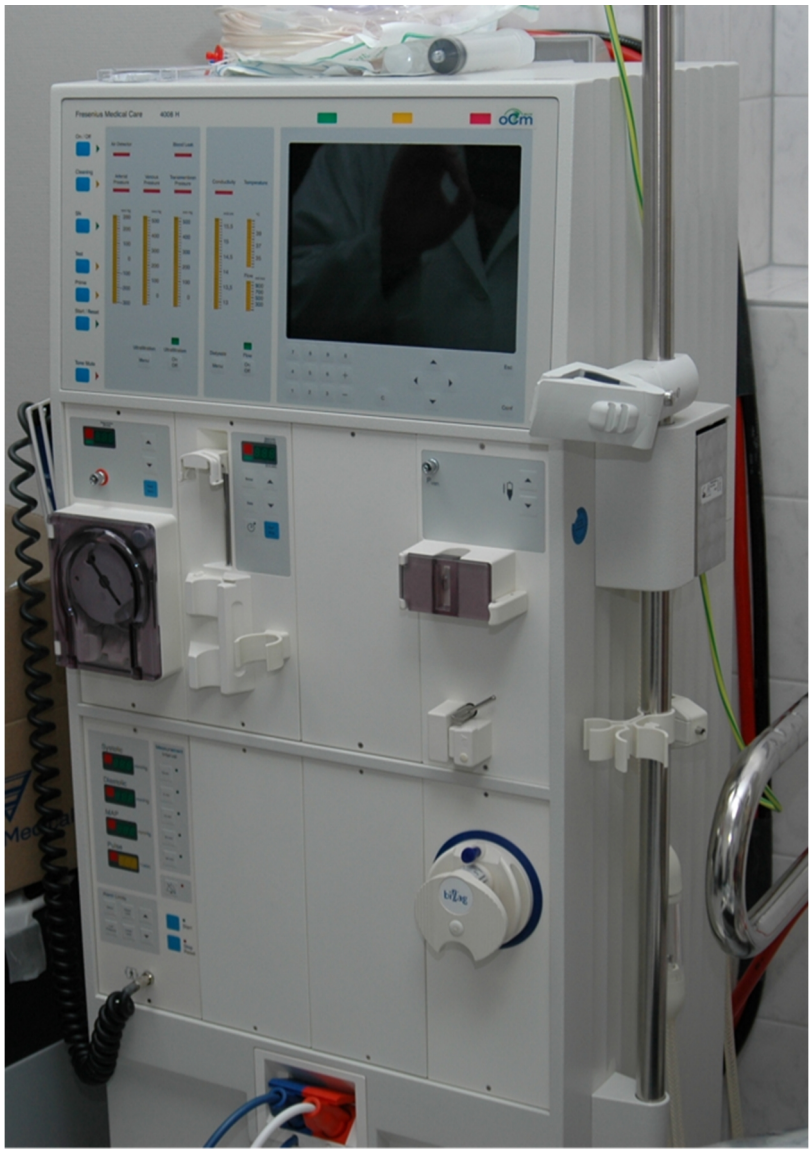
There are three essential components to haemodialysis.They are

1)The dialyzer

2)The composition and delivery of dialysate.

3)The blood delivery system.

HAEMODIALYSIS MACHINE



Dialyser:

The dialyser is a plastic chamber with the ability to perfuse blood and dialysate compartments simultaneously at very high flow rate. The hollow fiber dialyser is the most commonest in use. These dialysers are made of bundles of capillary tubes through which blood flows while the dialysate travels on the outside of the fibers.

DIALYSATE

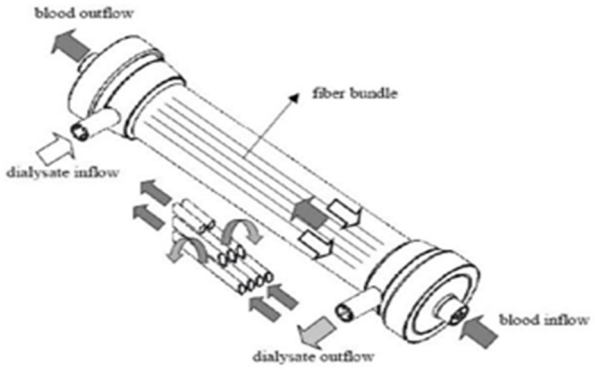
The dialyser is where the blood and dialysis solution circuits interact and where the movement of molecules between dialysis solution and blood across a semipermeable membrane occurs. The dialyser shell is a box or tube with four ports. Two ports communicate with a blood compartment and other two ports with a dialysis solution. The membrane present in the dialyser separates the two compartments.

Structure:

Hollow fiber dialyser:

In this type, the blood flows into a chamber at one end of the cylindrical shell called header, from there blood enters through the small capillaries tightly bound in a bundle. The dialyser is designed so that blood flows through the fibers and dialysis solution flows around the outside.

Hollow fiber dialyser

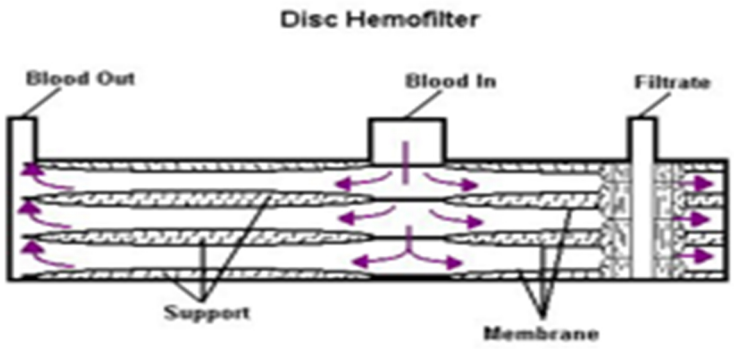


When blood flows through the capillaries, the blood collects in a header at the other end of the cylindrical shell and is then routed back to the patient through venous tubing and venous access device.

Parallel plate dialyser:

In this type ,blood and dialysis solution pass through alternate spaces between the membrane sheets.

PARALLEL PLATE DIALYSER



Membranes:

The majority of clinically used dialysers utilise a membrane manufactured from synthetic polymer blends .the membranes are made of any one of the following substances. They are

- polysulfone,
- polyethersulfone,
- polyacrylonitrile (PAN)
- polyamide and
- polymethylmethacrylate.

Synthetic membranes are more biocompatible than the earlier used cellulose membranes.

Cellulose membranes are made up of molecular chains that contain hydroxyl (OH) groups. These groups were responsible for the poor biocompatibility of the membranes as it activated the complement system.

Coated membranes :

Improved biocompatibility resulted from the coating of the membrane with an antioxidant such as vitamin E. It improved anti oxidant profile in the blood of patients.

Dialysate composition:

potassium	0-4 mmol / L
Calcium	1.25 – 1.75 mmol/ L
Sodium	136-145 mmol/ L
Magnesium	0.25- 0.35 mmol/ L
Chloride	98-124 mmol/ L
Glucose	0-1 mg/dl
PH	7.1- 7.3

Acetate	3.8MM
Citrate	0.8 – 1.0
Bicarbonate	25.35 MM

3)Blood Delivery system:

The blood delivery system consists of an extracorporeal circuit and the dialysis access. The dialysis machine is composed of safety monitors, dialysis solution delivery apparatus and blood pump. The role of dialysis solution delivery system is to dilute the concentrated dialysate system with water ,temperature monitoring, and to maintain the flow of the dialysate. The fluid removal depends on the varying ultrafiltration coefficient of the membrane.

Types of catheters:

Catheters are an important option for vascular access. They can be used immediately after insertion, can be used for long periods of time and provide painless haemodialysis access. There are multiple reasons for the high prevalence of catheter use,

1)Increasing age of patients initiating haemodialysis,

2)Increasing number of comorbid condition including significant vascular disease,

3)Inadequate preparation prior to the need to initiate haemodialysis,

4)Scheduled living donor transplant,

5)When arterovenous fistula or graft is maturing or healing,

6)When a peritoneal dialysis catheter is planned.

The relationship between the type of catheter material and the risk for bloodstream infection has been proved. Catheter made up of Teflon has less chance of infection

1)Non tunnelled HD catheter:

Single- or double-lumen catheters are made of polymers ,such as polyethylene or polyurethane. They enable simple and direct implantation of the catheter easier. The catheter length varies according to the site of insertion.

The femoral route requires catheters of 30 to 35 cm in length for distal tip to be located in inferior vena cava. The internal jugular vein route needs shorter catheters of 20 to 25 cm in length, with tip location at the inferior vena cava–right atrium junction. The subclavian vein should not be used due to high risk

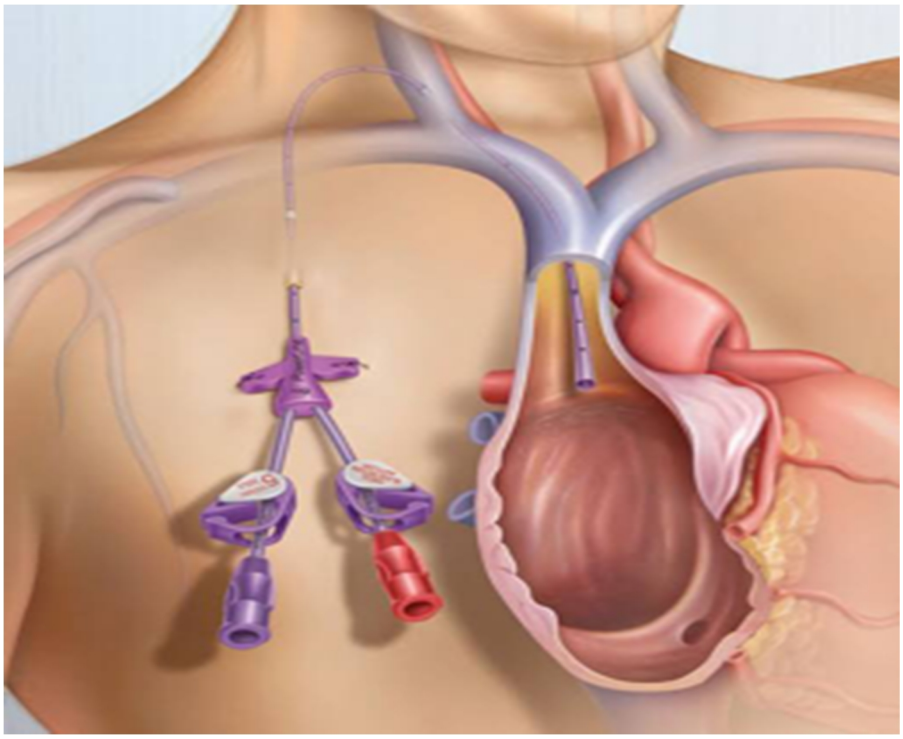
of venous stenosis. For sufficient blood flow rates through the catheters, diameter of these catheters must be ideally 12 to 14 French.

2)Tunneled catheters:

Tunneled central venous catheters have two lumens, measuring a length of 40 cm each,10 cm of the catheter is tunneled under the skin. Tunneled catheters are made of synthetic polymer with large internal lumen and a Dacron cuff to allow anchoring in the subcutaneous plane The catheter characteristics depends on the type of polymer used, design, and geometry - double-lumen catheters or dual catheters or split catheters .

Anti microbial impregnated catheter has less infection.Types of Anti microbial impregnated catheters are chlorhexidine-silver sulfadiazine-coated catheters and minocycline-rifampin-coated catheters. Incidence of infection can be reduced by the use of silver-impregnated collagen cuff catheters. Heparin-bonded catheters reduce catheter thrombosis and catheter related infection.

NON TUNNELED CATHETER



These temporary catheter are typically used when vascular access is required for urgent renal replacement therapy. In case of Acute kidney injury, when duration of RRT is unpredictable, NTHC are the recommended as the initial choice. But they are associated with the increased risk of complications.

Advantages of ultrasound use for NTHC insertion :

NTHC Site	Advantages
Internal jugular Vein	Reduces the risk arterial punctures, hematomas. Faster catheter insertion ,time saving.
Femoral vein	Significant reduction in complications Increased first-attempt successful catheter insertion
Subclavian vein	Should be performed by personnels experienced with this approach

Optimal site selection for catheterization:

The following are the optimal sites for catheter insertion ,

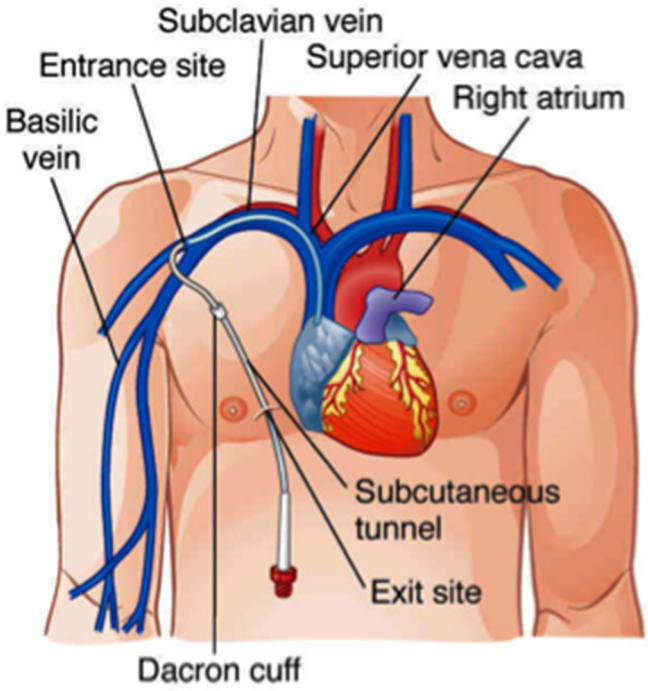
Right Internal jugular vein,

Femoral Vein ,

Left Internal jugular vein,

Left subclavian vein with preference for the dominant side.

TUNNELED CATHETER



Contraindications to tunnelled catheter insertion:

INR >1.5

Platelet count <50 x 10 9/c

Active septicemia

Catheter insertion site:

Venous catheter access:

Patients undergoing dialysis through arterovenous access do better than those with venous catheters. The latter type have more chance of infections as evidenced by higher levels of inflammatory markers like c- reactive protein. survival rate of catheter decrease with the longer duration of catheter.

Another important problem with the venous catheters are inadequate flow . Normal flow rate in venous catheter is 300ml/min, whereas the expected flow rate is >400ml/min. These factors reduce the use of venous catheters in larger proportion of patients. Ideally the catheter should be inserted on the opposite side of a maturing planned arteriovenous access .Common femoral vein can be used when the central veins are occluded. The catheter must be greater than 20cm in length to minimize recirculation but >35 cm should be avoided as flow rate decreases with increasing catheter length.

Venous catheters can be used as a long term access site in individuals where AV access could not be created easily.

For example,

* in children,

*in diabetic patients with peripheral arterial disease,

*overweight individuals,

*non availability of additional access site,

* in cardiomyopathy patients those who are not able to maintain the flow rate adequately due to low blood pressure,

*long term use of venous catheters for haemodialysis has been accepted in elderly patients with co-morbidities and reduced expectancy of life.

Strict disease control protocols like hand washing and catheter care protocols for reducing the infection of the catheter

Characteristics of an Ideal vascular access:

An ideal vascular access should have the following characteristic features,

1) maintain high blood flow rate
2) instant usability
3) long survival
4) low thrombosis rate
5) low infection rate
6) patients comfort
7) minimal cosmetic effect

Insertion technique:

Informed written consent is required before catheter insertion. Catheter insertion should be done under strict aseptic precautions. Sterile gloves ,apron should be worn .An ultrasound examination should be done over the selected site to make sure the veins are suitable for catheterization. Ultrasound probe should be covered with sterile sheath. Insertion site and surrounding areas should be cleansed with the surgical scrub and draped with sterile clothes.

Internal jugular approach:

The ultrasound probe can be placed either parallel or perpendicular to the long axis of the vessel. Perpendicular placement of the probe show the vein as a circle but the needle is not visualised. In parallel placement , needle should be inserted adjacent to the end of the probe. One should be able differentiate the internal jugular vein from the carotid artery as they are closely related to each other. We can differentiate them by applying gentle pressure of the probe which causes the collapse of the vein. In addition, the diameter of the vein increases on performing valsalva manuever. We should avoid catheter insertion through the muscle as this causes catheter dysfunction when the head is rotated.

After infiltration with the local anaesthetic agent,with the use of real time ultrasound guidance ,a 21G micropunture needle with an attached syringe is inserted into the vein because this type of needle has less complications if inadvertently inserted into the carotid artery. Guide wire is inserted through the needle and its position is confirmed by fluoroscopy.

The needle is removed after guidewire insertion and a 5F dilator is advanced over the wire. The dilator has a slow switch to prevent air embolism. . There should be a suture at the exit site and closure suture at the puncture site. Puncture site sutures can be removed in 10-14 days. The exit site suture can be removed after 3 weeks.

Uncuffed catheter insertion :

For inserting an uncuffed temporary catheter, guidewire is advanced into the vein and 5F dilator is removed and then serial dilators of increasing size are passed over the wire to dilate soft tissue and venous tract progressively. The dilator should move freely over the guidewire and should not be forcefully advanced as it can impinge and cause perforation of the vein and the mediastinum. After inserting ,a check x-ray should be taken to confirm the position of the catheter. In case if long term dialysis is required

,the temporary non cuffed type catheter can be converted into tunnelled catheter if there is no exit site infection.

Cuffed catheter insertion:

Dual lumen, large diameter catheter made of silastic elastomers of polyurethane or silicone are commonly used. A small incision is made from the 5F dilator exit site extending laterally. A blunt dissection is done to the surrounding subcutaneous tissue to create a pocket for the catheter to bend without kinking. The cuff should be within the tunnel approximately 1-2 cm from the exit site after accurate placement of the catheter using the guidewire. Once the catheter exit site is identified ,the area is infiltrated with the local anaesthetic and using 11 knife blade ,a puncture is made through the skin with the widest point of the blade. The tunnel tract is infiltrated with the long needle from the exit site to the venotomy site. The catheter is then mounted on the tunnelling device and is then pulled from the exit site subcutaneously to the insertion site. The cuff is pulled into the tunnel and then the tunnelling device is removed from the catheter.

Percutaneous trans lumbar insertion into inferior vena cava, transhepatic, external jugular catheter can be considered if other venous sites are not accessible.

Catheter care:

1)Dressing:

During catheter handling, both the dialysis staff and the patient should wear surgical masks. The catheter tips and lumen should never remain in open air. A cap or syringe should be placed on or in the lumen of catheter while maintaining a clean field under the catheter connectors. After each session of dialysis ,the catheter hubs should be soaked in povidone iodine for 3-5 minutes.

Locking solutions:

After the dialysis session ,the dead space of each lumen is filled with heparin 5000u/ml. Use of higher heparin concentration may result in high risk of bleeding. The dead space of each catheter lumen varies among the length of the catheter and manufacturers. The volume of heparin is usually labeled in the hub of the catheter. Before each dialysis session, the heparin in the lumen is aspirated ,the catheter is flushed with heparinised saline and dialysis initiated.

Citrate is used as the anticoagulant as it chelates calcium, which is essential for clotting to occur. Citrate can be used with a wider range of antibiotic solutions. Very high concentration of citrate should not be used due

to risk of inadvertent injection leading to hypocalcemia and precipitating cardiac arrhythmia.

Bathing and showering:

The exit site should never be immersed in water. showering can be done only after the exit site sinus tract is formed.

Exit site care:

Use of a sterile gauze or semipermeable dressing to cover the catheter exit site will prevent the infection. Mupirocin ointment application has been shown to reduce exit site infections and catheter related bacteria.

Complications of catheter insertion:

Mechanical complications due to catheter insertion are common .They are arterial puncture

- hematoma
- pneumothorax
- pneumopericardium
- air embolism

Blood loss occurs, fatal bleeding like retroperitoneal bleeding occur in approximately 0.5% of femoral insertions.

Cardiac arrhythmias are potentially serious complications of all central venous catheter insertion that typically relate to the insertion of the guide wire used to insert the catheter by the seldinger technique. Patients with AKI are at increased risk of serious ventricular arrhythmias during catheter insertion compared to the patients with ESRD or normal renal function.

Long term mechanical complications :

High risk of central venous stenosis, with NTHC insertion into subclavian vein. So catheter insertion into the subclavian vein is avoided whenever possible. The risk of stenosis may be related to the extent of direct contact between the catheter side wall and injury to the vascular endothelium. NTHC are most frequently used in critically ill patients, the catheter related complications may be attributed to concurrent illness of the patients.

Infectious Complications of catheter insertion:

Higher risk of infection compared with both tunneled hemodialysis catheters and nontunneled central venous catheter. CRBSI occurred higher and once suspected there is need for NTHC removal.

Catheter associated infections

- Central venous catheter associated infections are Catheter-related bloodstream infections, exit-site infections, and tunnel infections .
- Catheter-related bloodstream infection (CRBSI) is defined as the presence of bacteremia originating from an intravenous catheter .
- Infections are more common among patients in chronic kidney disease on chronic hemodialysis.
- Hemodialysis patients with the catheter have two to three fold increased risk of hospitalization for infection and death than the patients with an arteriovenous fistula or graft.
- Hemo study proves that switching from central venous catheters to AV fistulas decreases the relative mortality risk in chronic hemodialysis patients..
- The increased mortality risk is due to infection and sepsis associated with the central venous catheter.
- Typically infection rates are three episodes of infection per 1000 tunneled catheter–days and higher with non-tunneled catheters.

- Catheter associated localized infections can progress to metastatic complications like osteomyelitis, septic arthritis, epidural abscess, endocarditis , brain abscess , septic pulmonary emboli.

Risk factors

- The most important risk factor is prolonged duration of catheter .
- Type of catheter , site of insertion , underlying disease, method of catheter insertion, purpose of catheterization.
- Local risk factors like poor personal hygiene, occlusive transparent dressing, moisture around the exit site, Staphylococcus aureus nasal colonization, and secondary infections like urinary tract infection..
- Other risk factors for are history of previous catheter-related bacteremia, recent surgery, elderly patients, diabetes mellitus, iron overload, immunosuppression, hypoalbuminemia , chronic kidney disease , anemia, patients on total parental nutrition.

Diagnosis:

The diagnosis of catheter related infection is mainly based on clinical features and confirmation by laboratory investigations like blood culture and catheter tip culture.

Clinical features

- Fever and chills are the most sensitive clinical features. They are associated with positive blood cultures in 60% to 80% of patients.
- Only some patients with CRBSIs will have purulent discharge at insertion site and concurrent exit-site or tunnel infection.
- Other clinical manifestations are hemodynamic instability, altered mental status, catheter dysfunction, hypothermia, nausea,vomiting, and generalized malaise.
- Complications associated with bloodstream infection like suppurative thrombophlebitis, endocarditis, septic arthritis, osteomyelitis, epidural abscess, may be the first clue to the presence of catheter-related bacteremia.

Laboratory diagnosis of catheter related bloodstream infections

The diagnosis of CRBSI requires positive culture of blood obtained from peripheral vein and clear evidence that the catheter is the source .

- Concurrent positive blood cultures of the same organism from the catheter and a peripheral vein, with the colony count or differential time to positivity meeting certain criteria.

- ❖ Culture of the same organism from both the catheter tip and at least one percutaneous blood culture.
- ❖ Cultures of the same organism from two peripherally drawn blood cultures and an absence of an alternate focus of infection.

Clinical definitions

There are several definitions for CRBSI which are common in practice..

Kidney Disease Outcomes Quality Initiative (KDOQI)

Definite: Same organism from a semiquantitative culture of the catheter tip (>15 CFU/catheter segment) and from a Blood culture in a symptomatic patient with no other apparent source of infection.

Probable: Defervescence of symptoms after antibiotic therapy with or without removal of the catheter, in the setting in which BC confirms infection, but catheter tip does not (or catheter tip does, but blood does not) in a symptomatic patient with no other apparent source of infection.

Possible: Defervescence of symptoms after antibiotic treatment or after removal of catheter in the absence of laboratory confirmation of BSI in a symptomatic patient with no other apparent source of infection.

Center for disease control and prevention (CDC)

Clinical manifestations and at least one positive Blood culture from a peripheral vein and no other apparent source, with either positive semiquantitative (>15 CFU/catheter segment) or quantitative (>103 CFU/catheter segment) culture, whereby the same organism (species and antibiogram) is isolated from the catheter segment and a peripheral blood sample.

Simultaneous quantitative cultures of blood samples with a ratio of ≥3:1 (catheter vs peripheral) .

Differential period of catheter culture versus peripheral BC positivity of 2 h.

OR

Isolation of the same organism from semiquantitative or quantitative culture segment and from blood (preferably from a peripheral vein) of a patient with accompanying symptoms of BSI and no other apparent source of infection.

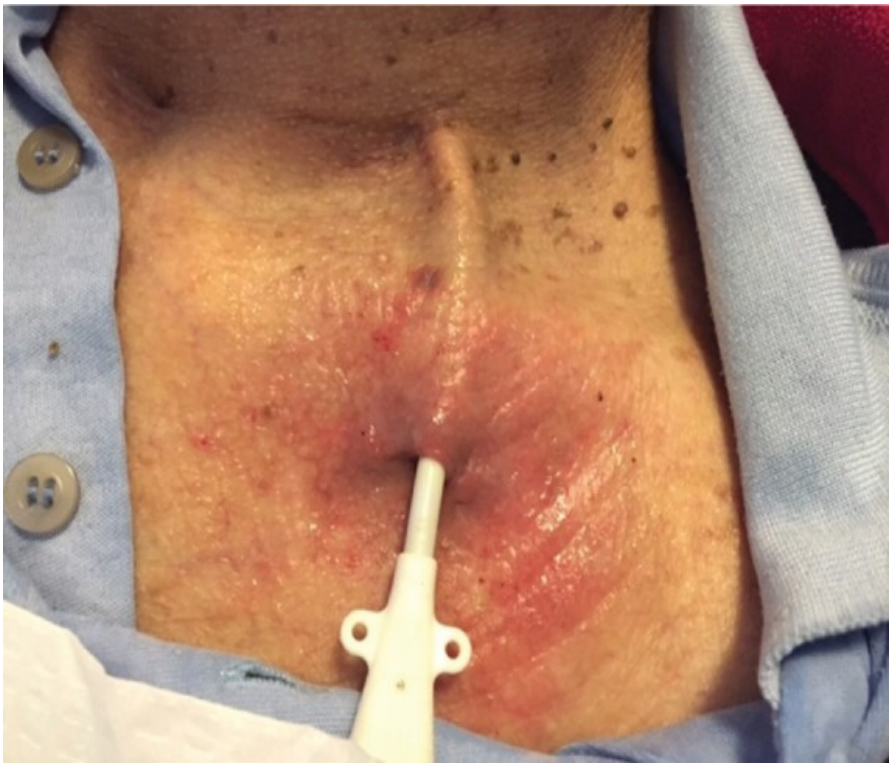
Exit site infection :

Hyperemia, induration, and tenderness ≤2 cm from catheter exit site. May be associated with fever and purulent drainage from the exit site. It may

or may not be associated with bacteremia. If there is purulent drainage, it should be collected and sent for Gram staining and culture.

CDC—Erythema or induration within 2 cm of the catheter exit site, in the absence of concomitant BSI and without concomitant purulence.

EXIT SITE INDURATION



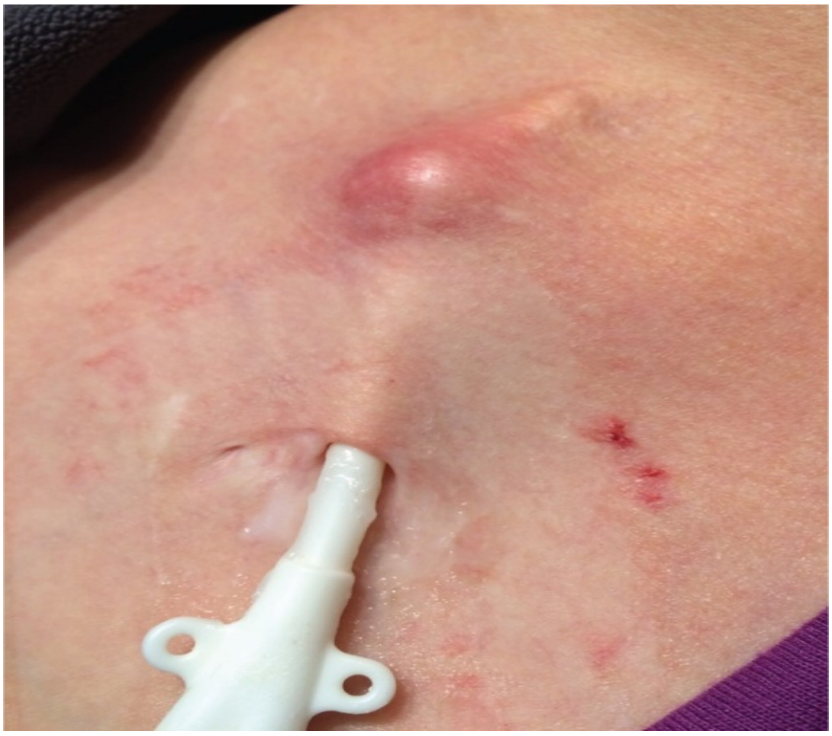
Tunnel infection

Tenderness, hyperemia, and/or induration that extends >2 cm from the exit site and along the subcutaneous tunnel. It may or may not be associated with

bacteremia. If there is purulent drainage, it should be collected and sent for Gram staining and culture.

CDC—Tenderness, erythema, or site induration >2 cm from the catheter site along the subcutaneous tract of a tunneled catheter, in the absence of concomitant BSI.

TUNNEL INFECTION



Blood cultures :

Specimen collection

- Blood samples are drawn from the catheter and a peripheral vein for culture before the initiation of antibiotic therapy.
- If the blood sample cannot be drawn from the peripheral vein, then blood can be drawn from different lumens of multilumen catheters.
- If this approach is used more than two blood samples should be drawn through catheter lumens at different times

Catheter culture

- Catheter cultures should be performed for suspected CRBSI
- Central venous catheters are evaluated by culturing the tip if the device has been in place for atleast 7 to 10 days.
- If catheter is in place for less seven days - intradermal portion of catheter can be cultured because the etiology of infection in these patients is most due to infection of the catheter wound.
- If the catheter is an implanted device the tip should be cultured

- Pulmonary artery catheters should be evaluated by culturing the introducer
- Catheter tips with antimicrobial coating like silver sulfadiazine or chlorhexidine should be cultured with specific inhibitors in the culture media
- The distal 5 cm of the central venous catheter tip was collected in a sterile test tube and transported immediately to the lab for culture.
- Immediately after catheter removal, 5 ml of blood was collected from peripheral vein in trypticase soy broth for blood culture.

Culture media

The catheters were cultured using three methods of catheter segment cultures: semi-quantitative, quantitative, and qualitative.

In semi quantitative method distal 5 cm of catheter segment is rolled across Blood agar plate four times with downward pressure

After SQC, the segment was immersed in trypticase soya broth. The plate was incubated at 37°C and colony count was recorded after 48 h. For qualitative culture, trypticase soya broth containing catheter segment was incubated as 37°C and then subcultured on Blood agar and MacConkey's agar plates after

24, 48 and 72 h. The plates were incubated for 24 h at 37°C. Blood collected from the peripheral vein in trypticase soya broth for qualitative culture was incubated at 37°C. Subcultures were made on Blood agar and MacConkey's agar plates after 24, 48 and 72 h. The plates were incubated for 24 h at 37°C. All the colonies grown were examined for the morphology followed by Gram staining and were identified by standard methods of Koneman.

Antibiotic susceptibility testing was performed for all isolates on Muller-Hinton agar. The susceptibility test was done by the standard Kirby Bauer disc diffusion method. The selection of antibiotic for sensitivity was based on the National Committee for Clinical Laboratory Standards (NCCLS) guidelines and suggestions of clinicians

Microbiology

- Most common organism related with catheter related infection is staphylococcus aureus..
- Polymicrobial - 16%
- Gram positive - staph aureus , staph epidermis ,MRSA, enterococcus , corynebacterium

- Gram negative - enterobacter , pseudomonas, acinetobacter, klebsiella, citrobacter , serratia.

Staphylococcus aureus

- Staphylococcus aureus is a gram-positive bacteria , they are cocci-shaped and arranged in clusters (“grape-like”).
- On culture media, these organisms can grow in up to 10% salt, and colonies are often golden or yellow colour .
- It is a normal commensal in skin , nose , respiratory tract..
- They can grow aerobically and anaerobically at temperatures between 18C and 40 C.
- Biochemical identification tests for staphylococcus are catalase test,nitrate reduction, coagulase test, sensitivity to novobiocin, mannitol fermentation.
- All pathogenic Staphylococcus species are catalase positive , to distinguish Staphylococcus aureus from other Staphylococcus species coagulase test is used. Staphylococcus aureus species are coagulase positive.. novobiocin sensitivity will be present in

Staphylococcus saprophyticus, and mannitol fermentation is used to distinguish from Staphylococcus epidermidis

Staphylococcus aureus

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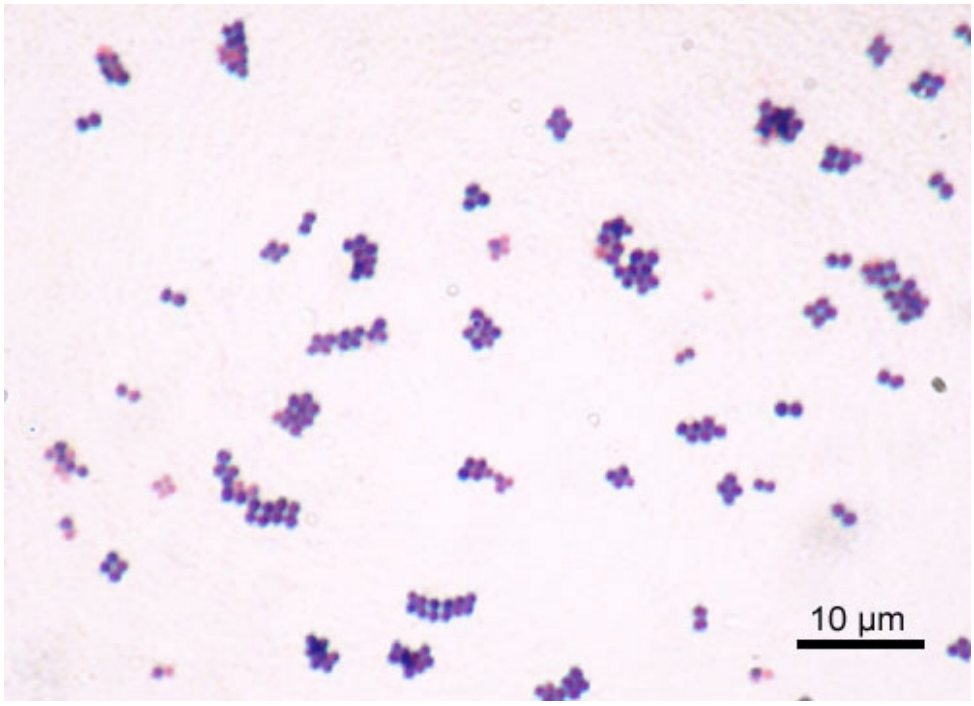
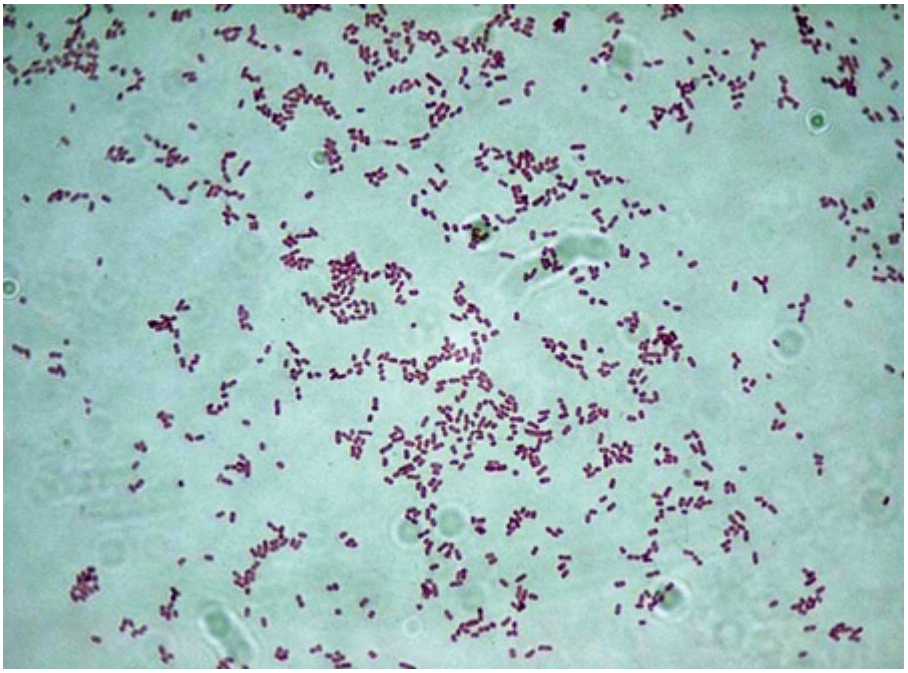


Klebsiella pneumoniae

- Klebsiella is a Gram-negative, oxidase-negative, rod-shaped bacteria with a prominent polysaccharide capsule
- Klebsiella species are found everywhere in nature. They can be found in water, soil, plants, insects . It is the second most aerobic bacterial flora of human intestine.

- It is also called as Friedlander bacillus , bacillus capsulatus.
- They are short , straight rods .
- It ferments sugars like glucose , lactose , sucrose, mannitol with production of acid and gas.
- They have no specific growth requirements and they grow well on standard laboratory media, between 35 and 37 °C and at pH 7.2. They produce mucoid colonies
- It is Indole and methyl red negative , Vokes - Proskauer and citrate positive
- They have been classified into three species k.pneumoniae , k.ozaenae, k.rhinoscleromatis.

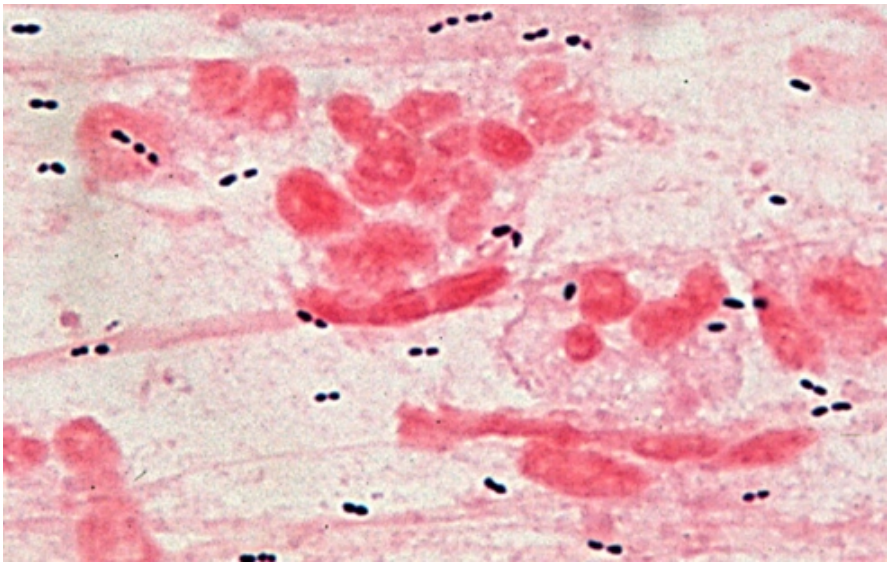
Klebsiella pneumoniae



Enterococcus

- Enterococci are Gram-positive cocci that often occur in pairs (diplococci) or short chains.
- They are part of the normal commensal flora of the gastrointestinal tract
- They grown in the presence of 40 percent bile , 6.5 percent sodium chloride, at pH 9.6 at 45 degree Celsius and 0.1 percent methylene blue milk.
- On Mac conkeys medium they produce tiny deep pink colonies
- They are heat resistant and usually non haemolytic.

Enterococcus



Prevention of CRBSI

Educational programs regarding hand hygiene and written protocols concerning catheter insertion - preparation of the equipment, skin antisepsis, strict aseptic insertion techniques , catheter manipulation , catheter care and Staff education and health care quality improvement.

- Catheters should be inserted under strict aseptic conditions.
- The right internal jugular vein position is the most preferred location for insertion, followed by the left internal jugular vein position.
- The use of femoral vein is usually discouraged.

- The use of the subclavian vein position is discouraged due to frequent stenosis.

- Choosing appropriate sites for catheter insertion
- Using the appropriate type of catheter material
- Using barrier precautions during insertion
- Changing catheter administration sets at appropriate intervals
- Ensuring proper catheter site care
- Ensuring removal of catheters when no longer essential

- The use of ultrasound guidance method to insert central venous catheter reduce the risk of complications and infections during central venous catheterization. In this technique, an ultrasound probe is used to localize the vein and it measures the depth of vein beneath the skin.

- Use the CVC with minimum number of ports

Site care :

Insertion site preparation

- Use of antiseptic solution for skin disinfection at the catheter insertion site prevents catheterrelated infection.

- Chlorhexidine-based solutions are superior to both aqueous and alcohol-based povidone-iodine in reducing the risk for catheter colonization and catheter-related bloodstream infection

Sterile technique

- While inserting the catheter one should use maximal sterile-barrier precautions, including mask, cap, sterile long -sleeved gown, sterile gloves, and a large sterile drape.

Tunneling

- Subcutaneous tunneling CVCs reduces the incidence of catheter infection, by increasing the distance between the venous entry site and skin .

- Tunneling of catheter gives better fixation.

Exit site dressing

- The catheter exit site should be covered by dressing as long as the catheter is in the place.

- The exit site should be inspected at every hemodialysis session, and the exit-site dressing should be replaced on a routine basis if it's not clean

- The patient should be instructed to maintain the hygiene and integrity of the dressing.
- The two most common types of dressing used are sterile, transparent, semi-permeable polyurethane dressings coated with layer of an acrylic adhesive, and gauze &tape dressings.
- Transparent, semipermeable polyurethane dressings allow continuous visual inspection of the site,require less frequent changes than do standard gauze and tape dressings
- If blood is oozing from the catheter insertion site, a gauze dressing may be preferred.

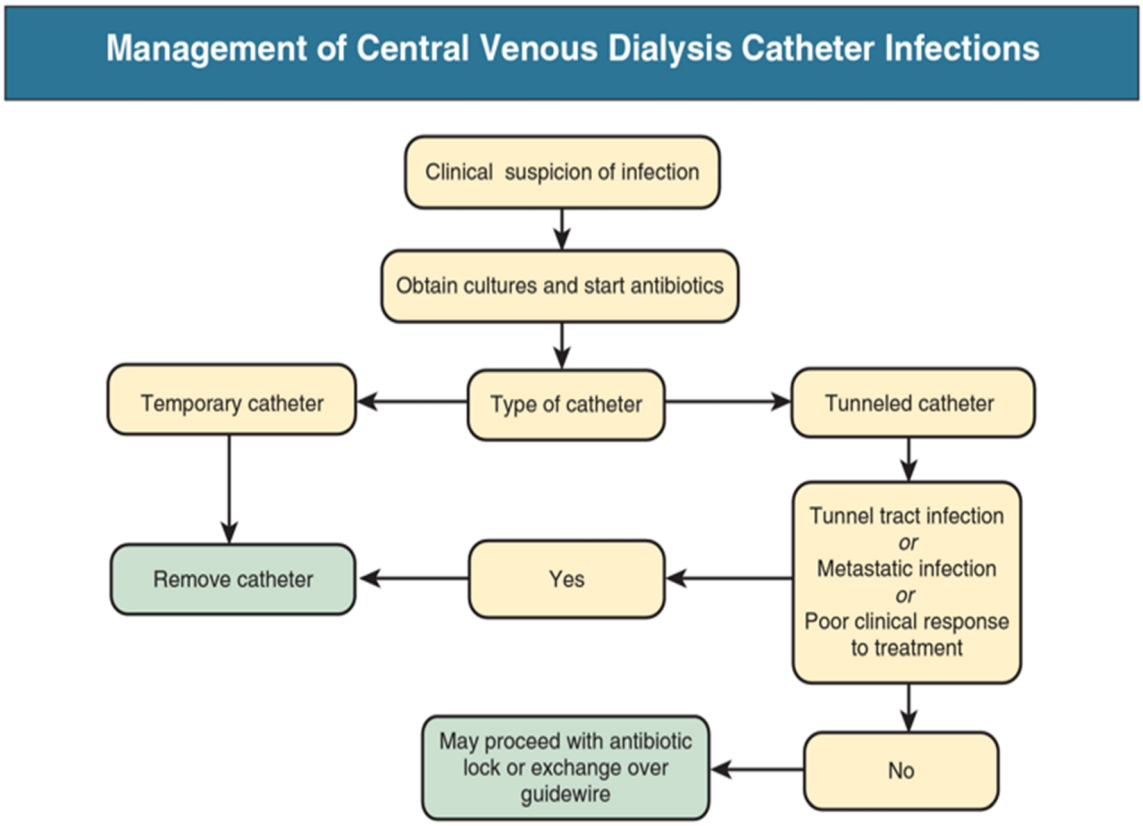
Topical antimicrobials

- Antimicrobial application to exit site with dressing can reduce catheter-related infections
- Mupirocin ointment , povidine iodine ointment are commonly used.

Antibiotic locks

The antibiotic lock technique for prevention of CVC-related infection includes filling of the catheter lumen with high concentrations of antibiotics for several hours in order to prevent colonization of the intraluminal surface

of the catheter. The main complication with the prolonged use of antimicrobial lock solutions are the potential development of antimicrobial resistance



MATERIALS AND METHODS

Materials :

Patients undergoing haemodialysis via central venous catheters in the dialysis unit of our institution were included in the study.

Duration of study :1 year

Type of study : Prospective study

Sample size : 75

Inclusion criteria:

1.patients undergoing haemodialysis via central venous catheters

Exclusion criteria :

1.patients undergoing haemodialysis via arteriovenous fistula

2.patients with cellulitis and other focus of infection

Methodology:

Demographic data and clinical variables including age, sex, duration of dialysis, site of catheter insertion, diabetes, and nutritional status for each of the patients were collected at the initial visit .Patients with symptoms and

signs of catheter related infection like fever, chills, hypotension ,local catheter site infection are subjected to blood cultures .One from the peripheral vein and the other from the central venous access .Catheter tip were also subjected to semi quantitative analysis in sterile container.

Statistical analysis :

Categorical variables were reported as numbers(percentage).Chi-square test was used for univariate analysis for factors in relation to catheter related infections

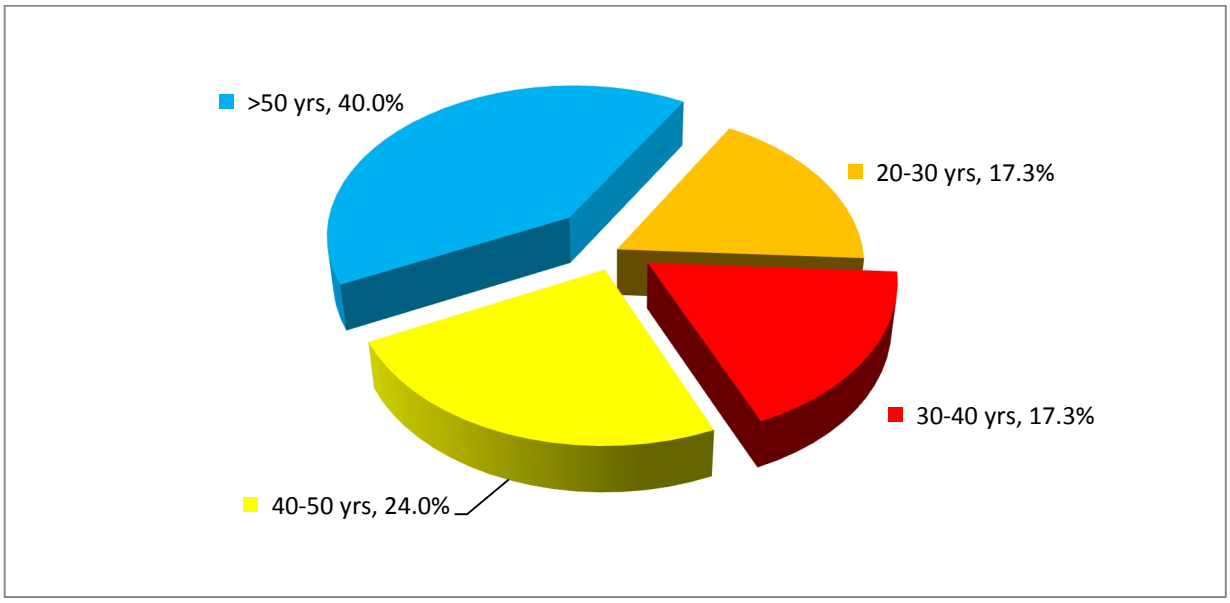
OBSERVATION AND RESULTS

Age Distribution

Table 1

Age group	Frequency	Percent
20-30	13	17.3%
30-40	13	17.3%
40-50	18	24.0%
>50	30	40.0%
Total	75	100.0

Chart 1



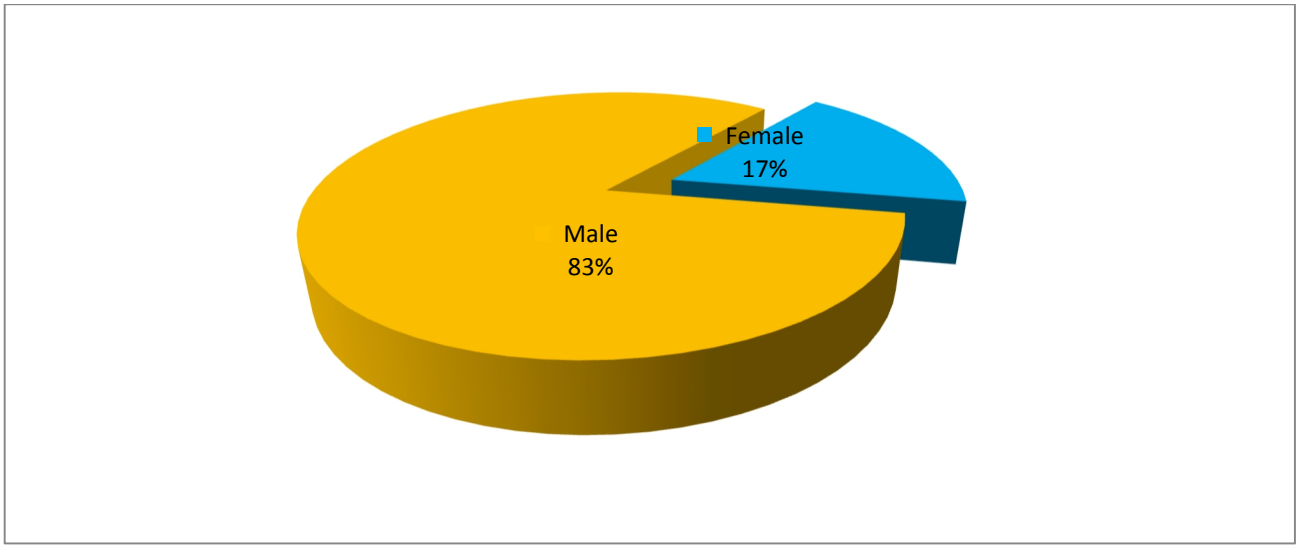
In our study, 40% of the patients were in the age group of more than 50 years.

Gender Distribution

Table 2

Gender	Frequency	Percent
Male	62	82.7%
Female	13	17.3%
Total	75	100.0

Chart 2



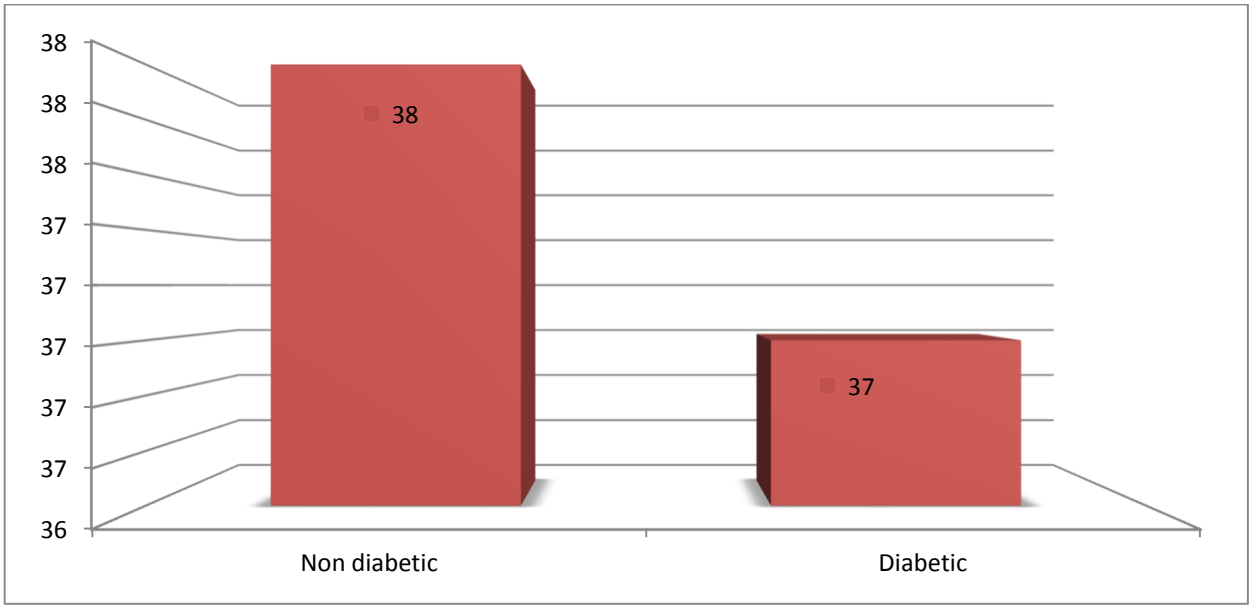
In our study, about 82.7% of the patients were males and 17.3% of the patients were females.

Number of Diabetic Patients

Table 3

Diabetes	Frequency	Percent
Non diabetic	38	50.7%
Diabetic	37	49.3%
Total	75	100.0

Chart 3



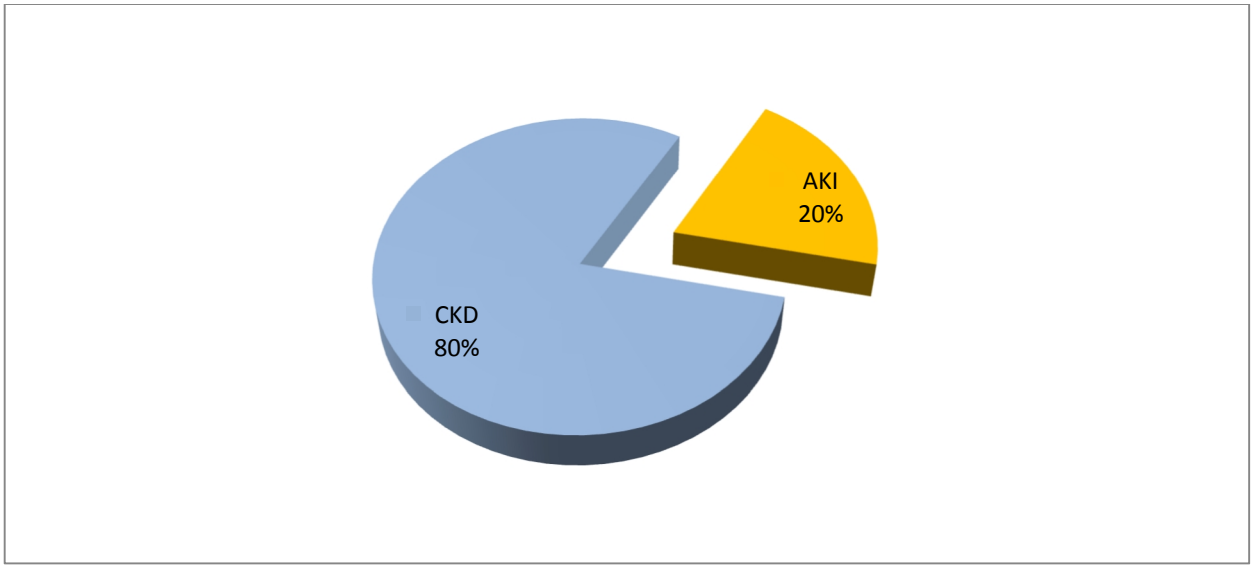
Among the study population, 37 patients were diabetic.

Type of Kidney Disease

Table 4

Type of Kidney disease	Frequency	Percent
AKI	15	20.0%
CKD	60	80.0%
Total	75	100.0

Chart 4



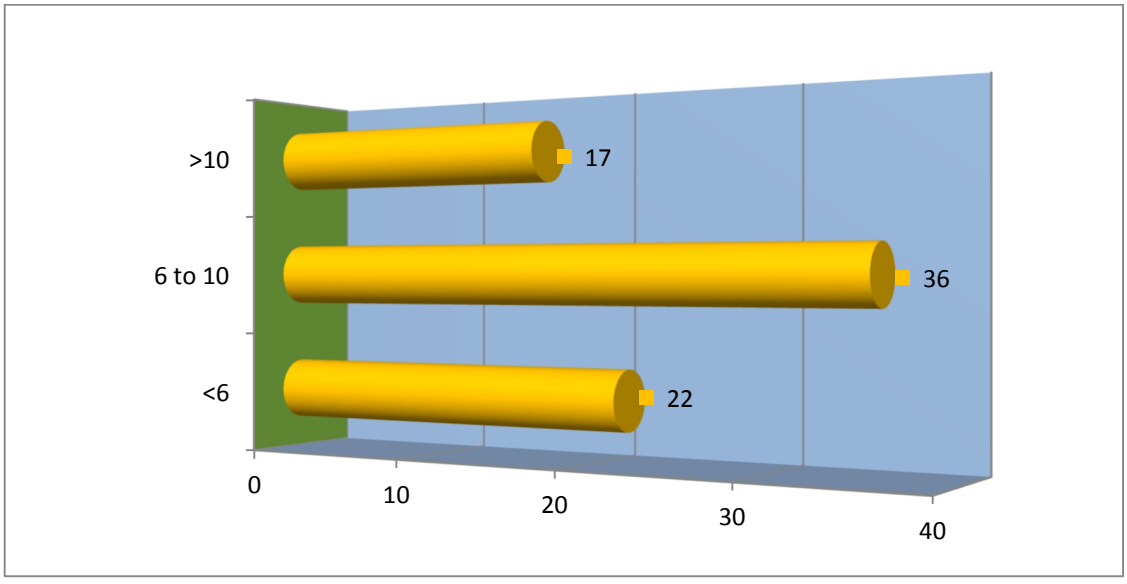
Among 75 patients, 60 patients were suffering from Chronic Kidney disease and 15 patients were suffering from Acute Kidney Injury.

Hemoglobin level among study population

Table 5

Hb	Frequency	Percent
<6	22	29.3%
6 to 10	36	48.0%
>10	17	22.7%
Total	75	100.0

Chart 5



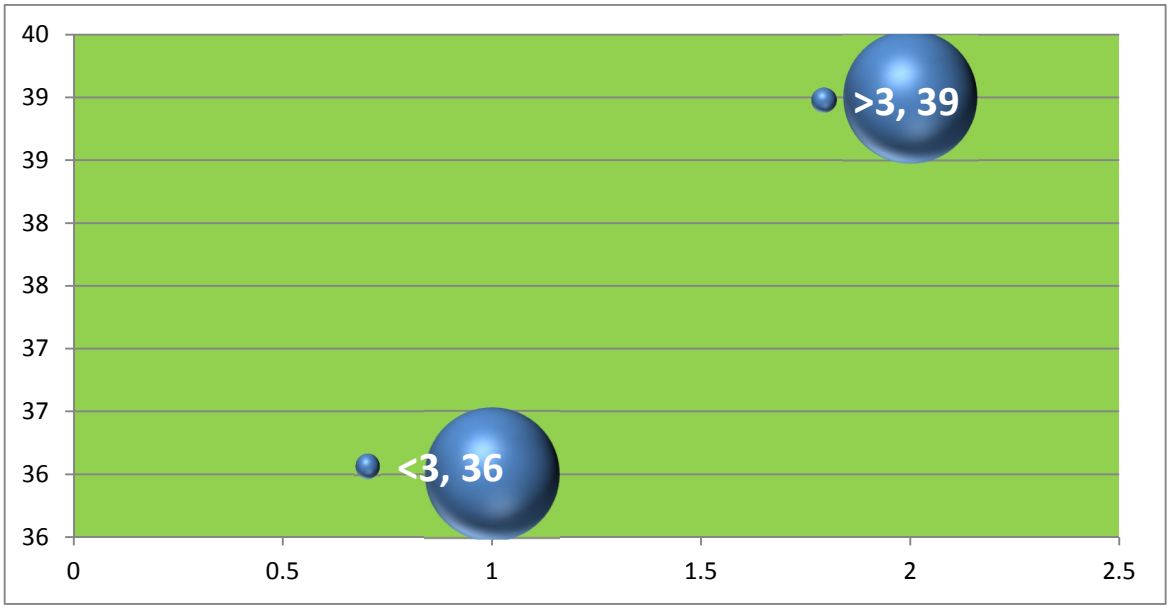
In our study population,22 patients had Hb less than 6; 36 patients had Hb 6 to 10; 17 patients had Hb greater than 10 g/dl.

Albumin level among study population

Table 6

Albumin	Frequency	Percent
<3	36	48.0%
>3	39	52.0%
Total	75	100.0

Chart 6



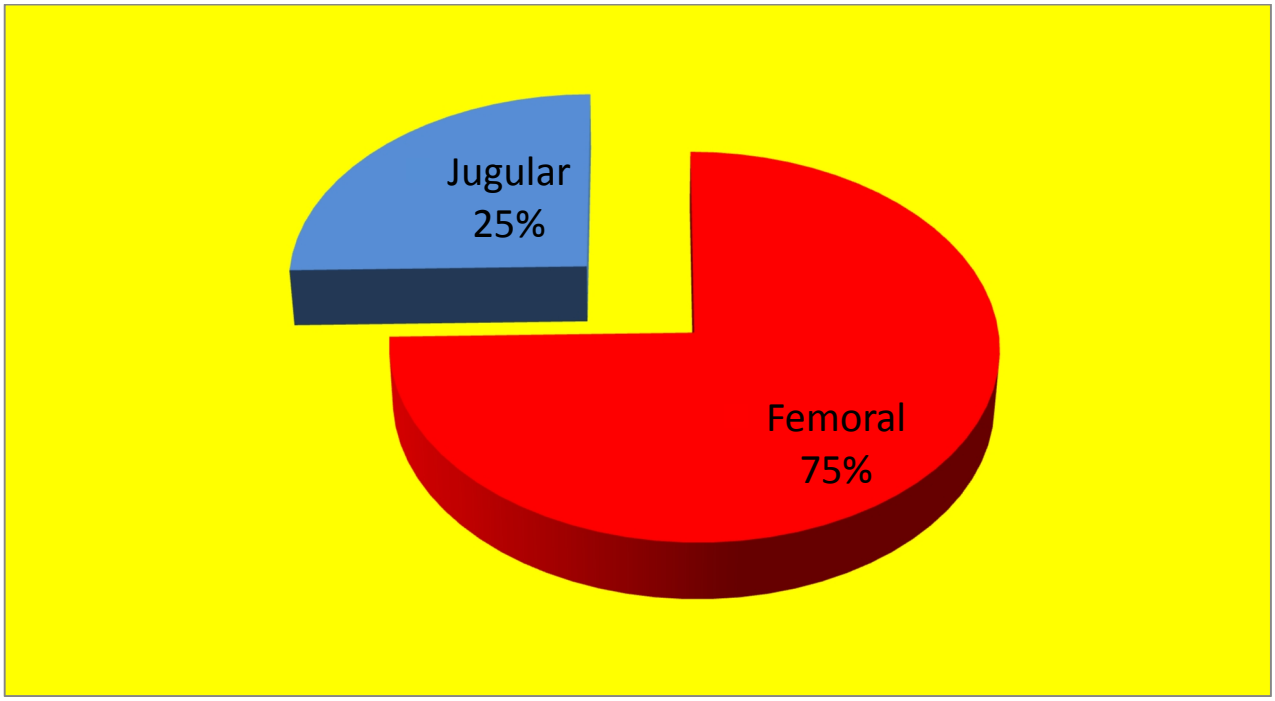
In our study population,36 patients had albumin less than 3 g; 39 patients had albumin more than 3.

Catheter insertion site

Table 7

Catheter site	Frequency	Percent
Femoral	56	74.7%
Jugular	19	25.3%
Total	75	100.0

Chart 7



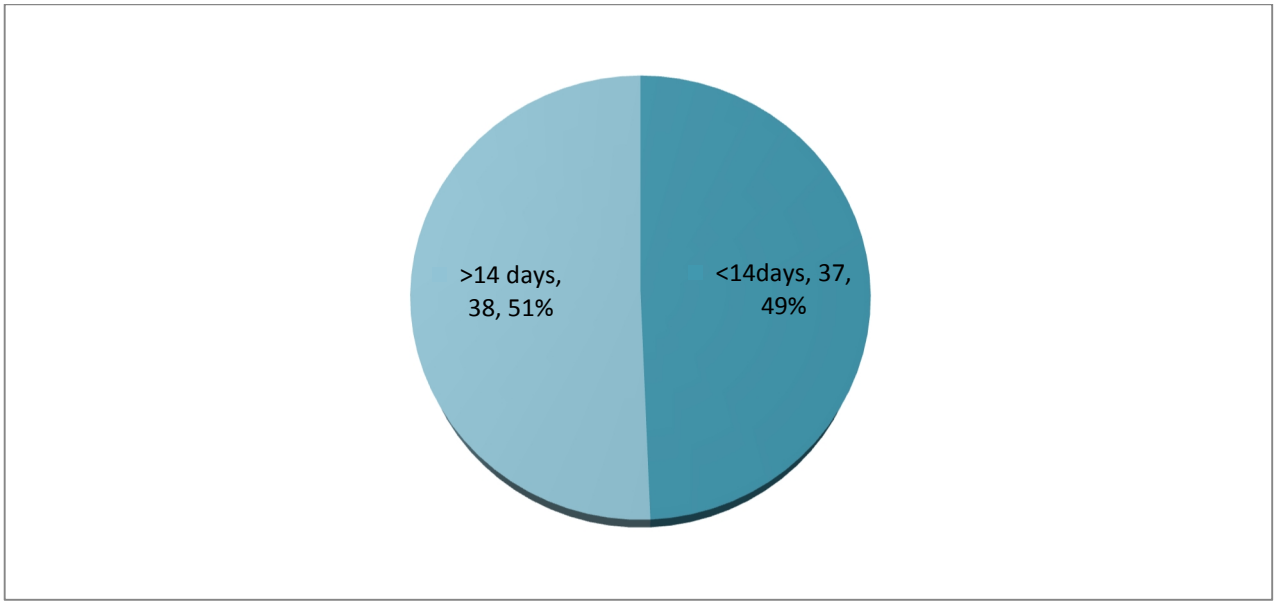
Among 75 patients, 56 had catheter insertion in the jugular vein and 19 patients had catheter insertion in the femoral vein.

Catheter duration

Table 8

Duration of catheter	Frequency	Percent
<14days	37	49.3%
>14 days	38	50.7%
Total	75	100.0

Chart 8



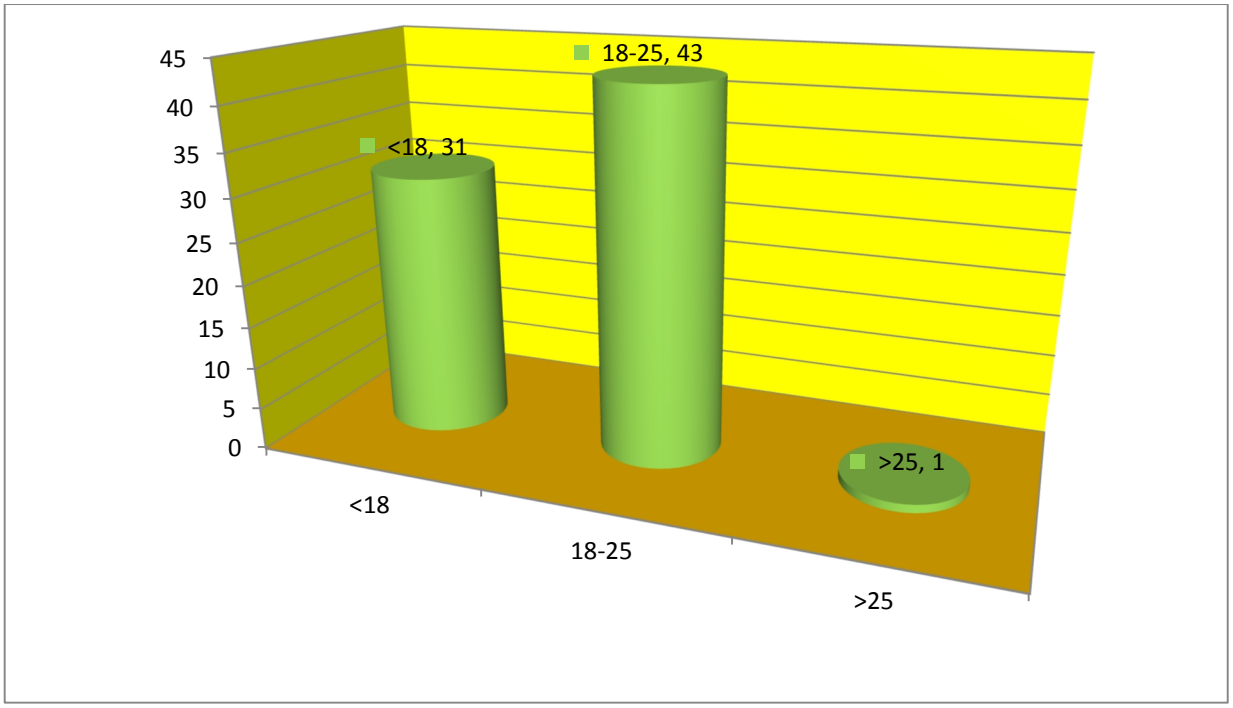
Among 75 patients, 37 patients had central venous catheter for less than 14 days and 38 patients had catheter for more than 14 days.

BMI

Table 9

BMI	Frequency	Percent
<18	31	41.3%
18-25	43	57.3%
>25	1	1.3%
Total	75	100.0

Chart 9



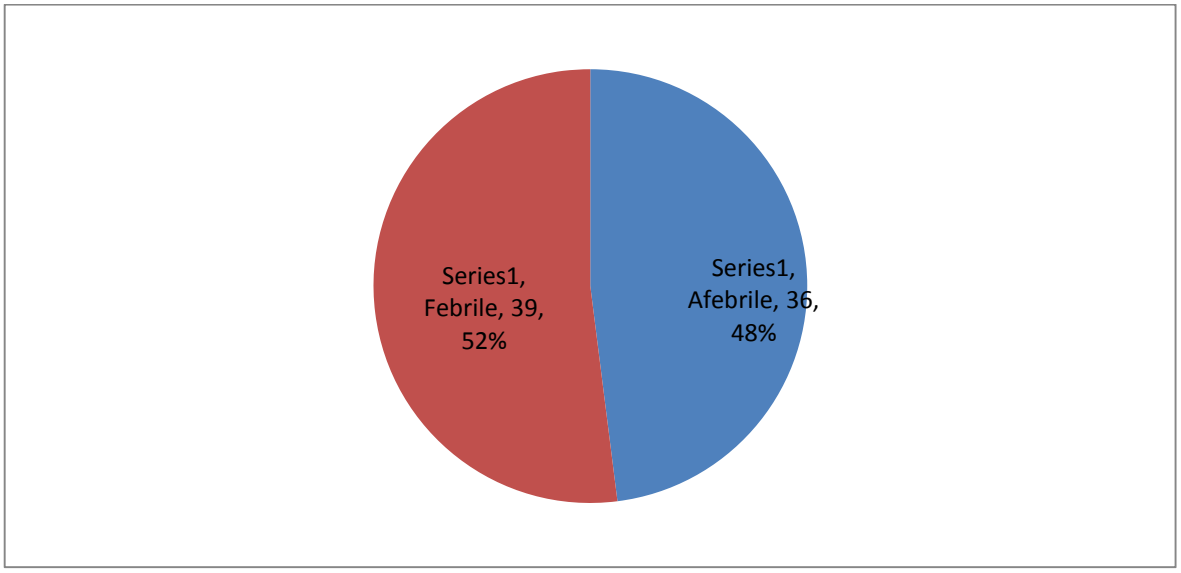
Among our study population, 31 patients had BMI less than 18 and 43 patients had BMI 18 to 25.

Number of fever patients

Table 10

Fever	Frequency	Percent
Afebrile	36	48.0%
Febrile	39	52.0%
Total	75	100.0

Chart 10



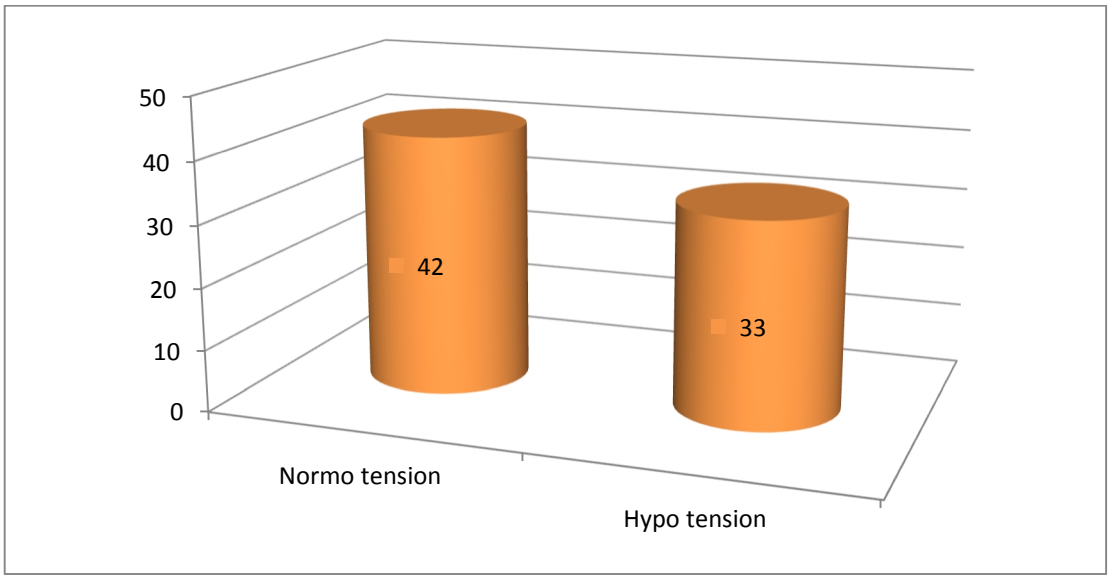
Out of 75 patients with CVCs, 39 patients had fever episodes.

Blood pressure during Hemodialysis

Table 11

Blood Pressure	Frequency	Percentage
Normotension	42	56.0%
Hypotension	33	44.0%
Total	75	100.0

Chart 11



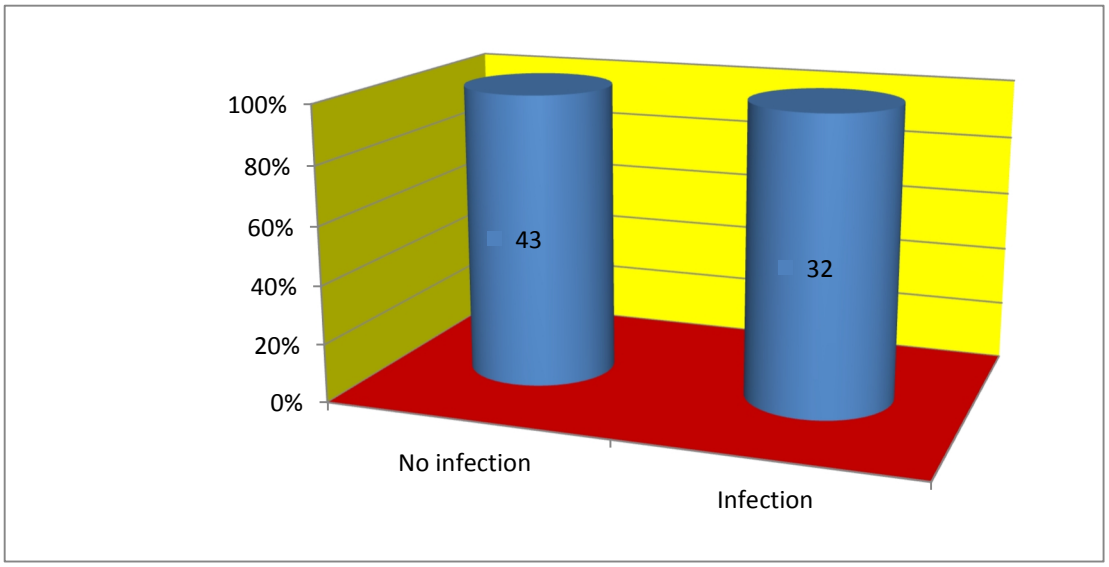
In our study, about 33 patients are hypotensive and about 42 were normotensive.

Catheter site infection

Table 12

Catheter site infection	Frequency	Percent
No infection	43	57.3%
Infection	32	42.7%
Total	75	100.0

Chart 12



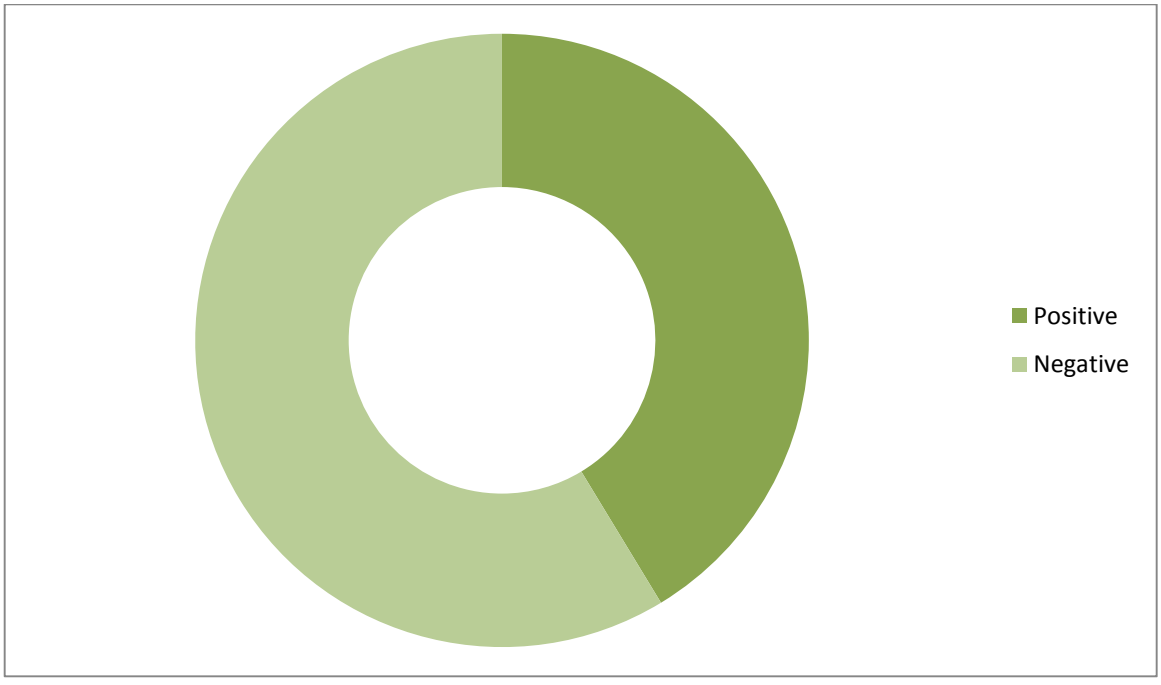
In our study, about 32 patients had local catheter site infection.

Catheter site skin swab culture

Table 13

Culture	**Frequency**	**Percentage**
Positive	31	41.4
Negative	44	58.6
Total	75	100

Chart 13



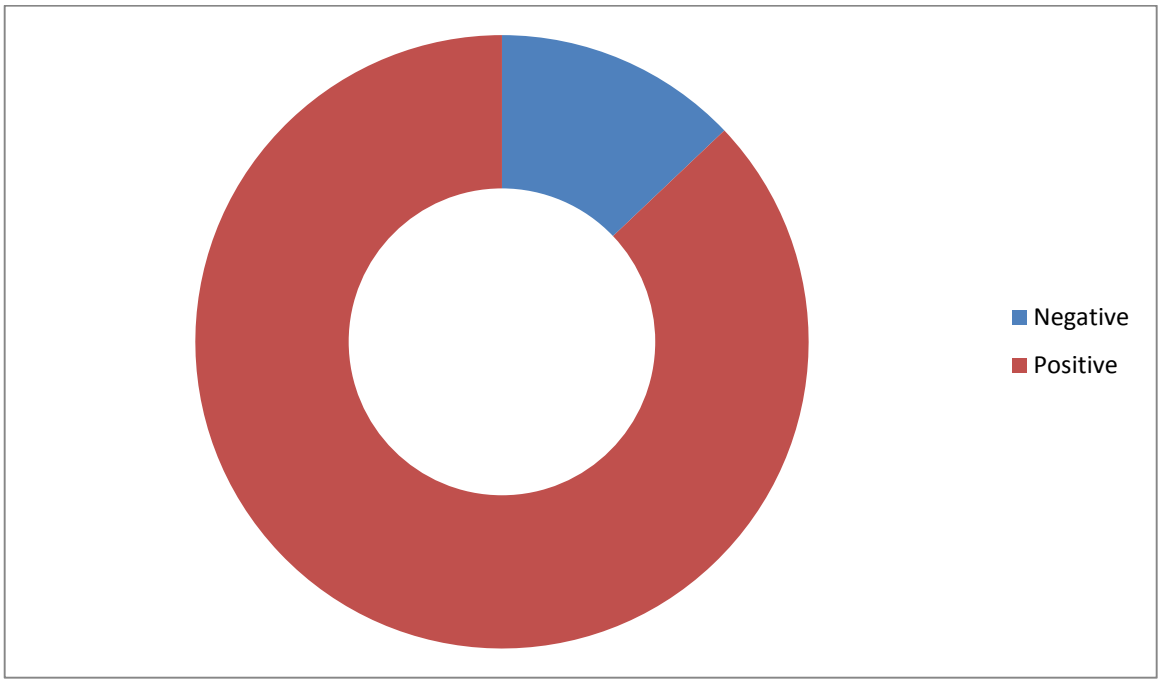
Among 75 patients, 31 patients had catheter site skin swab culture growth.

Type of organism in catheter insertion site

Table 14

Staining	Frequency	Percent
Negative	4	5.3%
Positive	27	36.0%
Total	31	41.3%

Chart 14



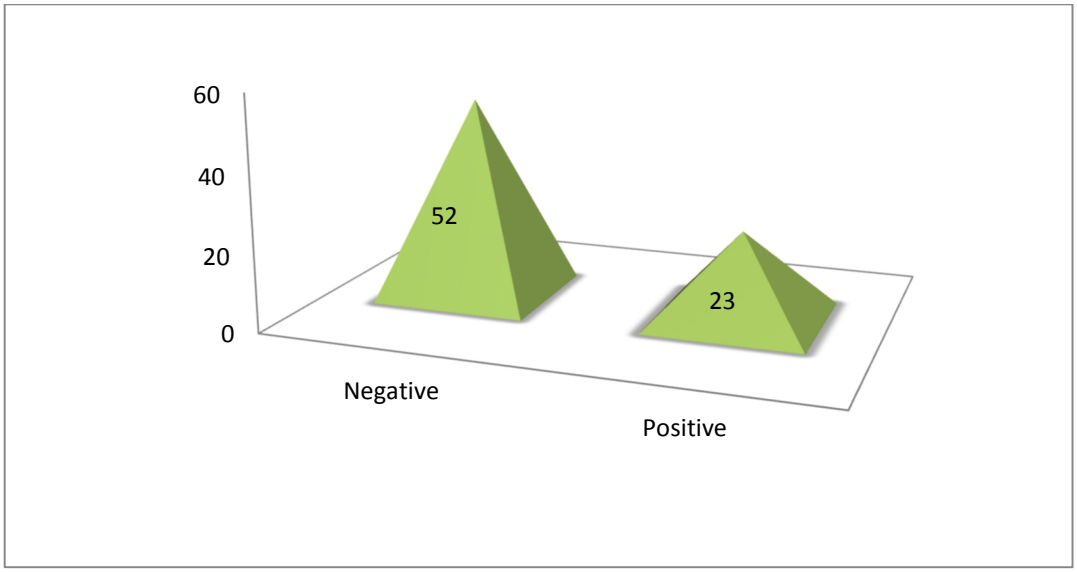
The organism isolated from pericatheter insertion site were mainly Gram positive organisms.

Blood culture

Table 15

Blood culture	Frequency	Percent
Negative	52	69.3%
Positive	23	30.7%
Total	75	100.0

Chart 15



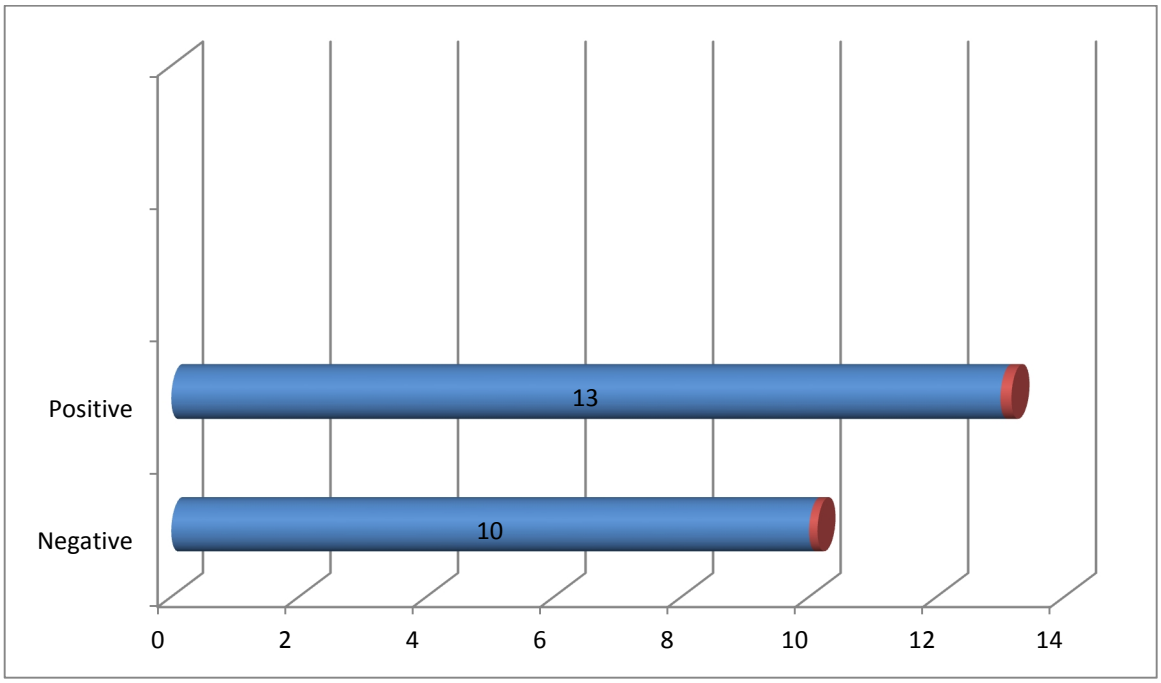
In our study, 23 patients showed growth in the blood culture.

Gram staining in Blood culture

Table 16

Organism staining	Frequency	Percent
Negative	10	13.3%
Positive	13	17.3%
Total	23	30.6%

Chart 16



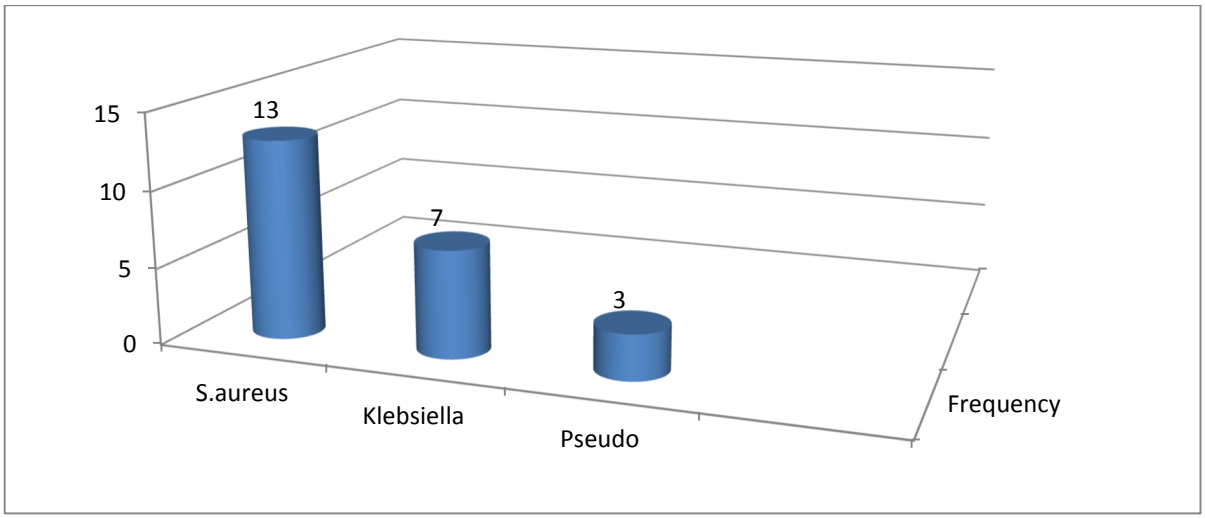
Of 23 patients who were Blood culture positive, 13 patients showed gram positive organism on staining.

Type of Organism

Table 17

Type of organism	Frequency	Percent
S.aureus	13	17.3%
Klebsiella	7	9.31%
Pseudomonas	3	3.99%
Total	23	30.6%

Chart 17



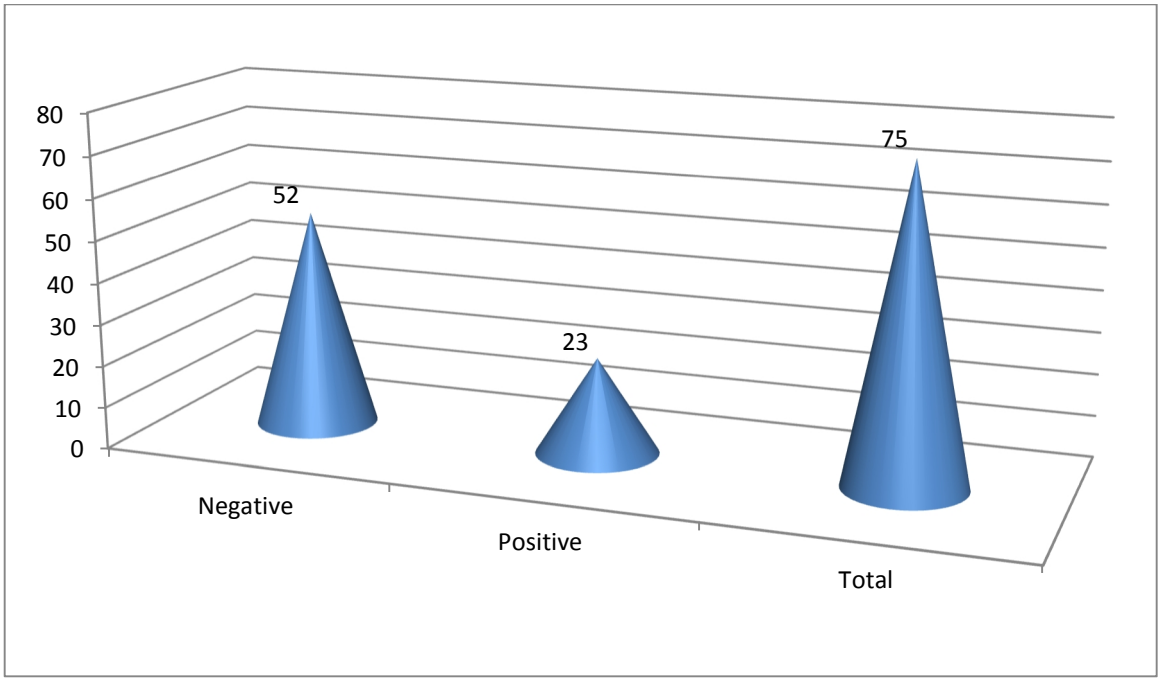
The main organisms isolated were S.aureus (17.3%), Klebsiella (9.31%), and Pseudomonas(3.99%).

Catheter tip culture

Table 18

catheter tip culture	Frequency	Percent
Negative	52	69.3%
Positive	23	30.7%
Total	75	100.0%

Chart 18



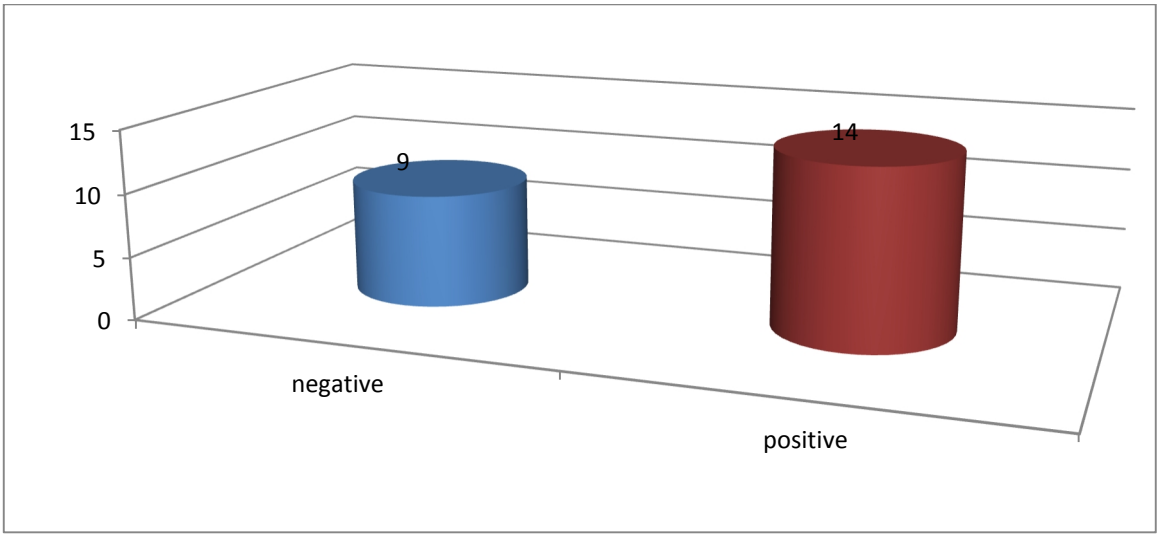
In our study, 23 patients showed growth in the catheter tip culture and remaining 52 showed no growth.

Catheter tip culture gram staining

Table 19

gram stain	Frequency	Percent
negative	9	12.0%
positive	14	18.7%
Total	23	30.7%

Chart 19



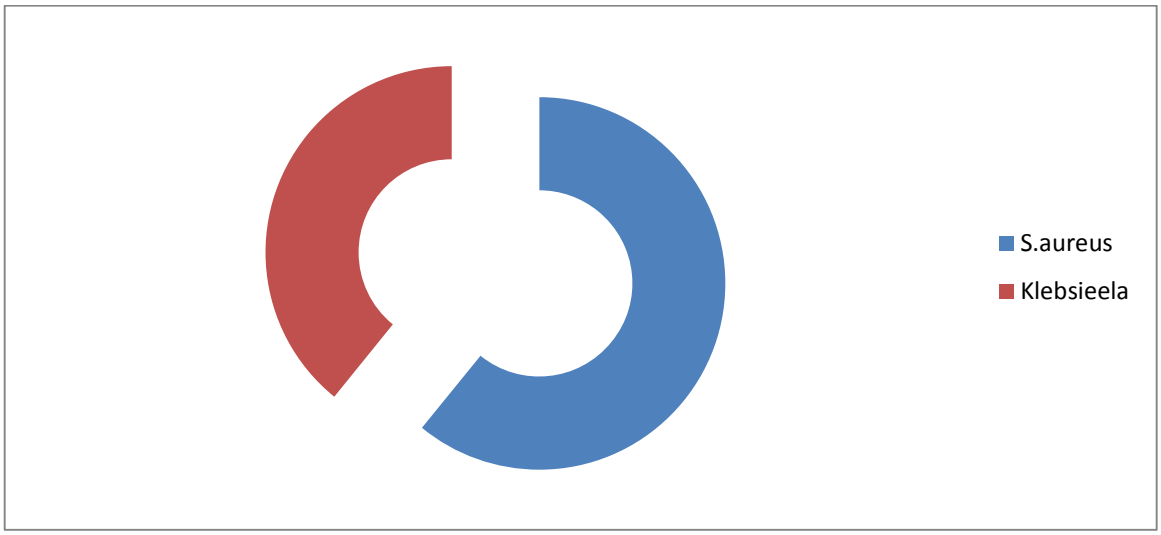
Of 23 patients who were catheter tip culture positive, 14 patients showed gram positive organism on staining.

Type of organism in catheter tip

Table 20

Type of organism	Frequency	Percent
S.aureus	14	18.7%
Klebsieela	9	12.0%
Total	23	30.7%

Chart 20



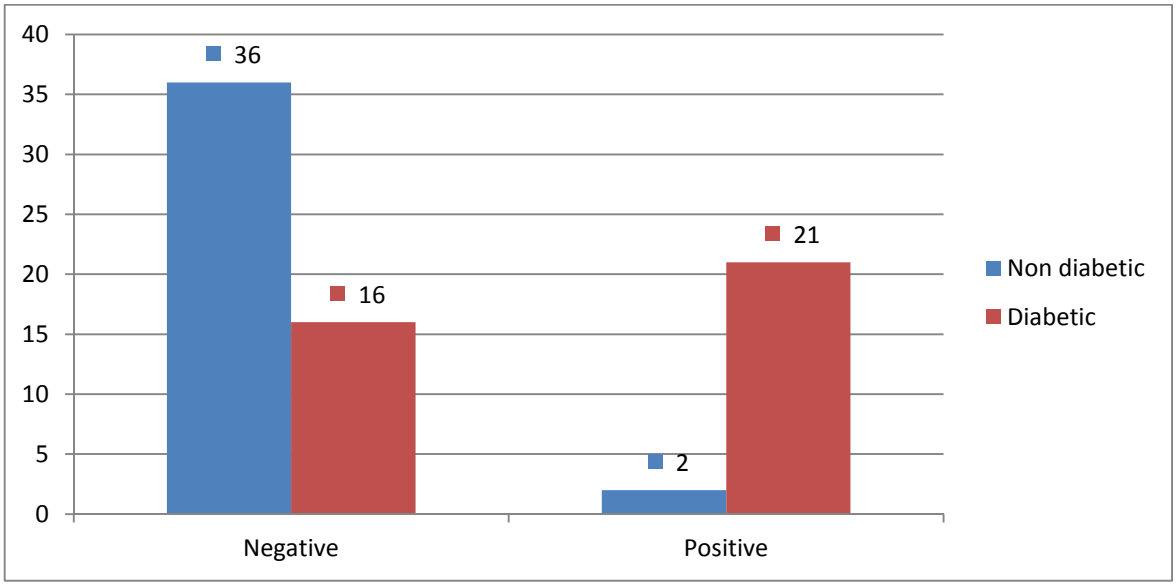
The main organisms isolated were S.aureus (18.7%) ,and Klebsiella (12%)

Association of Diabetes vs. Culture positivity in blood

Table 21

	Blood culture		Total	P value
	Negative	**Positive**		
Non diabetic	36	2	38	
Diabetic	16	21	37	<0.0001
Total	52	23	75	

Chart 21



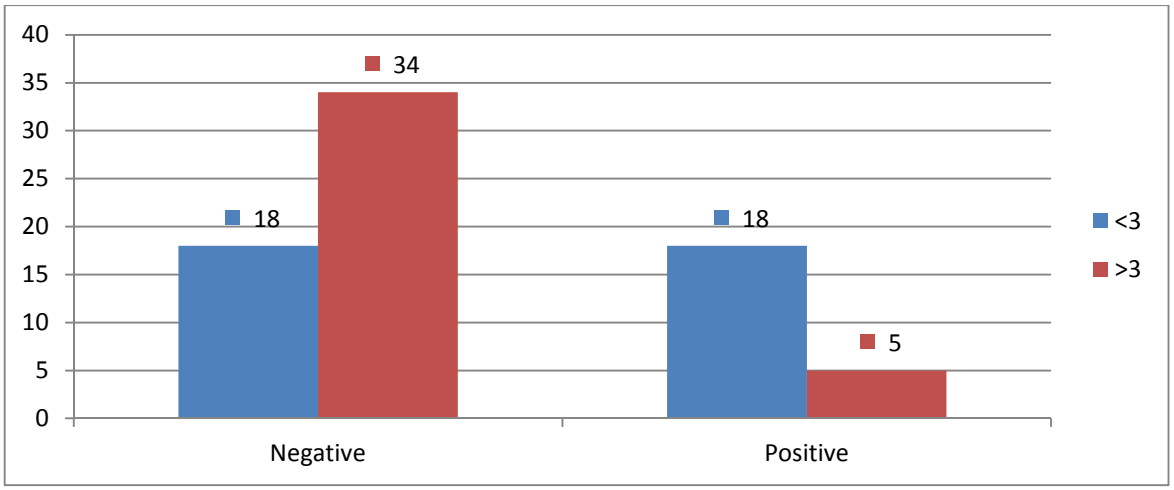
Out of 23 patients who are positive for blood culture, 21 patients were diabetic.(P value=<0.0001). So there is a significant association between Diabetes and blood culture positivity.

Association of Albumin vs. Culture positivity in blood

Table 22

		Blood culture		Total	P value
		Negative	Positive		
Albuminemia	**<3**	18	18	36	
	>3	34	5	39	<0.0001
Total		52	23	75	

Chart 22



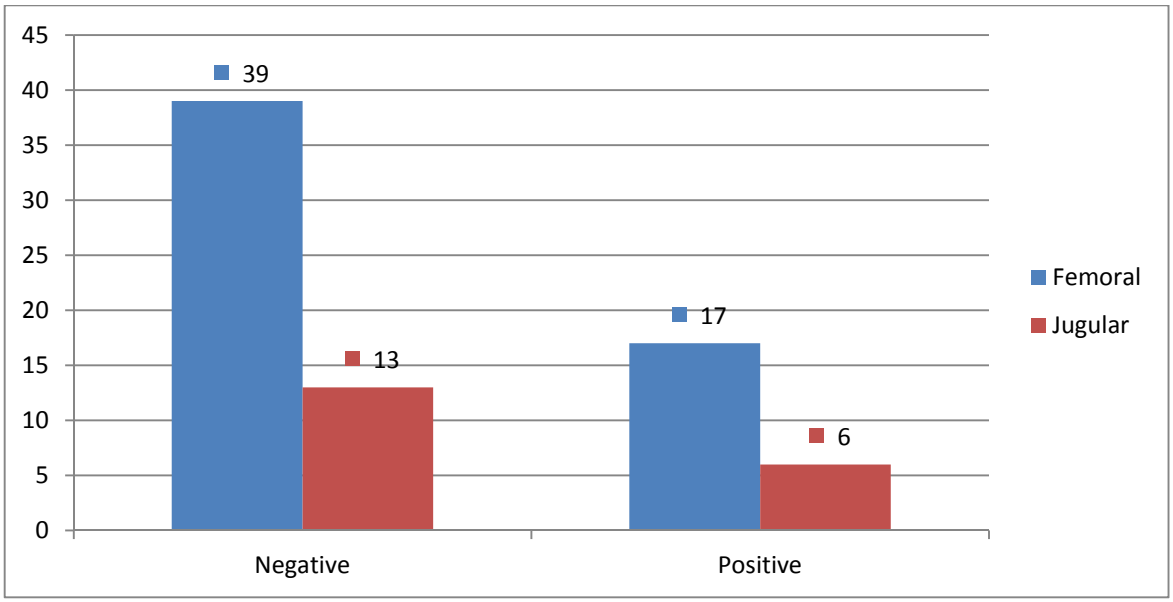
Out of 23 patients who are positive for blood culture, 18 patients were found with serum albumin less than 3.(P value=<0.0001). So there is a significant association between hypoalbuminemia and blood culture positivity.

Association between sites of catheter insertion vs. Culture positivity in blood

Table 23

		Blood culture		Total	P value
		Negative	Positive		
Catheter Type	Femoral	39	17	56	
	Jugular	13	6	19	0.921
Total		52	23	75	

Chart 23



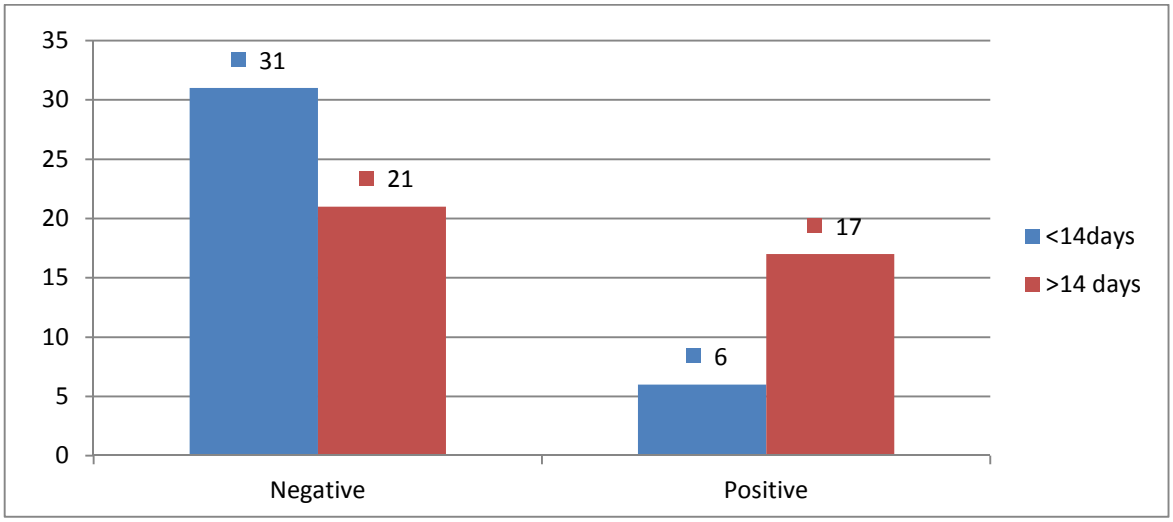
There is no significant association between Catheter site insertiom and blood culture positivity(P value=0.921).

Association between duration of catheter insertion vs. Culture positivity in blood

Table 24

	Blood culture		Total	P value
	Negative	Positive		
Duration of catheter				
<14days	31	6	37	0.007
>14 days	21	17	38	
Total	52	23	75	

Chart 24



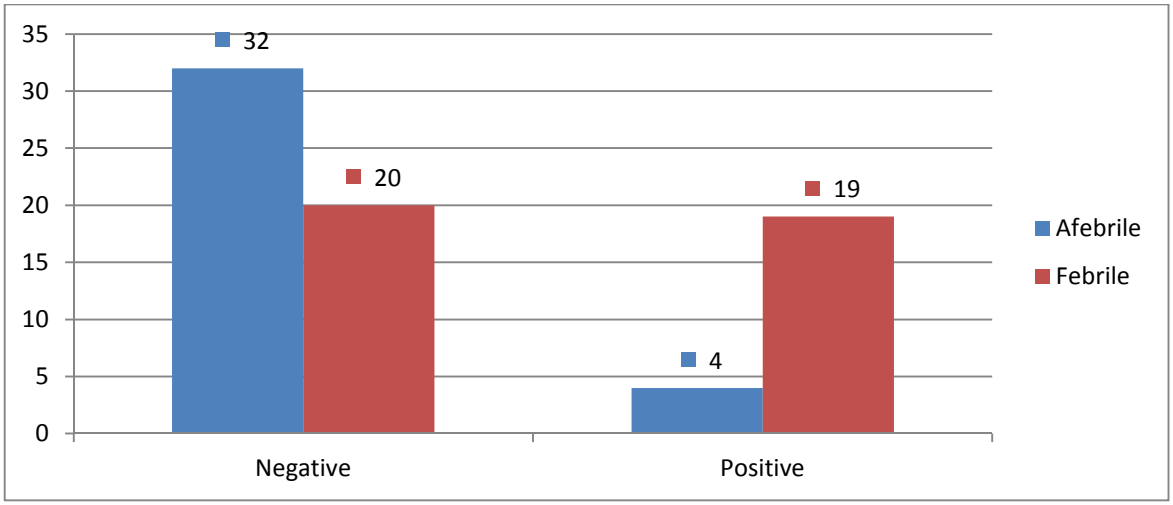
Out of 23 patients who are positive for blood culture, 17 patients had catheter more than 14 days.(P value=<0.007). So there is a significant association between duration of catheter insertion and blood culture positivity.

Association between febrile episodes vs. Culture positivity in blood

Table 25

		Blood culture		Total	P value
		Negative	**Positive**		
Fever	**Afebrile**	32	4	36	
	Febrile	20	19	39	<0.0001
Total		52	23	75	

Chart 25



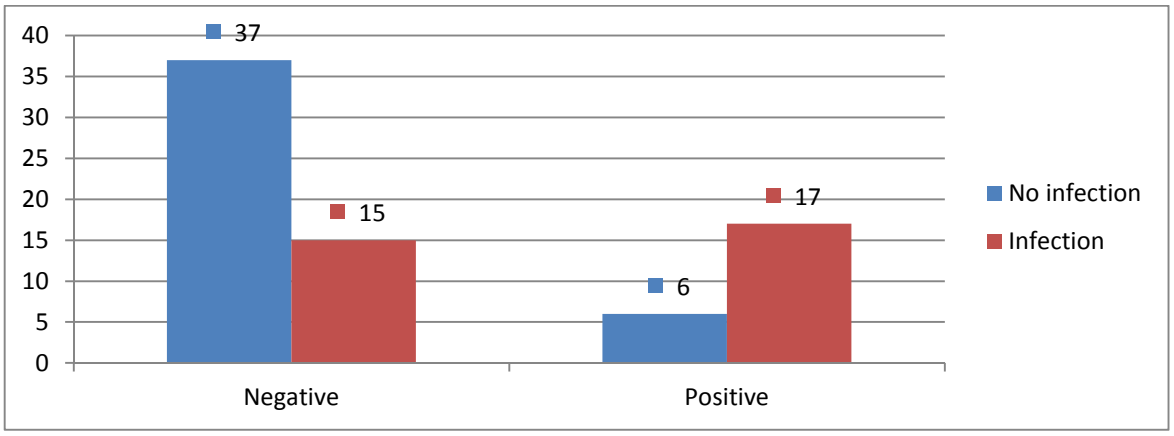
Out of 23 patients who are positive for blood culture, 19 patients had febrile episodes(P value=<0.0001). So there is a significant association between febrile episodes and blood culture positivity.

Association between Catheter site infections vs. Culture positivity in blood

Table 26

		Blood culture		Total	P value
		Negative	Positive		
Catheter site infection	**No**	37	6	43	
	Yes	15	17	32	<0.001
Total		52	23	75	

Chart 26



Out of 23 patients who are positive for blood culture, 17 patients had catheter infection in the catheter site.(P value=<0.001). So there is a significant association between catheter site infection and blood culture positivity.

DISCUSSION

Haemodialysis catheter related infection is the major cause of mortality and morbidity in haemodialysis. Identification of risk factors help in preventing the catheter related infection (suzan sanavi et al). To identify the predisposing factors, we studied 75 patients out of which 82.7% are male and 37 patients had comorbidities like diabetes.

Among 75 patients 60 patients had chronic kidney disease as the indication for dialysis. Regarding the type of venous access , 56 patients had femoral vein catheterization and 19 patients had jugular venous access.38 patients had catheter duration of more than 14 days.

Out of 75 patients ,febrile episodes occurred in 39 patients and hypotension in 33 individuals. Local catheter site infection occurred in 32 patients and swab culture from catheter site showed growth in 31 patients.

Blood culture from both central venous access site and peripheral vein showed growth of bacteria in 23 patients .The most common organism isolated from the blood culture was gram positive staphylococcus aureus(17.3%) followed by klebsiella (9.37%) and pseudomonas(3.99%).

Culture of the catheter tip by semi quantitative method showed growth in 23 patients , among them the common organisms are gram positive. From

our study ,we come to a conclusion that there is no significant association between the site of catheter insertion and catheter related blood steam infection in contrast to Lemaire et al .

Out of 23 patients who are positive for blood culture, 17 patients had catheter infection in the catheter site.(P value=<0.001). So there is a significant association between catheter site infection and blood culture positivity.

Among 23 patients who are positive for blood culture, 19 patients had febrile episodes(P value=<0.0001). So there is a significant association between febrile episodes and blood culture positivity.

Out of 23 patients who are positive for blood culture, 17 patients had catheter more than 14 days.(P value=<0.007). So there is a significant association between duration of catheter insertion and blood culture positivity.

Among 23 patients who are positive for blood culture, 18 patients were found with serum albumin less than 3.(P value=<0.0001). So there is a significant association between hypoalbuminemia and blood culture positivity.

Out of 23 patients who are positive for blood culture, 21 patients were diabetic.(P value=<0.0001). So there is a significant association between Diabetes and blood culture positivity.

From our study we concluded that, Patients with diabetes and hypoalbuminemia ,prolonged duration of catheter ,local catheter site infection, and patients with febrile episodes during the haemodialysis has significant association with the blood culture positivity compared to previous studies. Catheter related infection and blood stream infection during haemodialysis is more with patients in Diabetes, malnutrition,and prolonged duration of catheter

CONCLUSION

Out of 75 patients who were randomnly selected based on the inclusion and exclusion criterias, the following results were observed,

Blood culture positivity was observed in 23 patients out of 75 patients who had central venous catheter for haemodialysis (30.7% incidence). The incidence of catheter related infection and blood stream infection is 30.7%. The most common organism isolated was Gram positive organisms mainly Staphylococcus aureus followed by Gram negative organisms Klebsiella. Catheter related infection and catheter related blood stream related infections showed significant association with the diabetes, hypoalbuminemia, local catheter site infection and prolonged duration of catheterization

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PROFORMA

1.name

2.age 3.sex

4.Diabetes yes/no

5.type of kidney disease CKD /AKI

6.Site of catheter insertion jugular/ femoral

7.duration of catheter

8.clinical symptoms during dialysis fever and chills yes/no

Hypotension yes/no

Altered sensorium yes/no

Malaise yes/no

9.local catheter site induration/swelling/pus discharge

10.culture from pericatheter site :

11. type of organism gram positive/gram negative

12.blood culture from the venous access growth :positive/negstive

13 gram staining of organism from blood culture: gram positive/gram negative

14 organism isolated from blood culture:

15 catheter tip culture: positive /negative

16.organism from catheter tip :gram positive/gram negative

17.organism isolated from catheter tip culture:

18. inv : total count :

Hb:

Total serum protein:

Serum albumin:

Sl. NO.	Name	Age	Sex	Diabetes	CKD	AKI	HB	Albumin	Catheter Type	Duration of Cath	BMI	Fever / Chills	Hypotension	Local cath site infection	Blood Culture	Organism-gram stain	Specific organism	Pericatheterswab gram stain	Specificorganism	Catheter Tip Culture	Organism-gram stain	Specific organism
1	Murugan	>50	M	Y	Y		<6	<3	Jugular	<14	<18	Y	Y	Y	Posi (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
2	Pattathi	>50	M	Y	Y		6-10	<3	Femoral	>14	<18	Y	Y	Y	Posi (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
3	Mugesh	20-30	M	N		Y	>10	>3	Femoral	>14	18-25	N	N	N	Neg							
4	Vairamuthu	>50	M	Y	Y		6-10	<3	Femoral	>14	18-25	Y	Y	Y	Posi (C+P)	Negative	Klebsieela	Positive	S.aureus	Negative	Negative	Klebsieela
5	Sathiyaraj	20-30	M	N		Y	>10	>3	Femoral	>14	18-25	N	N	N	Neg							
6	Sudalaimuthu	>50	M	Y	Y		>6	<3	Femoral	>14	<18.5	Y	N	N	Neg							
7	Vinothkumar	20-30	M	N		Y	>10	>3	Jugular	<14	18-25	N	N	N	Neg							
8	Chinapadi	30-40	M	N	Y		>10	>3	Femoral	<14	18-25	N	N	N	Neg							
9	Mariammal	>50	F	Y	Y		6-10	<3	Femoral	<14	18-25	N	N	N	Neg							
10	Chinnapandi	30-40	M	N	Y		6-10	>3	Femoral	<14	18-25	N	N	N	Neg							
11	Karthick	20-30	M	N	Y		>10	>3	Femoral	<14	18-25	Y	Y	Y	Posi (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
12	Arumugan	30-40	M	Y		Y	>10	>3	Femoral	<14	18-25	Y	Y	Y	Posi (C+P)	Negative	Klebsieela	Negative	K.seill	Positive	Negative	Klebsieela
13	Joseph	>50	M	Y	Y		<6	<3	Femoral	>14	>25	N	Y	N	Posi (C+P)	Negative	Klebsieela	Negative	Klbeslella	Positive	Negative	Klebsieela
14	Selvam	>50	M	Y	Y		6-10	>3	Jugular	>14	18-25	N	N	N	Neg							
15	Murugan	>50	M	N	Y		6-10	>3	Jugular	>14	18-25	N	N	N	Neg							
16	Kannan	>50	M	Y	Y		6-10	>3	Femoral	>14	18-25	N	N	Y	Neg			Positive	S.aureus	-	-	-
17	Velusamy	>50	M	N	Y		6-10	>3	Femoral	>14	18-25	N	N	Y	Neg			Positive	S.aureus	-	-	-
18	Kathiresan	>50	M	Y	Y		<6	<3	Jugular	>14	<18	N	N	N	Posi (C+P)	Negative	Klebsieela			Positive	Negative	Klebsieela
19	Manikandan	20-30	M	N		Y	6-10	>3	Femoral	>14	18-25	N	N	N	Neg							
20	Paulthai	40-50	F	Y	Y		6-10	>3	Femoral	>14	18-25	N	N	N	Neg (C+P)							
21	Padma	>50	F	Y	Y		<6	<3	Femoral	<14	<18	Y	Y	N	Pos (C+P)	Positive	S.aureus			Positive	Positive	S.aureus
22	Jananeshan	30-40	M	N	Y		6-10	>3	Femoral	<14	18-25	N	N	N	Nega							
23	Vinoth	20-30	M	N		Y	>10	>3	Jugular	<14	18-25	N	N	N	Nega							
24	Kalangaray	>50	M	Y	Y		6-10	<3	Femoral	<14	<18	N	N	Y	Nega					-	-	-
25	Saravanaraj	20-30	M	N		Y	>10	>3	Jugular	<14	18-25	N	N	N	Nega							
26	Lakshmanan	>50	M	N	Y		>10	>3	Femoral	<14	18-25	N	N	N	Nega							
27	Kumar	20-30	M	N		Y	>10	>3	Jugular	<14	18-25	N	N	N	Nega							
28	Sakthivel	20-30	M	N		Y	>10	>3	Jugular	<14	18-25	N	N	N	Nega							
29	Selvaganesh	40-50	M	N	Y		6-10	>3	Femoral	<14	<18	Y	Y	N	Nega							
30	Mariyaselvam	30-40	M	N	Y		6-10	<3	Femoral	<14	18-25	Y	Y	Y	Nega							
31	Subaish	40-50	M	N	Y		6-10	<3	Femoral	<14	18-25	N	N	N	Nega							
32	Ramrajan	40-50	M	N	Y		6-10	>3	Femoral	<14	18-25	N	N	N	Nega							
33	Iruthyaselvi	40-50	F	Y	Y		<6	<3	Jugular	>14	<18	Y	Y	Y	Posit (C+P)	Negative	Pseudo	Negative	Klbeslella	Positive	Negative	Klebsieela
34	Ramraj	30-40	M	N	Y		6-10	>3	Femoral	>14	<18	Y	Y	N	Nega							
35	Kaleeswari	26-30	F	N		Y	>10	>3	Femoral	<14	18-25	Y	N	N	Neg							
36	Anbu	30-40	M	N		Y	>10	>3	Femoral	<14	18-25	Y	N	Y	Neg			Positive	S.aureus			
37	Moses	20-30	M	N	Y		>10	>3	Femoral	<14	18-25	Y	Y	N	Neg							
38	Akbar	20-30	M	N	Y		>10	>3	Femoral	<14	18-25	Y	Y	N	Neg							
39	Dharmendra	30-40	M	N	Y		>10	>3	Femoral	>14	18-25	N	N	N	Neg							
40	Hanifa	40-50	M	N	Y		>10	<3	Femoral	>14	18-25	N	N	N	Neg							

Sl. NO.	Name	Age	Sex	Diabetes	CKD	AKI	HB	Albumin	Catheter Type	Duration of Cath	BMI	Fever / Chills	Hypotension	Local cath site infection	Blood Culture	Organism-gram stain	Specific organism	Pericatheterswab gram stain	Specificorganism	Catheter Tip Culture	Organism-gram stain	Specific organism
41	Esakki	>50	F	Y	Y		<6	<3	Femoral	>14	<18	Y	Y	Y	Pos (C+P)	Negative	Pseudo	Positive	S.aureus	Positive	Negative	Klebsieela
42	Amutha	>50	F	Y	Y		<6	>3	Jugular	>14	<18	Y	Y	Y	Pos (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
43	Alaguraj	40-50	M	N	Y		6-10	>3	Femoral	<14	18-25	N	N	N	Neg							
44	Ramachandran	40-50	M	Y	Y		6-10	>3	Femoral	<14	18-25	Y	N	Y	Neg							
45	John	>50	M	Y	Y		<6	<3	Femoral	<14	<18	Y	Y	Y	Pos (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
46	Muthukumar	>50	M	Y	Y		6-10	<3	Femoral	<14	<18	Y	Y	N	Neg							
47	Balammal	>50	F	Y	Y		6-10	>3	Femoral	>14	18-25	N	N	N	Neg							
48	Pooraiah	>50	M	Y	Y		<6	<3	Femoral	>14	<18	Y	Y	Y	Pos (C+P)					Positive	Negative	Klebsieela
49	Manthramoorthy	>50	M	Y	Y		<6	<3	Femoral	>14	<18	Y	Y	Y	Pos (C+P)	Negative	Klebsieela	Positive	S.aureus	Positive	Negative	Klebsieela
50	Chinnathai	40-50	F	Y	Y		6-10	>3	Femoral	<14	18-25	N	N	Y	Neg (C+P)			Positive	S.aureus			
51	Murugan	40-50	M	Y	Y		<6	<3	Jugular	>14	<18	Y	N	Y	Pos (C+P)	Negative	Pseudo	Negative	pseudomone	Positive	Negative	Klebsieela
52	Balu	40-50	M	Y	Y		<6	<3	Femoral	>14	<18	Y	Y	Y	Neg							
53	Kalimuthu	30-40	M	N		Y	6-10	>3	Femoral	<14	18-25	Y	N	N	Neg							
54	Aruna	30-40	F	Y	Y		6-10	>3	Femoral	<14	18-25	Y	Y	N	Neg							
55	Naveenthan	>50	M	Y	Y		6-10	>3	Femoral	<14	<18	Y	Y	Y	Neg			positive	S.aureus			
56	Karunanthi	30-40	M	Y	Y		<6	<3	Jugular	>14	<18	N	N	Y	Pos (C+P)	Negative	Klebsieela	Positive	S.aureus	Positive	Positive	S.aureus
57	Lawrence	20-30	M	N		Y	6-10	>3	Jugular	>14	18-25	N	N	N	Neg							
58	Palani	>50	M	Y	Y		<6	<3	Femoral	>14	<18	Y	N	N	Pos (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
59	Sudalaimani	40-50	M	N	Y		6-10	<3	Femoral	>14	<18	Y	Y	Y	Neg							
60	Sankaranainar	>50	M	Y	Y		<6	<3	Femoral	>14	<18	N	N	Y	Pos (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
61	Ramar	>50	M	Y	Y		6-10	>3	Femoral	<14	<18	Y	Y	Y	Pos (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
62	Mundan	40-50	M	Y	Y		6-10	<3	Femoral	<14	18-25	Y	Y	N	Neg			Positive	s.aureus			
63	Gurusamy	>50	M	Y	Y		<6	<3	Femoral	>14	<18	Y	Y	N	Pos (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
64	Gopalakrishnan	40-50	M	N		Y	6-10	>3	Femoral	>14	18-25	Y	Y	Y	Pos (C+P)	Positive	S.aureus	Positive	S.aureus	Positive	Positive	S.aureus
65	Pandiyan	40-50	M	Y	Y		6-10	<3	Femoral	>14	<18	Y	Y	Y	Pos (C+P)	Positive	S.aureus	Positive	S. aureus	Positive	Positive	S.aureus
66	Rubeela	>50	F	Y		Y	<6	<3	Femoral	>14	<18	Y	Y	N	Pos (C+P)	Positive	S.aureus	Positive	s.aureus	Positive	Positive	S.aureus
67	Daisy	>50	F	N	Y		6-10	<3	Jugular	>14	18-25	N	N	N	Neg							
68	Marimuthu	40-50	M	N	Y		6-10	>3	Femoral	>14	18-255	Y	Y	N	Neg							
69	Madasamy	40-50	M	N	Y		<6	<3	Jugular	<14	18-25	N	N	Y	Neg			Positive	S.aureus			
70	Pandiyan	40-50	M	N	Y		<6	<3	Jugular	<14	18-25	N	N	Y	Neg			Positive	S.aureus			
71	Romalaush	20-30	M	N	Y		<6	<3	Jugular	>14	<18	N	N	N	Neg							
72	Sankaran	30-40	M	N	Y		6-10	<3	Femoral	>14	<18	N	N	Y	Neg			Positive	S.aureus			
73	Rubeela	30-40	F	N	Y		6-10	<3	Jugular	<14	<18	Y	Y	N	Neg							
74	Balamurugan	>50	M	Y	Y		<6	<3	Femoral	<14	<18	Y	Y	Y	Neg			Positive	S.aureus			
75	Gokul	>50	M	Y	Y		<6	<3	Femoral	>14	<18	Y	Y	Y	Neg			Positive	S.aureus			