EVALUATION OF RISK FACTORS FOR ACUTE MECHANICAL COMPLICATIONS FOLLOWING CENTRAL VENOUS CATHETER INSERTION IN PATIENTS ADMITTED TO A TERTIARY CARE CENTER IN SOUTH INDIA – OBSERVATIONAL STUDY

A dissertation submitted in partial fulfilment of

M.D. (General Medicine) branch-I Examination of the Tamil Nadu

Dr. M.G.R. University, Chennai

to be held in 2018

DECLARATION:

I, Dr. Vineeth Varghese Thomas hereby declare that the dissertation entitled 'EVALUATION OF RISK FACTORS FOR ACUTE MECHANICAL COMPLICATIONS FOLLOWING CENTRAL VENOUS CATHETER INSERTION IN PATIENTS ADMITTED TO A TERTIARY CARE CENTER IN SOUTH INDIA – OBSERVATIONAL STUDY' is a bonafide original work done by me, towards the M.D. Branch-I (General Medicine) Degree Examination of the Tamil Nadu Dr. M.G.R. University, Chennai to be conducted in 2018

Signature:

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CERTIFICATE:

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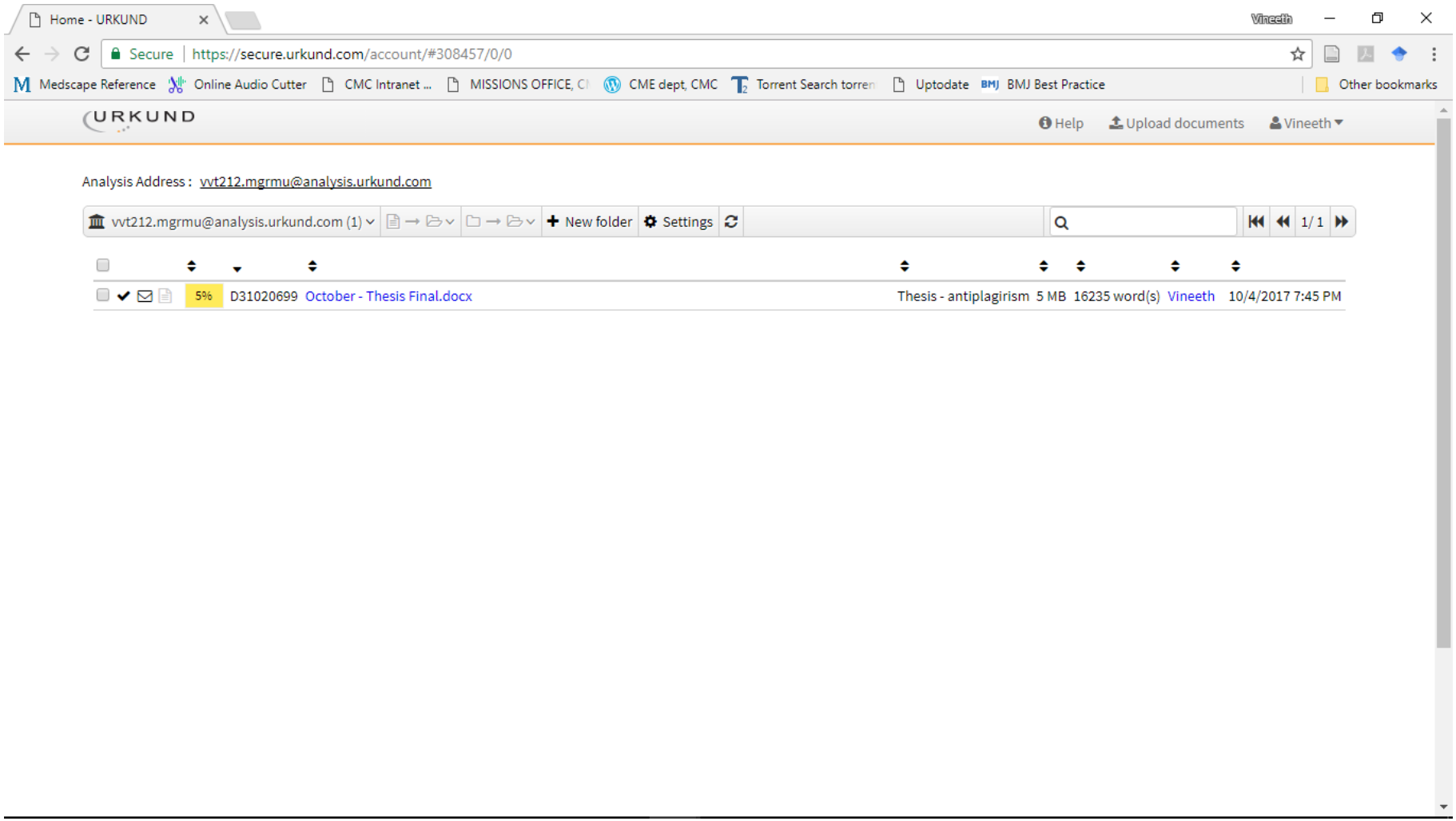
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Evaluation of risk factors for acute mechanical complications following central venous catheter insertion in patients admitted to a tertiary care centre in south India - Observational Study.

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Dear Dr Vineeth Varghese Thomas,

I enclose the following documents:-

1. Institutional Review Board approval 2. Agreement

Could you please sign the agreement and send it to Dr. Biju George, Addl. Vice Principal (Research), so that the grant money can be released.

With best wishes,

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

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Dear Dr. Vineeth Varghese Thomas,

The Institutional Review Board (Blue, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project titled "Evaluation of risk factors for acute mechanical complications following central venous catheter insertion in patients admitted to a tertiary care centre in south India - Observational Study" on April 04 2016.

The Committee reviewed the following documents:

1. IRB Application format
2. Data Collection Form
3. Consent Form (English, Tamil)
4. Curriculum Vitae of Drs. Alice, Peter, Ramya, Soumya, Tina, Vignesh Prasad and Vineeth.
5. No. of documents 1 - 4.

The following Institutional Review Board (Blue, Research & Ethics Committee) members were present at the meeting held on April 04th 2016 in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore - 632002.

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Dr. Ratna Prabha	MBBS, MD (Pharma)	Associate Professor, Clinical Pharmacology, CMC, Vellore	Internal, Pharmacologist

We approve the project to be conducted as presented.

Kindly provide the total number of patients enrolled in your study and the total number of with drawals for the study entitled: "Evaluation of risk factors for acute mechanical complications following central venous catheter insertion in patients admitted to a tertiary care centre in south India - Observational Study" on a monthly basis. Please send copies of this to the Research Office (research@cmcvellore.ac.in).

Fluid Grant Allocation:

A sum of 10,000/- INR (Rupees Ten thousand Only) will be granted for 2 years..

Yours sincerely

Dr. Biju George
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I would like to thank the doctors and staff for their support while doing this study.

I would like to thank the patients whom had consented to take part in the study despite being in times of great personal distress.

I would like to close by saying thanks to Jesus for with Him all things are possible.

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AIM

To evaluate the risk factors, incidence and outcomes for acute mechanical complications following central venous catheter insertion in patients admitted to a tertiary care center.

OBJECTIVES

1. Primary Objectives

a. To identify risk factors for acute mechanical complications following central venous catheterisation

b. Prevalence of mechanical complications and identification of risk factors which contributed to them

2. Secondary Objectives

a. Indications for central line placements for patients to a tertiary care center

b. To assess the prevalence of using ultrasound in performing central line procedures

c. Time taken for confirmation of correct central line placement following insertion

INTRODUCTION

Medicine as a science has progressed dramatically over the last century. Evolution of treatment and management of diseases has led to an improvement in not only the duration of life but also its quality. Treatment has progressed much that even diseases which used to cause much suffering even a century ago can now be treated with a visit to the local doctor. However, this has not been a win-win situation. Cost of medical treatment and the evolution of new diseases have become a burden to the patient and a stress on health care. Medical science has broken through many barriers in efforts to effectively manage critically ill patients whom would otherwise have succumbed to their illness. As medical science has progressed so has the number of interventions to treat critically ill individuals from the theatres to the intensive care wards.

In the world today, tertiary care centers are ever present in our metropolitan cities with each centre providing state of the art care which is comparable on an international level. The bridge between the busy metros and the quiet villages are also being narrowed with central based helplines providing effective and fast means of transport to such centers. As a result of this the access to high end treatment to even the critical patients are a possibility.

Statistics from the US reveal that more than 6 million patients require ICU treatment annually for various treatment of cardiovascular, respiratory or neurological diseases.

And with anywhere from 20 to 50% of casualty admissions to these wards, the number of critically ill patients is on the rise[1]. Although there is no national data on the burden of critically ill patients, with the propagation of hospitals and improvement in technical expertise, management of such patients is becoming a frequent exercise[2]. Central venous catheters for use in patients was first described in 1953 by Sven-Ivar Seldinger and has since become a common procedure in the management of critically ill patients[3]. Because of this use of central venous catheters in the management of such patients becomes essential. It use is not limited only to the administration of medication but also in measurements vital to the management of the patients[4]. Complications like infections which contribute to prolonged stay in the hospital along with extended duration of antibiotics have been examined in detail to assess its impact on health care. However, mechanical complications due to the procedure of central line insertion can also account to patient morbidity and requires adequate skill, training and adequate equipment to perform the procedure without any complications[5]. Previous studies in the US show a prevalence of 5-20% of mechanical complications and thrombosis of vessels accounting up to 10%[6].

This study hopes to shed light on the techniques followed and possible risk factors that can lead to mechanical complications. It also aims to study the prevalence of risk factors in a tertiary care centre in South India.

DEFINITION

Mechanical complications are the complications which arise during or following the insertion of a central venous catheter into the cannulated vessel which leads to either trauma to the vessel or its related structures which can lead to harm to the patient.

They include local bleeding, arterial puncture, pneumothorax, etc. and can lead to an increased morbidity and cost in case any intervention is required to correct the same.

EPIDEMIOLOGY

Mechanical complications following venous catheter insertion are a frequent yet underreported issue that can cause significant morbidity. One review article which was published in 2003 found that mechanical complications rates were as high as 20% and arterial puncture[7]. While another 6-month study of 385 lines published in 2006 found a incidence rate of 14% with varying frequencies depending on the site of catheter insertion[8]. Although there have been no studies to assess the overall cost incurred by these complications, the possibilities of vascular injury causing ischemia and blood transfusions following hemorrhage may be a cause of concern. In 2007, a retrospective study of 1319 central catheter insertions found that all the patients who had pneumothorax due to central line insertions required an intercostal drain which can lead to prolonged hospital stay[9]. There have been reports although rare of central venous catheters cannulating related vessels, causing mediastinitis and may even cause myocardial rupture[10–12].

The most recent randomized control trial published in 2015, mechanical complications were reported to be account for 3% of all complications. The same study also found the incidence of pneumothorax requiring chest tube account for 1.5% of the all complications[13]. The incidence of other mechanical complications was reported as misplaced catheter (22%), arterial puncture (5%), subcutaneous hematoma, pneumothorax and asystolic cardiac arrest at less than 1%[8]. A review of Indian literature

in ICMR and clinical trial registry of India had shown that there were very limited studies regarding mechanical complications of central line insertion and none of which were published. While one study was to estimate depth of insertion of the catheter, none of the studies had available data on mechanical complications.

LITERATURE REVIEW

Central venous catheter(CVC) complications have long been a problem faced by intensivists and professionals which can not only affect immediate care of the patient but also lead to significant morbidity. Complications due to CVC lines have been broadly classified into immediate and late complications[14]. The immediate complications pertain to most of the mechanical complications such as bleeding, hematoma and trauma to related structures. In the case of central venous catheters include cannulation of the internal jugular or subclavian vein, pneumothorax, hemothorax and cardiac arrhythmias are the more life threatening complications[15]. A summary of the complications associated with central venous catheters are summarized in table-1 and table-2.

Central venous catheter complications are classified into infectious related and mechanically related complications. Infectious complications have been studied in the past and there is enough evidence to suggest that early removal of central lines when not required and use of femoral lines was associated with a higher incidence of catheter related blood stream infections. Mechanical complications however are often overlooked and need to be kept in mind when a physician plans for one as it can expose the patient to risk for both mechanical and infectious related to line insertion.

Compared to the yesteryears where complications were common due to lack of access to current technologies and expert training, complications in intensive care units have substantially reduced. With the advent of electronic monitors with touch light emitting

diode (LED) screens the intensivist of today have access to the best technological advancements in order to provide the best and safest possible care to their patients. The use of disposable gowns and hand wash technique compliance have helped in reducing the incidence of hospital acquired infections and at the same time provide cost-effective care to its patients. The availability of a portable ultrasound machine in intensive care units are also useful when examining a critically patient.

Table 1: General Complications with Central Line Insertion

1. Air embolism
2. Intravenous thromboembolism
3. Catheter embolism
4. Local hematoma
5. Local cellulitis
6. Arterial puncture
7. Catheter infection
8. Intravenous loss of guidewire

Table 2: Complications from Internal Jugular & Subclavian lines

1. Pneumothorax
2. Hemothorax
3. Chylothorax
4. Phrenic nerve injury
5. Brachial plexus injury
6. Cerebral infarct from carotid arterial catheterisation

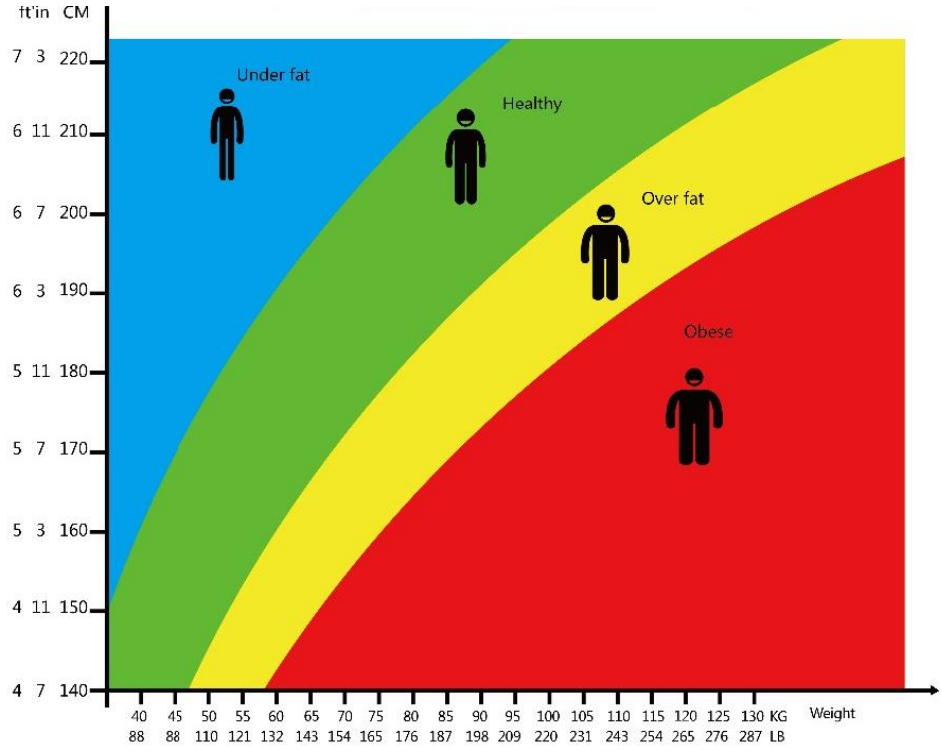
Because of this, there has been a lot of interest in studies over the years to identify the possible risk factors which may predispose to these complications so that they may be identified. One of the important factors which was highlighted in a study done in 2009 showed that even professionals when performing tasks under pressure significantly performed worse off than their counterparts[16]. This is especially true while managing a critically ill patient in whom a delay in institution of therapy can be a life or death situation which the operator if inexperienced or unable to perform in the situation can lead to complications during insertion of CVC line.

In a recent 2015 article studying complications of central venous line insertion, body mass index (BMI) was found to be associated with an increased risk of pneumothorax[17].

The body mass index is defined as the ratio of weight in kilograms by the square of the height in meters. The accepted normal range of BMI is 19-25 although there is some variation with respect to south- Asian population the World Health Organization (WHO) classification is what is most commonly used. The body mass index is used in epidemiological studies as a health indicator to diagnose and classify obesity. The difficulty with insertion of central line in obese individuals is that the anatomy of the vessel with relation to underlying structures may be variable. In addition to that, the patient may not be able to position himself/herself appropriately to gain access. Some of the additional challenges include thickness of subcutaneous tissue to gain access to the vein, length of the guidewire to be inserted may not be long enough, compression of the vessel by related structures and correct placement of the CVC line into the right atrium[18,19]. An important problem that may arise is the occlusion of the vessel once inserted in case of tangential or improper placement of the lumen.

India is having a new epidemic, the epidemic of non-communicable diseases such as diabetes, hypertension and obesity is fast becoming a social health issue for us. This is mostly related to the diet which has taken over our dining table and the lack of exercise and physical activity. The country already has the dubious distinction of being the diabetes capital of the world and data analysis do not show that it is going to change very soon. Recent articles have shown that one in every two middle aged Indians are either suffering from diabetes and hypertension with obesity following close behind.

Image 1: WHO Classification of Body Mass Index



<u>WHO classification based on BMI:</u>

Underweight: < 18.5

Normal: 18.5 – 25.0

Overweight: 25.0 – 30.0

Obese I: 30.0 – 35.0

Obese II: 35.0 – 40.0

Obese III: > 40.0

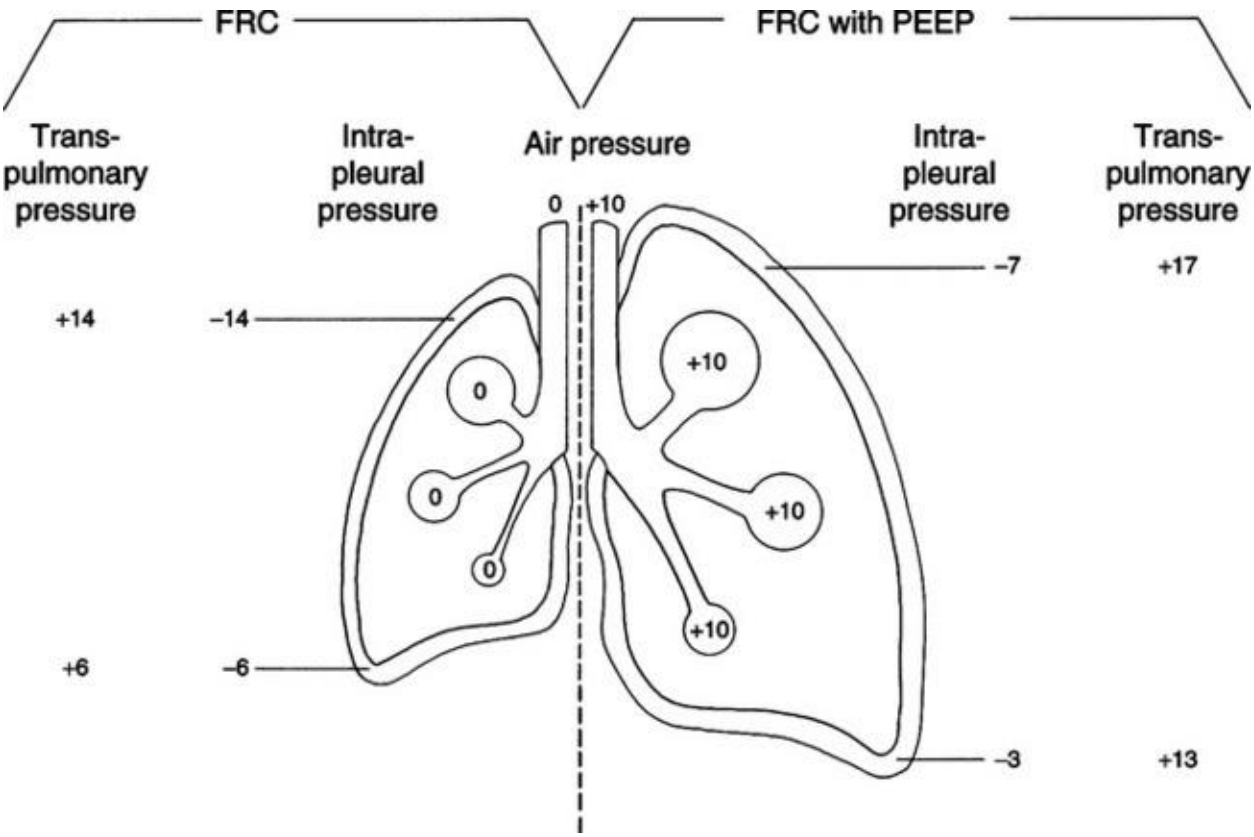
It is well known that the procedure of a central venous catheter insertion should be done in an environment suitable to perform the procedure and with technical expertise of the operator. An essential component is to allay anxiety of the patient and provide adequate analgesia prior to performing the procedure[20]. A systematic review detailing the analysis for risk factors of pneumothorax found that patients who were restless at the time of procedure or were not given adequate analgesia had an increased risk of pneumothorax as compared to their counterparts[21]. In the critically ill patients, most often the patients who are intubated may not be given adequate instructions or reassurances as compared to those who are able to communicate and this can often lead to complications. Another issue may relate to the level of comprehension of the patient as India being a multilingual country, effective communication should be ensured.

Patients who are on a ventilator provide a different problem due to the positive end expiratory pressure (PEEP) that they receive. The PEEP as provided by the ventilator is used by critical care specialists to improve and aid oxygenation by providing positive pressure. As a result of this, the alveoli are kept distended at the end of expiration to prevent collapse of the alveoli and indirectly cause ventilation -perfusion mismatch[22]. PEEP itself if not properly adjusted can lead to barotrauma by itself and cause a pneumothorax, hence appropriate setting of the PEEP for patients is essential. Due to the distension of the alveoli and distension of the lung, there is an increased chance of subclavian and internal jugular catheterizations to puncture the parietal and visceral pleura which may lead to a pneumothorax or bronchopleural fistula respectively[23,24]. The

increase in the intra-alveolar pressure can lead to shear stress over the alveoli causing lung damage (image 2). This can be avoided by reducing the PEEP supplemented to an intubated patient and increasing the fractional inspiratory oxygen concentration before the procedure so as not to compromise oxygenation. This maneuver does not distend the pleura and the central line can be safely introduced. Following completion of the procedure, the ventilatory settings can be changed back.

The positive end expiratory pressure is useful especially in patients admitted with type 1 respiratory failure where there is hypoxia but ventilation is preserved. The most common conditions requiring positive end expiratory pressure seen in our country was due to congestive cardiac failure, acute respiratory distress syndrome, etc. In the case of congestive cardiac failure, there is increased hydrostatic pressure in the pulmonary capillaries which causes the alveoli to be filled with fluid. In these instances, PEEP helps to overcome this hydrostatic pressure and provide symptomatic relief to the patient. The pathophysiology of acute respiratory distress syndrome is to do with inflammatory destruction of the alveoli secondary to any insult which affects the normal integrity and therefore diffusion of gases especially oxygen. In these patients PEEP is also useful to provide adequate oxygenation to the body while the primary insult is being evaluated and treated. In such cases the use of PEEP does not have any mortality benefit or outcome on the primary etiology itself.

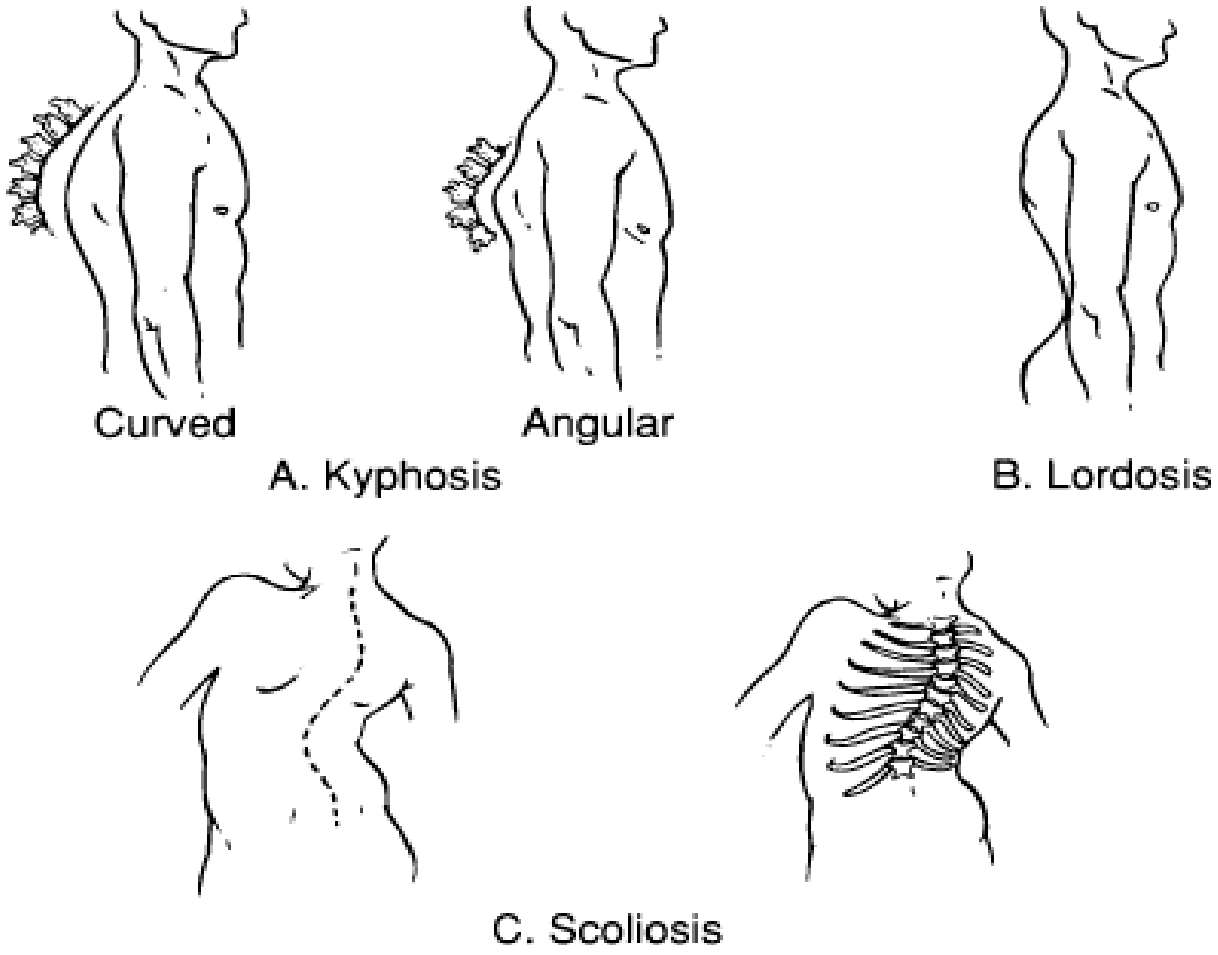
Image 2: Effect of PEEP on intra-thoracic pressures



The normal vertebra constituting the 33-vertebral column consists of individual vertebrae arranged longitudinally and held in place by ligaments and joints. The vertebral column however is not straight like the superstructure of a building but is curved to allow range of movement at that level while at the same time not compromising on the stability and strength provided by it. The vertebral column is divided into 4 regions which are cervical, thoracic, lumbar and sacral. There is a total of 33 vertebrae with 7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 4 coccygeal which are fused together. The cervical and lumbar vertebrae are forward bending or which is medically termed as 'lordosis' while the thoracic and sacral are outward bending which is medically termed as 'kyphosis'. Scoliosis is the lateral bending of the spinal cord (Image 3). An exaggeration of either lordosis or kyphosis can lead to alteration in structure and position of the related anatomic structures. Due to alteration in the anatomy of the vertebrae, surface markings for reliable insertion of subclavian catheter can be challenging.

Chest wall abnormalities though not common in elderly can be a potential risk factor for central line complications. Due to the anatomical variation of vessels in relation to its structures, usual surface marking techniques may not be accurate in performing the procedure[25]. A 2009 publication to assess the prevalence of chest wall deformity found that only 1.05% of a 25,587-population had a chest wall deformity[26]. A 2013 retrospective survey of chest X-rays in geriatric age group found prevalence of 1 per 899 patients[27].

Image 3: Types of Chest Wall Abnormalities



The body is a unique structure and functioning system which is constituted by many types of cells and organ tissue which serve and sub-serve each other which is under the conscious and unconscious control. One of these mechanisms is the coagulation pathway which serves to stop bleeding in the event of any injury or trauma to the body. Without these mechanisms set in place, we would continue to bleed following to injury and would have probably succumbed to our injuries. The coagulation pathway involves platelets, coagulation factors, vessel wall endothelium and smooth muscle cells (Image-4). The platelets are synthesized in the bone marrow and released into the blood stream. They are activated upon injury to the endothelial wall or upon presence of certain factors and help in maintaining homeostasis. The blood flow within the vessel wall is commonly streamlined with platelets constituting the central part of this laminar flow therefore not meeting the vessel wall and endothelium. Upon injury to the vessel, the blood flow no longer becomes streamlined due to disruption of blood flow and the platelets come into contact with the pro-coagulant factors released by the damaged endothelium and vessel wall. This results in platelet aggregation where many platelets clump together to reconstitute temporarily albeit the damaged vessel wall. The vessel wall smooth muscles also play a role in primary hemostasis by contracting which reduces the damaged vessel wall lumen by trying to oppose each other and stem the flow of blood. However, this is only a temporary solution, the vessel wall cannot maintain this function for prolonged periods and platelet aggregation can only temporarily maintain hemostasis. This is where the coagulation cascade or the coagulation factors come into play. These consist of proteins predominantly synthesized by the liver and released into the circulation which on

contact with certain factors in the appropriate environment form fibrin polymers which have immense tensile strength and serve to maintain reliable, durable and hemostasis.

The coagulation cascade consists of two pathways, an intrinsic and extrinsic pathway (Image 5). The intrinsic pathway or the contact pathway involves the activation of factors XII, XI, IX in the presence of cofactors calcium and phospholipids to initiate clot formation. This pathway has a minor role as compared to extrinsic pathway and is more involved in cases where inflammation is present. Severe deficiencies of some of the factors involved in the pathway do not result in clinical or soft tissue bleeding thereby emphasizing the previous statement. Tissue factor which is released upon damage to cellular structure and vessel wall is central to the extrinsic pathway. The tissue factor activates factor VII which further activates factor X. Factor X is the result of the intrinsic & extrinsic pathway which on further cascading activation results in formation of fibrin. Any pathology resulting in the disruption or non-functioning of this cascade can predispose to bleeding. Some of the common causes for coagulopathy are severe sepsis, liver dysfunction, uremia, burns, etc.

Image 4: Overview of Hemostatic Mechanisms

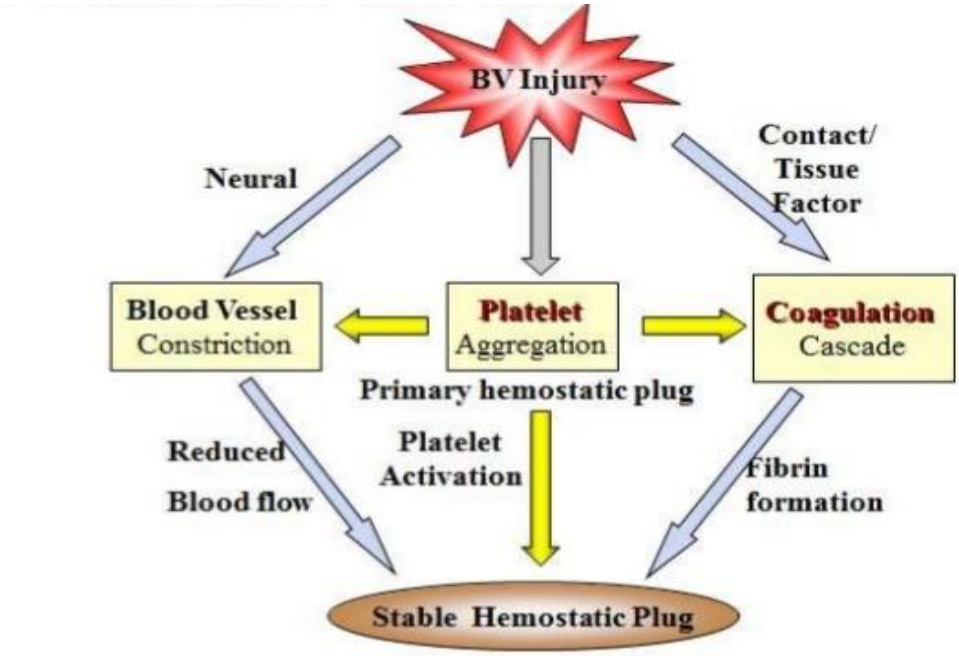
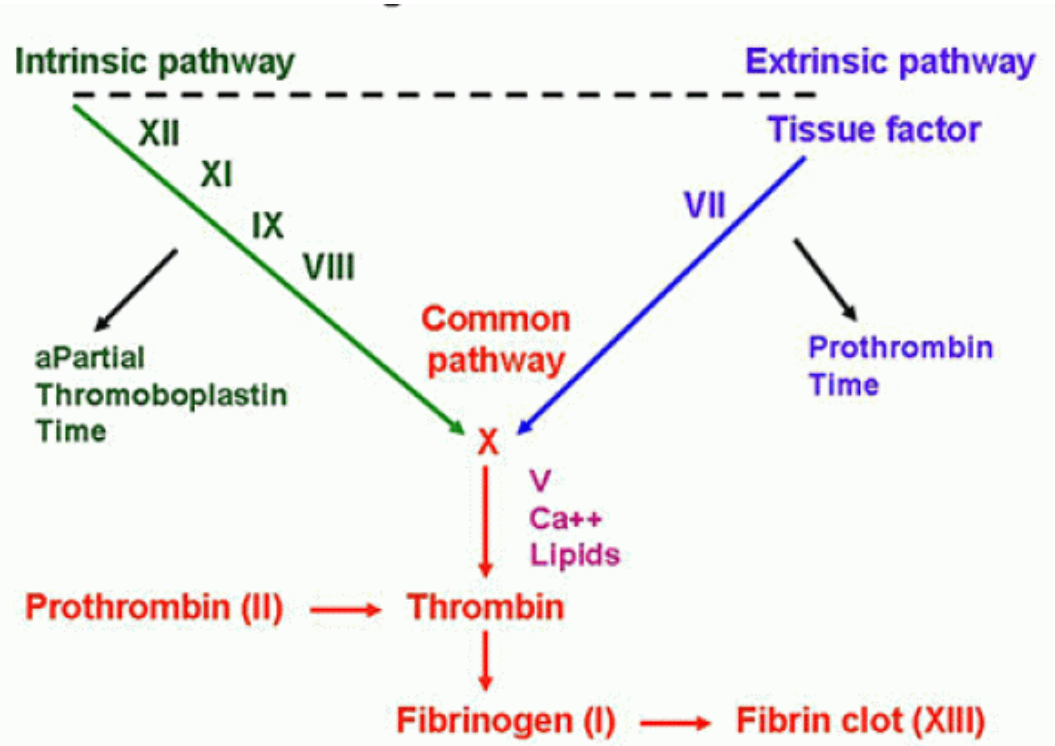


Image 5: Coagulation Cascade



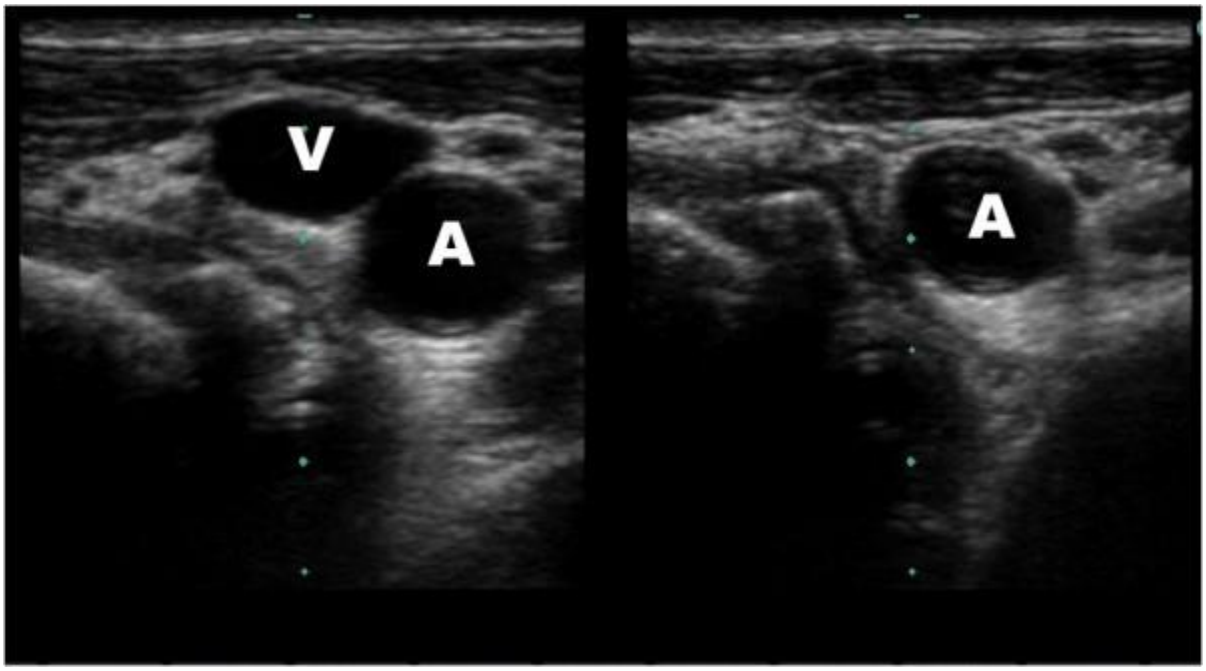
Coagulopathy refers to predisposition of the patient for bleeding. Patients whom are on antiplatelet, anticoagulants or present with multi organ dysfunction syndrome or disseminated intravascular coagulation are at risk for bleeding. The problems which arise with CVC line insertion is due to profuse bleeding, which often can be managed with local compression however if bleeding becomes internal can be severe[25]. A retrospective study in 2000 observing complication rate over two years found that low platelet count was significantly associated with bleeding risks. However the coagulopathy in the study was not more than one and half times that of reference range[28]. A 2010 study also assessing bleeding complications in coagulopathic population found that no complications occurred in patients with a platelet count more than 50,000 per cumm or an INR of at least 1.5. Bleeding incidence was only 0.95% however their outcome was major bleed requiring intervention[29]. A 2011 review article to assess factors which prevent bleeding in coagulopathic disorders found that use of ultrasound to insert central lines was associated with significantly less complications[30]. However, there is data support that central venous insertions by skilled professionals can be done safely without any need for product administration and least harm to the patient[28,31].

Since the introduction of ultrasonography(USG) to assist in the insertion of central lines in 1978, the use of ultrasound has been backed by multiple studies about both its effectiveness and ease of performing the procedure as well as avoiding complications. The ultrasound machine works on the principal that sound reflected off a surface or in

this case tissue is directly proportional to its density. Hence, denser objects tend to reflect more sound than rarer surfaces which allow sound to traverse through it or is absorbed by it. The ultrasound machine consists of an emitter and receiver which transmits sounds waves and receives the reflected waves separately. Modern day USG machines have both the emitter and receiver manufactured onto one probe or transducer (Image 6). Depending upon the frequency of sound waves produced by the probe, the depth of penetration of sound waves can be adjusted. For example, in order to visualize deep structures, the frequency of the probe produced should be a low frequency and high amplitude. As a result of this, the sound waves are able to penetrate deep to visualize deep organs. However, as a result of the decrease in frequency of the sound, contrast or resolution of the image suffers and the image of the organ visualized is grainy and unclear. The corollary of the same is the use of high frequency probes to visualize superficial structures. These probes however will be unable to visualize deep lying structures however resolution of the structures visualized would be excellent. Hence while using USG for central venous catheter insertion, use of a high frequency probe is recommended as most of the vascular structures are superficial and with good resolution successful cannulation of the vessel is possible (Image 7).

Image 6: Portable ultrasound machine

Image 7: Ultrasound image of vein (V) and artery (A)



The ultrasound machine can be maneuvered over the surface related to the vein to be cannulated in order to visualize it. Not only can visualization of the structure be seen but also its relation to structures located near it. The probe by action of rotation can be used to either ascertain a transverse or longitudinal 2D image of the structure to help assist in cannulation. Another advantage of using ultrasound is the real-time visualization of introducing the cannula into the tissue and guiding it to the required position. This offers an enhanced accuracy and reduced complication rate which cannot be matched by surface marking or use of a CT machine. Another advantage of using ultrasonography is the absence of radiation and therefore tissue exposure of harmful radiation. Radiation released in the case of X-rays or CT scan have been associated with neoplastic outcomes and therefore any intervention/investigation which can be done without significantly adversely affecting the health worker or patient is invaluable.

There have been multiple studies done over the last decade that shows benefit if the procedure was done in a variety of situations like emergency, intensive care units, theatres and wards[32–34]. A recent study done in 2014 found that the complication rates were up to 15% lower among those whom had the procedure done under ultrasound guidance and the procedure when performed by a senior registrar was 10% lower[35]. The 2001 update on 'Making health care safer II' had also emphasized and recommended the use of ultrasound in performing skilled procedures like central venous catheter insertion[36]. A 2015 Cochrane review found that ultrasound provided a better safety

profile than based on anatomical landmarks[37]. There has also been evidence to show that an early introduction in training of techniques for a period of 6 months showed that the subjects had performed better than their peers[38].

The procedure of performing a central venous catheter insertion is one which requires both skill and patience of the operator during the procedure. The team taking care of critically ill patients commonly comprises of a senior resident who is well versed in tackling the many situations and problems that may occur, and who is also able to instruct and if needed to perform a central venous catheterisation. A 2015 article regarding central line insertion found that the incidence of complications were less if the operator had experience of at least 50 prior procedures[17].

An arrhythmia which is defined as any rhythm not originating from the sinoatrial node and conducting down the normal atrioventricular conduction pathway. Arrhythmias are a common occurrence in patients with chronic cardiac failure and are associated with 50% mortality in patients with dyspnea at rest. Of this, nearly 50% of all arrhythmias occur during the first year of diagnosis emphasizing the importance of early detection and treatment[39]. Management of arrhythmias can be challenging requiring oral antiarrhythmic and in case of severe left ventricular dysfunction may require an ICD[40]. It has been confirmed that certain cardiomyopathies which have a propensity to predispose to cardiac arrhythmias may be genetically determined and these subgroups of patients are at more risk of developing arrhythmias[41]. In critically ill patients, there are a multitude of factors

which contribute to arrhythmias like acute stressful event, dyselectrolytemia, metabolic disequilibrium, renal failure, drugs, etc.[42,43]. A 2014 study revealed that psychological stress that patients even in intensive care units are exposed to can present with arrhythmias. The study had found that due to sympathetic stimulation due to anxiety and even anxiety itself can induce T wave changes which are an indirect predictor of subsequent arrhythmias[44–47]. A 2001 review article studying effects of psychological stress on arrhythmias in patients admitted to hospitals found that majority of 96 studies (90%) had data supporting the association of psychological stress and arrhythmias[48]. A 2016 review article of arrhythmias in ICU found that most of the arrhythmias occurred within the first 3 days of ICU stay. It also revealed that myocardial ischemia and acute kidney injury were independently associated with early onset arrhythmias however they were not independent predictors for mortality.

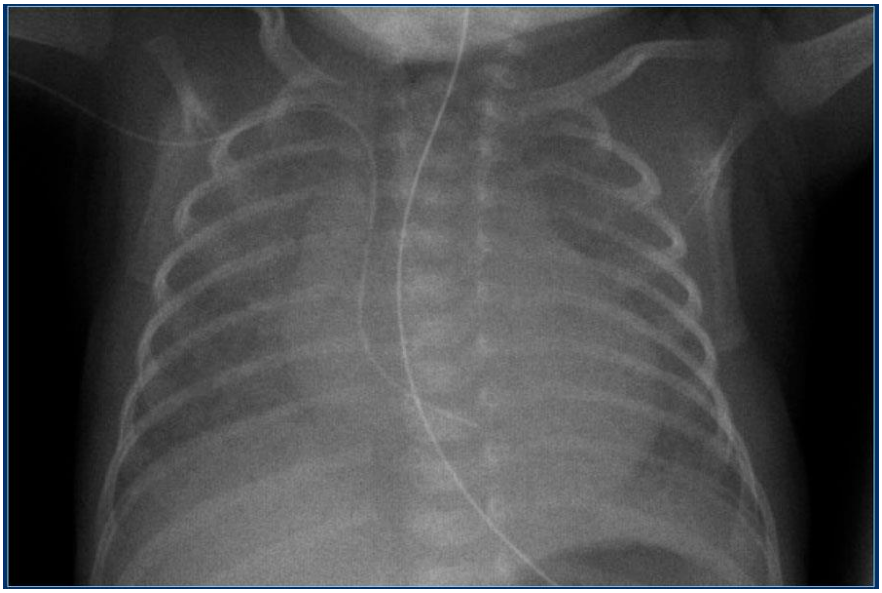
Guidewires which are essential in the procedure of central venous catheter insertion are made of metal and has a J shaped end (Image 8). As has been often reported if inserted incorrectly can induce arrhythmias of atrial or ventricular origin which could potentially lead to arrhythmias[49]. Continuous electrocardiogram monitoring during insertion of the central line helps to identify if an arrhythmia is induced so that appropriate corrections can be made[50]. Continuous cardiac monitoring is a common occurrence for critically ill patients and this is an effective and noninvasive method of detecting arrhythmias (Image 9). Its accuracy has been tested in many studies and a 2004 study done to assess ECG guidance of central line insertion proved its efficacy[51]. There have been certain

modifications of this technique in attempting to use an intravascular ECG guided central line placement which also found to be helpful in correct placement of the line without precipitating arrhythmias. However, the main drawback of this method is the cost of procuring especially in a resource restrained setup[52,53]. In a 1990 study of central line insertion, 40% of central line insertions were associated with arrhythmias which were almost equal distribution between atrial or ventricular origin[54]. A 1996 study had found that marking of central lines and to limit insertion to less than 20 cm averted induction of arrhythmias. The study had also found that site of insertion, height and gender were directly related to guidewires inducing arrhythmias[55,56].

Arrhythmias can be classified into bradyarrhythmia's and tachyarrhythmias. The bradyarrhythmia's are commonly either due to ischemic heart disease resulting in damage to the normal conduction pathway from the sino-atrial (SA) node, atrioventricula (AV) node and peripheral Purkinje network of nerves. The other common cause for bradycardia seen in critical conditions are electrolyte imbalance such as severe hyperkalemia, hypocalcemia or drug induced due to beta-blockers, calcium channel blockers. Tachyarrhythmias are classified into narrow complex and broad complex based on duration of QRS wave. Common causes are fever, pain, sepsis, hypovolemia or aberrant conductions precipitated by drugs, electrolyte imbalance or underlying cardiac disease.

Image 8: Guide wire

Image 9: Position of guide wire into ventricle



This study aims to give an accurate account of the prevalence of complications that occur during the insertion of a central venous catheter. As has already been mentioned, complications can be divided into those which occur immediately or later following line insertion. We have so far seen the evidence for factors which relate to the incidence of complications and what risk factors are known to lead to them. We will now consider the complications themselves and how they affect the patient. We will be dealing with the description followed by the diagnosis and management of each complication. We would also be mentioning about the current standards of treatment.

Bleeding following central line insertion is a common complication which results from trauma to the underlying vessels. Bleeding that has been defined by the Bleeding Academic Research Consortium (BARC) have been classified into five types ranging from 0-5 which correlates with increasing severity over bleeding and if action was required to stop the bleeding[57,58]. Although most studies have shown that bleeding risk due to central line insertion are at most moderate not requiring any urgent intervention or treatment, there still are the odd case reports. Most of these case reports pertain to patients whom had a coagulopathy, poor operator technique or some unforeseen variant which could not have been avoided[59,60]. In the event of the rare cause of bleeding following central line insertion, administration of blood products may be indicated to prevent serious blood loss. There have been many studies to assess the need for pre-procedure blood transfusion with the hypothesis that bleeding complications can be reduced. While theoretically this is plausible, there are no randomized control trials to

show that routine transfusions will be beneficial. However, in the case of severe coagulopathy in special situations like platelet function dysfunction or insertion of subclavian central lines where uncontrolled bleeding can result in serious harm can transfusions be considered[61,62]. Among the recent interventions which have been found to reduce the complications of catheter induced bleeding, ultrasound has been shown to reduce complications due to central line insertion including bleeding. Use of ultrasound was associated with fewer attempts, less procedural time and easier operator access in insertion of central line. It has now been recommended by various groups as standard of care for insertion of central line[63,64]. Use of central line has also been found to be superior in situations like liver disease[65]. Central line insertions are commonly done in the supine position as the distension of the jugular vein is maximal and the incidence of air embolism is low. A 2010 article demonstrated the first use of ultrasound in insertion of central line in a prone patient[66]. The challenges being the anatomical variation that will occur, however with the use of real time ultrasound guidance central line insertion can be performed.

Diagnosis of hematoma following central line insertion can be by clinical examination which would reveal a swelling with skin discoloration and warmth. There may also be tenderness on palpation of the swelling. Ultrasonography can also be used to diagnose a hematoma which appears as a well circumscribed hypodense fluid collection. Dimensions and volume of fluid can also be assessed with the help of an ultrasound (Image 10).

Accidental arterial puncture during insertion of central line is a common complication of central line insertion due to the anatomical proximity of the artery to the vein in the neck, thorax and inguinal region. This predisposes to trauma of the artery in case of insertion by an untrained registrar or in case of minor anatomical variation[67]. Some studies put incidence of arterial trauma up to 25% when performed by surface marking[28,68]. Most of the data seems to support the use of appropriate techniques and proper positioning of the patient to avoid arterial puncture. Operator experience as has already been discussed is an important factor to avoid arterial trauma. Some studies have even supported the use of alternative methods of approach to avoid complications[69,70]. One study had proposed the use of a pressure transducer to accurately confirm the position of the needle prior to guidewire insertion to prevent inadvertent catheterisation of the artery[71,72]. A 2008 article on the management of arterial injury outlined that in case of serious injury usually due to use of large bore catheter, immediate vascular surgery should be instituted when indicated and assessment of associated structures including a neural examination[73,74].

Arterial punctures are more common with femoral vein catheterizations due to its close relation (Image 11). Arterial punctures are identified by observing bright red color of the blood aspirated while insertion. Other signs suggestive of arterial cannulation are jet of blood on cannulation, arterial pressures and wave form when attaching to a transduced. Perhaps the confirmatory test for the same is assessment with a blood gas of the sample which will reveal high oxygenation suggestive of an arterial sample.

Image 10: Hematoma as visualized with ultrasonography

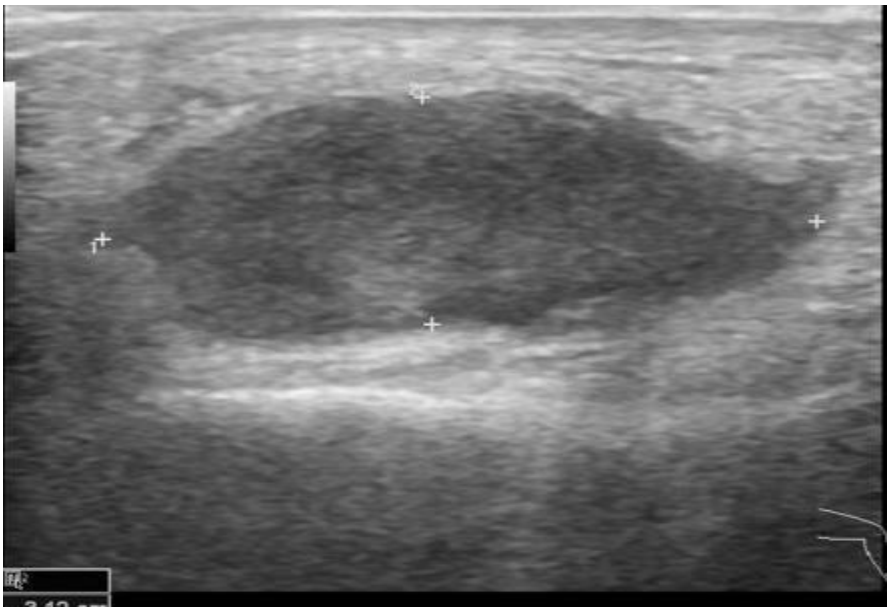
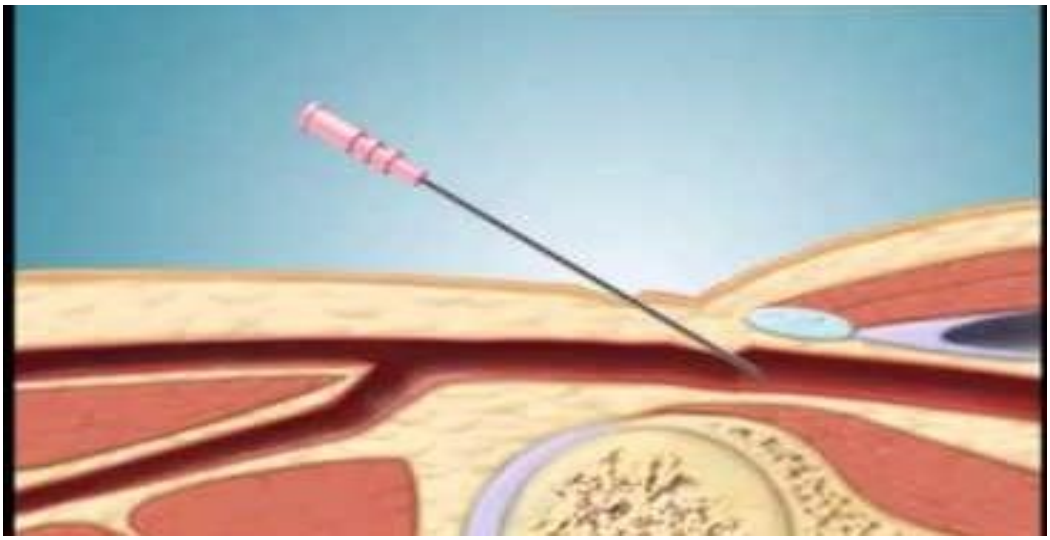


Image 11: Accidental cannulation of an artery



Injury to nerves following central complications although very rare is an easily overlooked complications due to the delayed identification. The earliest signs of involvement would be lower limb weakness in case of involvement of the femoral nerve, diaphragmatic weakness in case of phrenic nerve involvement or even laryngeal involvement in case of laryngeal nerve trauma[75–78]. These deficits can only be identified in case of high suspicion of this complication and the temporal profile of its onset. A nerve conduction study can be used to diagnose the nerve involvement however treatment is predominantly supportive[79,80].

The nerves commonly related with central lines are the femoral nerve and phrenic nerve to femoral and internal jugular catheterizations respectively. The femoral nerve is a sensory-motor nerve which has its origins from L2-L4. It supplies the muscles dealing with extension of the knee and provides sensation to the anterior aspect of the thigh. The femoral nerve lies within the femoral canal and is related medially to the femoral vein and artery (Image 12). In case of injury to femoral nerve, presentation may be of sensory deficit over anterior aspect of the leg or weakness in extension at the knee. The phrenic nerve is related to the internal jugular vein and is prone to damage in case of careless insertion of central line (Image 13). These patients may be asymptomatic however X-ray may reveal an elevated diaphragm. The diagnosis however can be confirmed by electromyography of the phrenic nerve which shows poor/absent conduction or its function can be assessed with a barium swallow.

Image 12: Relation of femoral nerve in thigh

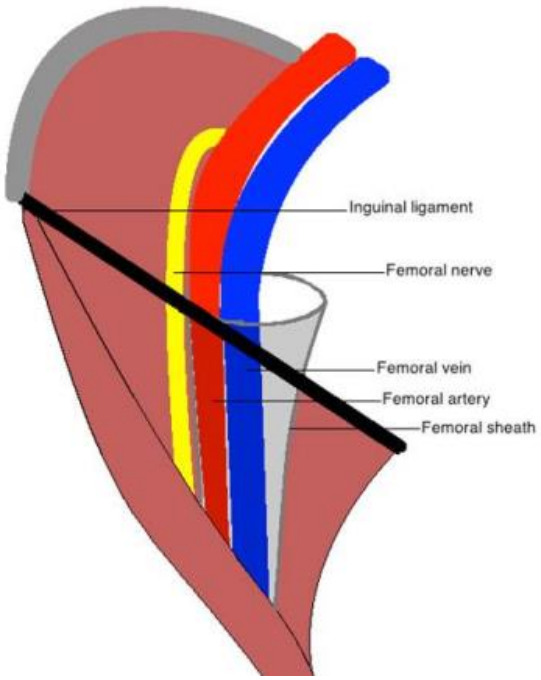
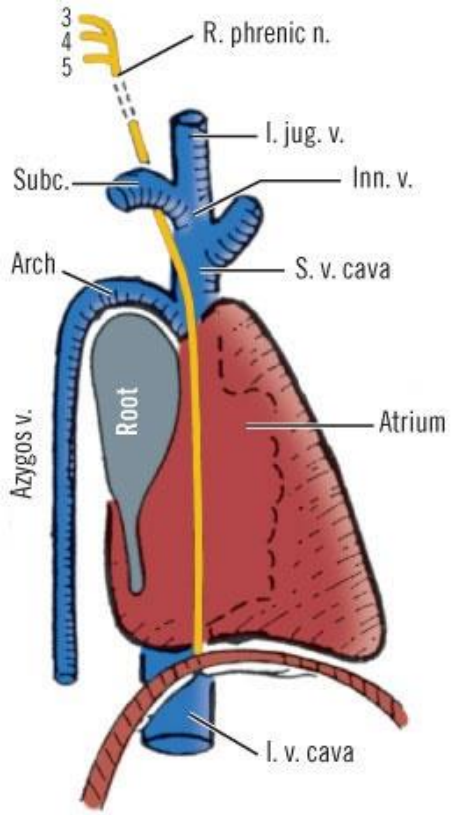


Image 13: Relation of phrenic nerve to internal jugular vein



The thoracic duct is an anatomical structure which takes origin in the abdomen and ascends into the thorax to drain into the left brachiocephalic trunk. It carries with it a cholesterol rich fluid called chyle which is the lymphatics from the gastrointestinal tract. There are anatomical variations which can be seen in the population[81,82]. There have been multiple case reports of thoracic duct injury following central venous line insertion. There are no statistics to provide an accurate assumption of its prevalence however what is known is that it is a rare complication. It presents as a unilateral or bilateral pleural effusion and a diagnostic tap reveals presence of a whitish fluid which is rich in lipid content. Complications include secondary infection into an empyema which would need therapeutic drainage and antibiotics[83,84].

Line related thrombosis refers to the presence of a clot in the vessel following insertion of a central line which was not present prior to insertion. The pathophysiology of venous thrombosis is based on Virchow's triad which includes venous stasis, hypercoagulability & endothelial injury. In patients whom are requiring a central venous catheter, endothelial injury is caused during the procedure of line insertion due to damage of the vessel lumen. This is compounded by the technique used by the operator and the number of attempts performed in order to successfully cannulate the vessel. Venous stasis can occur especially if a patient is mechanically ventilated, admitted to an ICU, bed bound due to debilitating illness or immobilization of limb due to cannulated vein in the case of a femoral central venous catheter. These two risk factors predispose critically ill patients

whom are the ideal candidates for central venous catheters to predispose them to line related thrombosis.

Diagnosis of line related thrombosis is challenging from the fact that the most common symptoms is pain while swelling may also be present. However, most patients admitted in a critical condition may not be able to communicate the same and hence a large volume of patients may go undiagnosed. Hence, screening of all central line sites following insertion is indicated in patients with symptoms or unexplained limb swelling. A convenient and cost-effective diagnostic test is a screening doppler which by method of doppler effect of sound waves is used to visualize the vein real-time to assess the patency of the vessel. In an ICU, this can also be performed with a portable ultrasound machine which can also have a doppler probe for easy and convenient use. While visualizing the vessel, presence of an echogenic mass within the lumen of the vessel is suggestive of a thrombus (Image 14-16). Other supportive findings using color doppler to document the flow velocity and degree of obstruction can also be done (Image 17). The main advantage of performing these screening tests is the common availability of ultrasound in an intensive care unit coupled with the relatively low skill set required to learn and perform the tests. Intensivists and residents can be trained within a short span and with relative confidence in diagnosing venous thrombosis rather than the test be performed by a trained radiologist. For cases in whom screening tests are positive, a formal doppler can be conducted to confirm the same.

Image 14: Ultrasound Visualization of Normal Patent Vessels

Image 15: Compression Test to Screen for Vessel Thrombosis

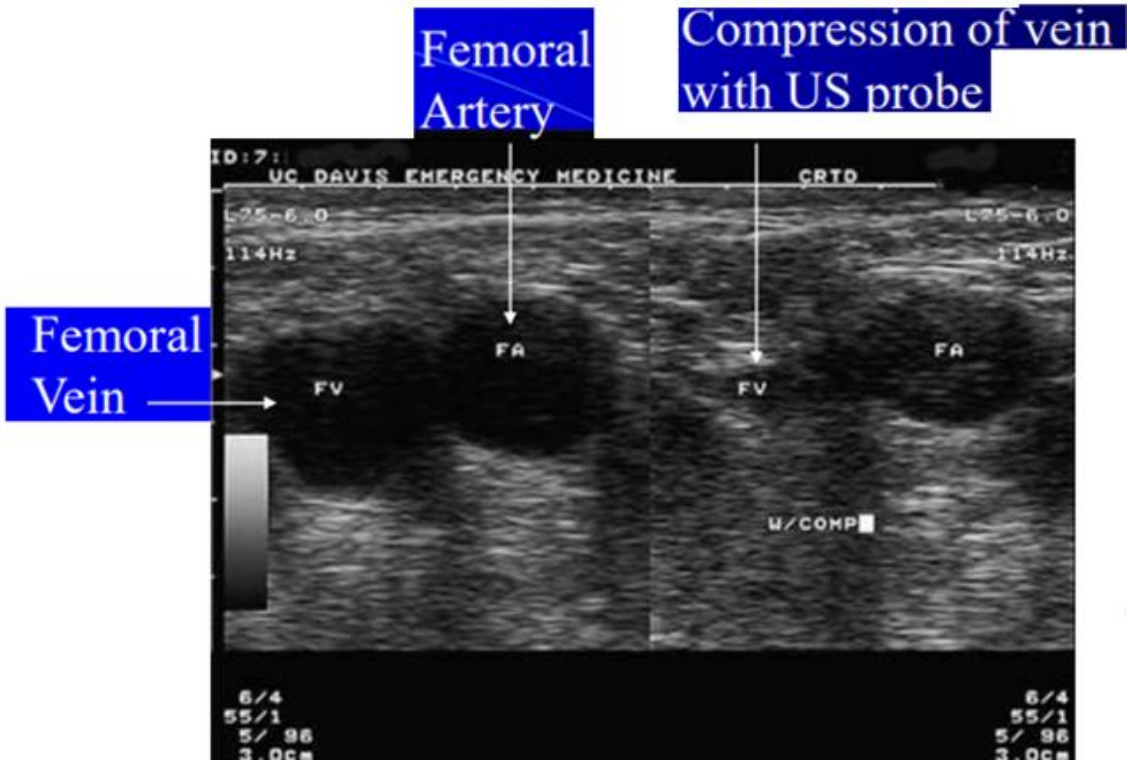


Image 16: M-mode of Thrombosed Vein

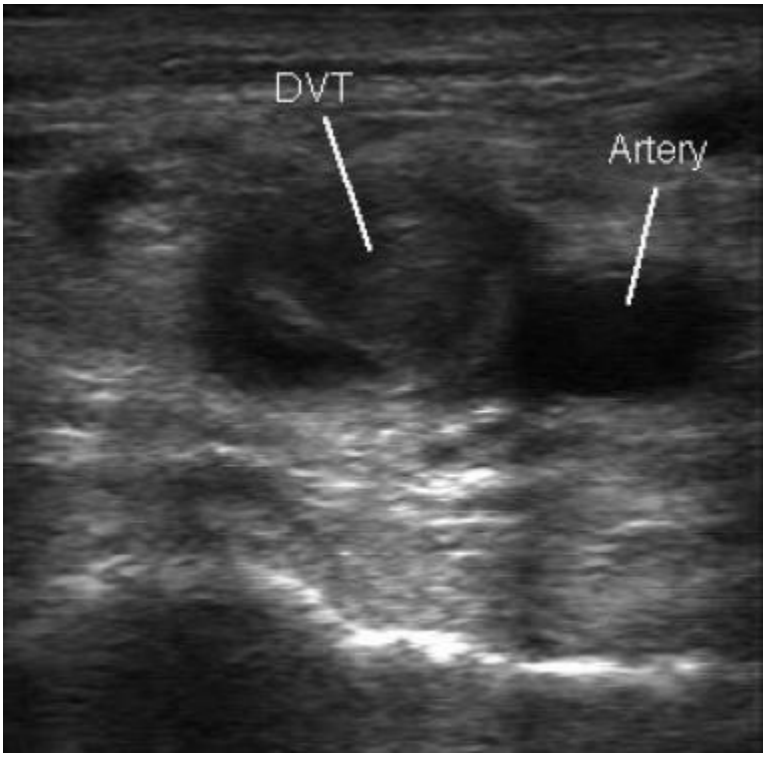
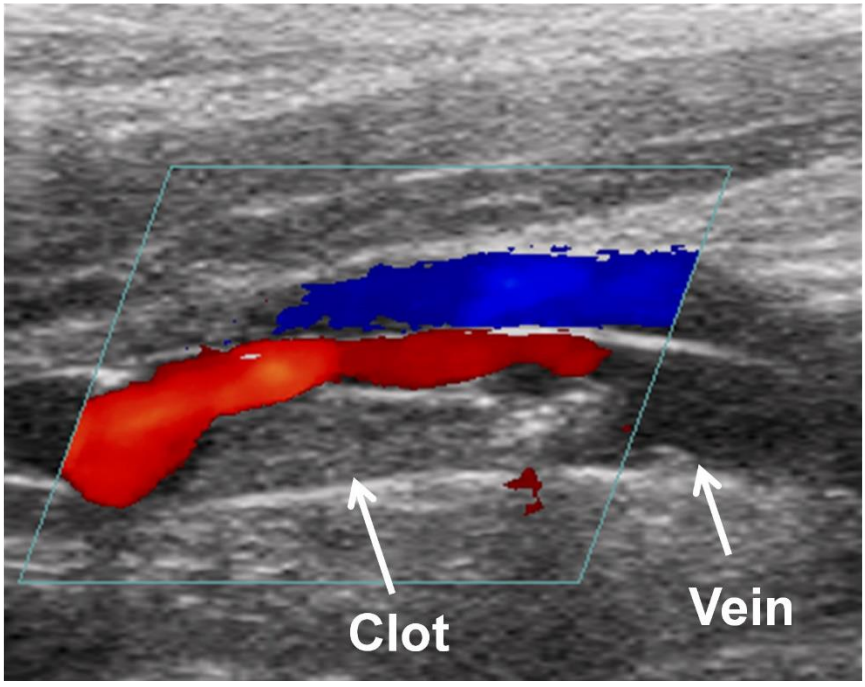


Image 17: Doppler of Thrombosed Vein



A 2003 study of the prevalence of line induced thrombosis found the prevalence to be as high as 15%. However, the patients included in this study were with an underlying malignancy[85]. A 2013 clinical practice guideline identified that multiple factors including insertion of central line on the right side and correct line tip positioning in the atrium were important factors with relation to thrombosis[86]. In a 2011 study of incidence of thrombosis from central versus peripherally inserted central lines, the latter group associated with more thrombosis vs the former (18%). This study had also shown that increase in lumen diameter of the central line was an independent risk factor for thrombosis[87]. The most common presentation of venous thrombosis is unilateral swelling of the limb involved along with discomfort and venous distension[88]. The most cost-effective method for diagnosis is the use of duplex ultrasound which can not only assess the presence or absence of flow but also the degree of obstruction when comparing with the opposite side. In case of further doubt, a contrast venography would help in confirming the same however has the disadvantage of being expensive, exposure to radiation and running the risk of renal damage[89,90]. Guidelines on management have supported the use of anticoagulation for a period of 3 months in case of symptomatic patients. There is evidence to show that there is no benefit of prophylactic anticoagulation[91–93].

Image 18: Pneumothorax

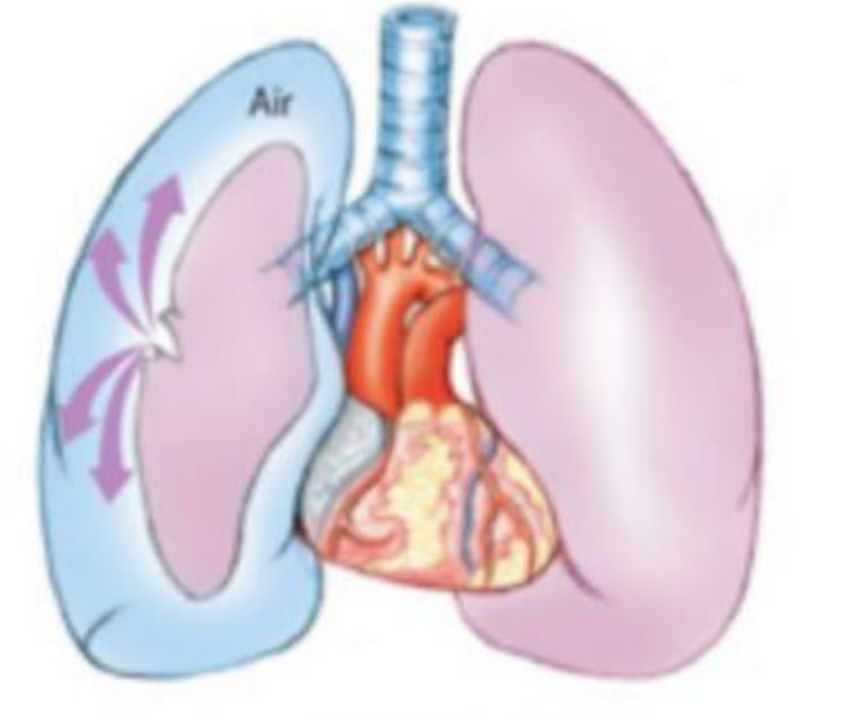
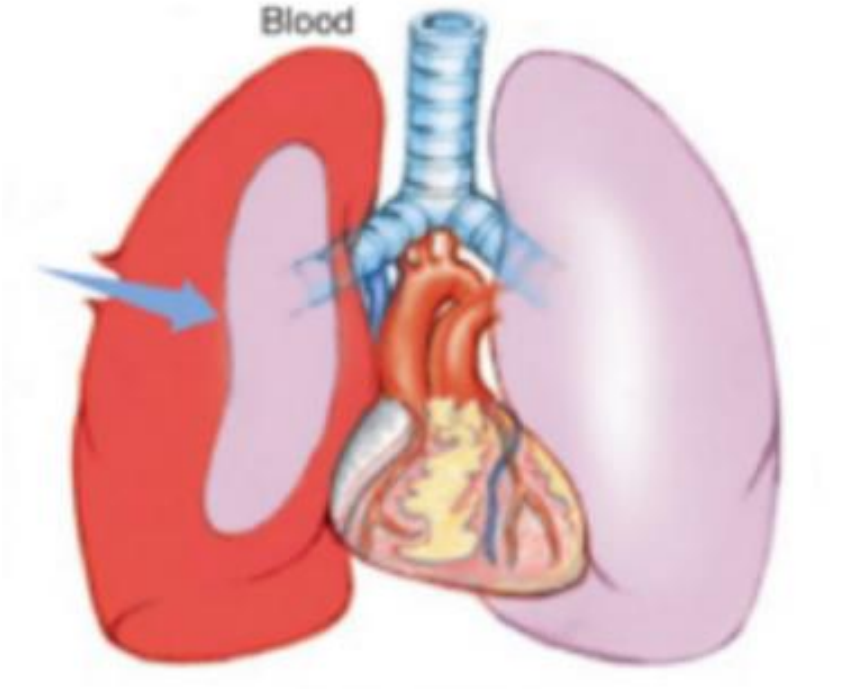


Image 19: Haemothorax



Pneumothorax is defined as the presence of air between the parietal and visceral pleura[94]. In a 2000 article which retrospectively looked at pneumothorax, the most common cause was traumatic. Nearly 92% of all pneumothorax which occurred in the study required an emergency interventional procedure[95]. Non-traumatic pneumothorax is broadly classified into primary where there is no identifiable underlying lung disorder and secondary as in patients with chronic obstructive pulmonary disease[96]. The pathology behind penetrating pneumothorax which occurs during central venous catheter insertion is that the needle introduced punctures the visceral pleura and forms a conduit through which air enters the pleural space. This air when it builds sufficient pressure can lead to collapse of the alveoli and subsequently the lung causing a pneumothorax (Image 18). A dreaded complication is when there is a tension pneumothorax which can present with additional feature of hemodynamic instability[97]. Some of the clinical signs which indicate presence of a pneumothorax are tracheal deviation, decreased breath sounds on the affected side and hyper resonance over the affected site[98]. A chest radiograph was the earliest used and still a reliable method to diagnose pneumothorax. An X-ray will reveal areas of absent lung markings in the periphery along with a visible lung border. In case of fluid present in the thorax, an air fluid level marking will be seen suggestive of a hydropneumothorax. Some of the mimics of a pneumothorax are skin folds, scapula shadow or previous lung surgery[99]. The ultrasonography commonly available in intensive care units are also used as a sensitive test to diagnose pneumothorax. With the added advantage of it being available at point of care, there has been a lot of studies evaluating its use for rapid diagnosis. The modalities used to diagnose pneumothorax are the presence of a

continuous line on imaging the lung and the lung sliding over the adjacent pleura during normal respiration in case of a normal hemithorax[100]. A 2006 prospective study comparing ultrasound and CT thorax to diagnose pneumothorax found that ultrasound had a positive predictive value of 96.3% and negative predictive value of 94.8%[101]. Chest radiograph has also been studied in numerous studies against chest radiograph in the diagnosis of pneumothorax and has been found to be non-inferior with the added benefit of reduced complication rate in performance of the procedure[102–104]. These statistics suggest that use of ultrasound in detection of pneumothorax is a very useful tool for diagnosing patients. There have also been studies to assess the cost effectiveness of ultrasound compared to traditional method of diagnosis as a chest X-ray which found that there was no compromise on accuracy with decreased of cost to the patient[105].

Hemothorax is yet another dreaded however thankfully uncommon complication following central venous catheter insertion (Image 19). The incidence of hemothorax during one review was found to be less than 0.5 percent. Some of the risk factors included severe coagulopathy and poor technique[69]. Bleeding into the thoracic cavity commonly present following central line insertion with a new onset fluid collection which may present as a pleural effusion. In case of severe torrential bleeding, this can present as sudden onset tachycardia with hypotension with a concomitant drop in hemoglobin. Diagnosis of haemothorax would require not only the clinical context of new onset pleural effusion following procedure but also a diagnostic thoracentesis[106,107]. A visual inspection of the fluid being bloody and one that clots on standing is very

specific. A hematocrit of the fluid also aids in diagnosing a haemothorax[108,109]. Damage to arteries like the subclavian artery are the most common artery involved for haemothorax during central venous catheter insertion. Caliber of the vessel such as a large diameter dialysis port has a greater risk of causing haemothorax[110–113].

From the evidence, we have reviewed we have seen about the various complications and risk factors in patients requiring central venous catheters. With the evidence and literature reviewed we can see that not only has the incidence of these complications reduced with better training and understanding of risk factors but also the introduction of new equipment for safer performance of procedures but also early diagnosis of complications. Hence this study was done to study the prevalence of complications and risk factors.

MATERIALS AND METHODS

This study is a prospective cohort study among adult patients admitted to medical wards and in medical intensive care units who require a central line as per the criteria defined below.

SETTING

This study was conducted at a tertiary care centre in South India. Most of the patients who are admitted to the medical wards and medical intensive care units (ICU's) are admitted through the Accident and Emergency Department. The medical wards also have admissions from the outpatient department. These patients consist of both stable and critically ill patients as the hospital not only caters to patients in the vicinity but also acts as a referral centre to nearby cities and provides medical facilities to patients from other states as well.

PARTICIPANTS

Adult patients admitted to medical wards and the medical intensive care units from 04 April 2016 to 31 July 2016

Inclusion criteria

- All patients requiring central venous catheter insertion
- Indication and place of insertion as clinically indicated
- Technique and site chosen as convenient to the physician

Exclusion criteria

- Participants with complications on same side as site chosen for CVC insertion
- Children

Case ascertainment

Any adult patient who requires the insertion of a central venous catheter as indicated by the treating physician admitted under medical unit or medical intensive care unit could be recruited for the study. A informed consent regarding the study was explained to the patient / attending relative in a language of their own understanding and a certificate of

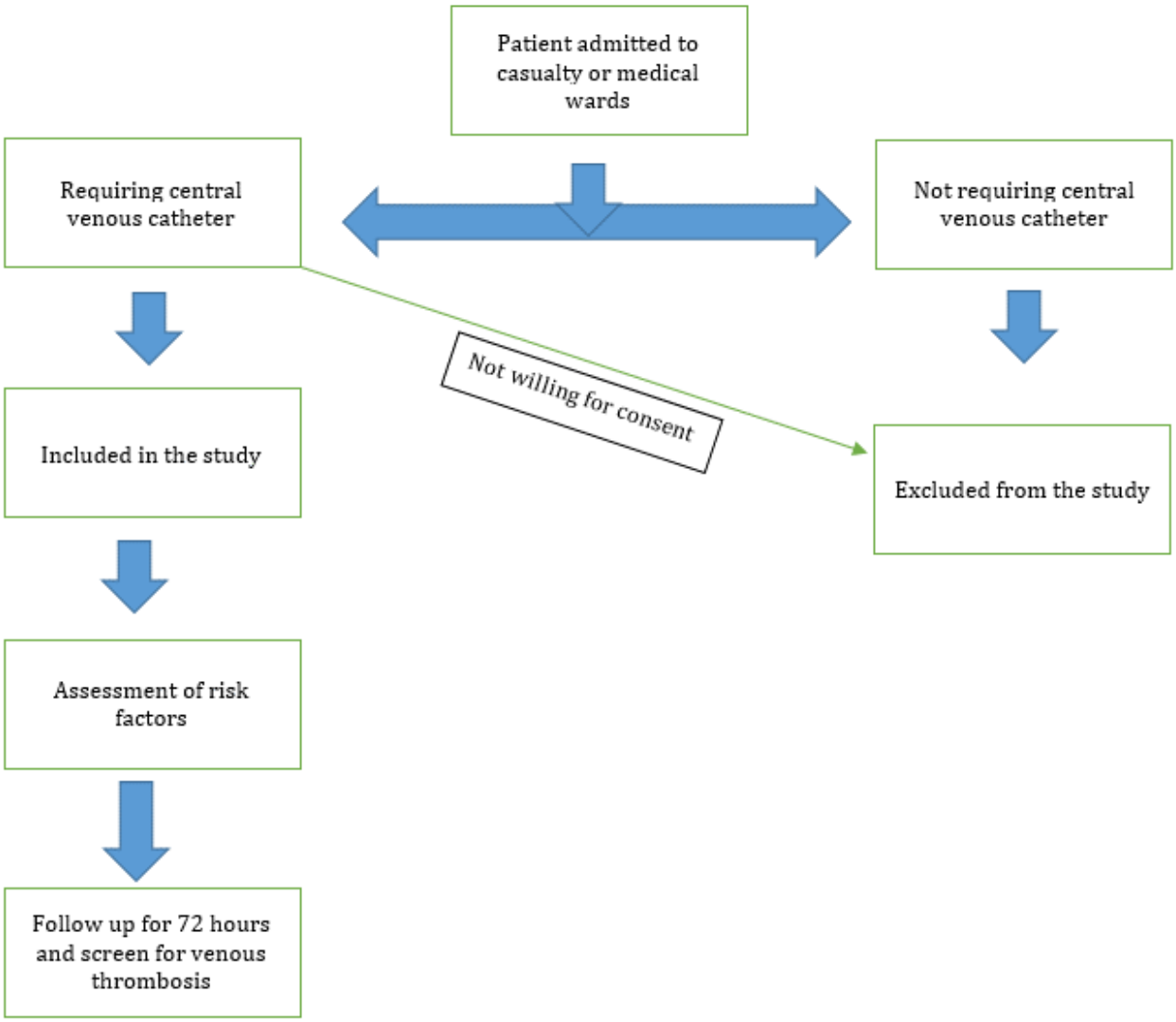
consent was taken from them. The consent was taken by the primary investigator or the physician performing the procedure. The data was collected only after consent was given by the primary investigator or the treating physician. A well-defined and written proforma was used to document the details of the procedure including the technique used, aids while performing the procedure, complications during the procedure and investigations / lab results as indicated based on the site of central line insertion chosen. The patients were then followed up for 24 hours where an ultrasound screening of the vein was performed to assess for thrombosis of the vein. The definitions mentioned below were explained to the data collectors prior to data collection to maintain accurate and uniform collection of data.

If the patient had required a second central line subsequently then he/she could be recruited into the study.

If the patient had required a second central line to be inserted on the same side hemithorax as may occur in cannulating an internal jugular vein with a subclavian already cannulated, then the patient could be recruited provided there were no complications documented while insertion of the previous line.

The study methodology was evaluated and approved by the institution review board (IRB Min No: 10022 [OBSERV] dated 04.04.2016)

The overall algorithm for the study methodology is depicted below:



Flowchart 1: Study methodology

DEFINITIONS

Elective procedure: if need for central venous catheter was planned. Eg: need for prolonged antibiotics, hypertonic fluids

Emergency procedure: if need for central venous catheter was not planned for and requirement essential for immediate use for treatment. Eg: cardiogenic shock, septic shock

Body mass index: defined as the body mass by kilograms divided by the square of the body height in meters.

Anatomical disorder: defined as unexpected deformation of an anatomical structure. Eg: enlarged thyroid, asymmetric chest wall

Experienced physician: if the physician has completed two months training in an intensive care unit or completed at least 15 central venous catheter insertions without assistance.

Ultrasound guided central venous catheter insertion: if a sonological device was used to aid in either localization for surface marking or real-time insertion of central venous catheter

Positioning of the patient: patient is positioned in given anatomical position to aid insertion of central venous catheter with minimal complications.

Adequate analgesia: patient in given either local or intravenous medication to alleviate pain during the procedure which results in full cooperation of the patient during the procedure

Attempts of catheterisation: number of times needle had to be reintroduced before cannulation of the vein.

Prior catheterisation: if the central vein chosen had a previous central line insertion within the last one month

Required assistance: requirement of assistance in performing the procedure or procedure was performed by senior physician.

Coagulation disorder: platelet count less than 50,000/cumm, prothrombin time > 1.6 of normal range, partial thromboplastin time > 2 times of the normal range

Hematoma: swelling equal to or more than 5 cm in largest diameter at site of insertion with or without blood discharge from site within 24 hours which was not present prior to attempted CVC line insertion visualized and measured by ultrasonography

Venous thrombosis: echogenic tissue visualized intraluminal in a cannulated vein which causes partial or complete obstruction to flow of blood as determined by ultrasonography

Pneumothorax: as confirmed by chest X-ray with absence of lung parenchymal markings on the affected side with visible lung border or as confirmed by CT or absence of lung sliding as seen on ultrasound

Hemothorax: as confirmed by fluid analysis of a new onset pleural effusion occurring following insertion of a central venous catheter on the same side whose hematocrit is two thirds of blood or as diagnosed by the treating physician

OUTCOME ASSESSMENT

Primary outcome

A. To identify risk factors for acute mechanical complications following central venous catheterisation
B. Prevalence of mechanical complications and identification of risk factors which contribute to them

Secondary outcome

A. Indications of central line placement for patients to a tertiary care centre
B. To know the prevalence of using ultrasound in performing central line procedures
C. Time taken for confirmation of correct central line placement following insertion

Sample size calculation

As per data from two studies, the prevalence of mechanical complications in their respective case series was between 12 to 18%. This was seen 80% of the time with 5% level of significance.

- Proportion of disease: 0.18
- Anticipated odds ratio: 2

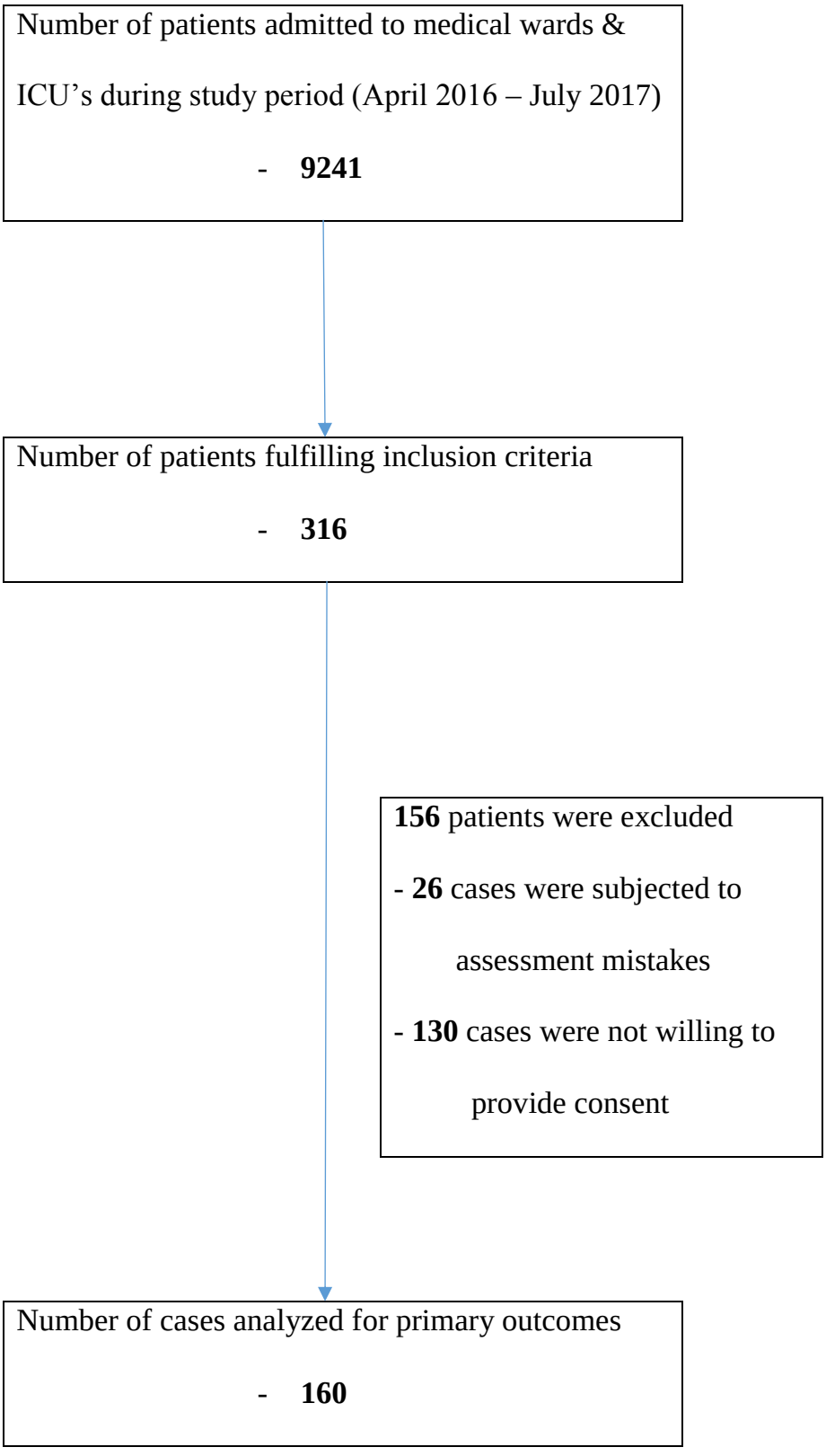
- Power (1-beta) %: 80
- Alpha error (%): 5
- 1 or 2 sided: 2
- Multiple correlation coefficient of the: 0.3
  exposure variable with the confounders:
- Required sample size: 218

Using this data, the sample size calculated for multiple logistic regression with an alpha error of 5% and beta error of 80% was calculated to be 218.

Patient Characteristics

From April 2016 to July 2017 a total of 9241 patients were admitted to medical units and intensive care units. Of them, 316 patients had fulfilled the inclusion criteria as mentioned earlier. 130 patients were subsequently excluded from the study because although they fulfilled the inclusion criteria they were not willing for consent. 26 patients were excluded as data collection with respect to assessment of complications were not as per protocol. Therefore a total of 160 patients were analyzed as shown in the figure below.

Flowchart 2: Patient Recruitment


Number of patients admitted to medical wards & ICU's during study period (April 2016 – July 2017)
- 9241
Number of patients fulfilling inclusion criteria
- 316
156 patients were excluded
- 26 cases were subjected to assessment mistakes
- 130 cases were not willing to provide consent
Number of cases analyzed for primary outcomes
- 160

RESULTS

Comparison of baseline characteristics

A total of 160 patients had central venous catheter insertions during the study period. Of these 137 (85.6%) were performed in ICU's and 23 (14.4%) were performed in medical wards.

The mean age in the cohort was 51 years with 58% male constitution in our cohort. The trend of age distribution was similar in wards and ICU setting. Male prevalence was higher in ICU's than in ward (61% vs 40%).

93 (58.1%) of the participants were male while 69 (41.9%) were female in our cohort.

In our cohort, we found that 139 (86.9%) were elective insertions were 21 (13.1%) of CVC line insertion were as an emergency. A larger percentage of lines were inserted in wards as compared to ICU's (27% vs 11%).

The most frequent indications for central line insertions were for administration of drugs in 87 (54.4%) while requirement for inotropic supports were in 35 (21.9%). In 22 (13.8%) patients, central line was indicated for both drug and inotropic administration. In 16 (10%) indications were for indications such as central venous pressure measurement,

parenteral nutrition and frequent blood sampling. In wards, insertion for administration of drugs was high (70%) as compared to ICU's (51%).

Some of the indications categorized as others was for purposes such as insertion for measurement of central venous pressure and nutritional supplementation.

The average time taken for insertion of central line as previously defined was more than 10 minutes in 80% of our cohort. This trend was similar in both ward and ICU setting with 20% completing line insertion between 5-10 minutes.

Table 3: Patient Characteristics at Baseline

Characteristic	Total	Wards	Intensive Care Unit	p – value*
Number of CVC (%)	160 (100%)	23 (14.4%)	137 (85.6%)	0.314
Age (mean years)	51 ± 16	53.3 (±14)	49.2 (±16)	0.468
Male (%)	93 (58.1%)	9 (40%)	84 (61%)	0.391
Setting: (%)				0.064
- Elective	139 (86.9%)	17 (73%)	122 (89 %)	
- Emergency	21 (13.1%)	6 (27%)	15 (11%)	
Time for Insertion				0.442
- 1- 5 mins	1 (0.7%)	0 (0%)	1 (0.7%)	
- 5-10 mins	29 (19.3%)	5 (22.8%)	24 (19%)	
- 10 or more	120 (80%)	18 (79.3%)	102 (80.3%)	
Indication: (%)				3.80
- Drugs	87 (54.4%)	16 (70%)	71 (51%)	
- Inotropes	35 (21.9%)	3 (13%)	32 (23%)	
- Both	22 (13.8%)	1 (4%)	21 (15%)	
- Others	16 (10%)	3 (13%)	13 (11%)	

Characteristics of Central Line Insertion Setting

The number of patients who were on mechanical ventilator during the procedure were 96 (60%) while the remaining 64 (40%) were either on non-invasive or other oxygen assist devices. A higher percentage of patients in ICU were on ventilators as compared to ward (67% vs 13%).

Of the 160 patients in the study more than 95% of patients had received adequate analgesia prior to procedure. In ICU's near 100% of patients had adequate analgesia.

Of the 96 patients who received mechanical ventilation, 63 patients had data available regarding ventilatory parameters. 35% of the cohort predominantly from the ICU group had a high PEEP as defined previously during time of the line insertion. None of the patients from ward had a high PEEP during line insertion.

Of the 160 patients, 41 (25.6) patients already had a central line at the time of study central line insertion. The indication for central line in these patients were suspected line induced infection, nonfunctioning central line and line change in view of prolonged medication.

The number of central lines inserted by 'experienced' individual as previously defined were 101 (63.1%) of the cohort. Of the remaining 59 patients whom had central line

inserted, 26 (44.1%) of them required assistance. This translates into 16.3% of the cohort requiring assistance for central line insertion.

The preferred line for insertion in our cohort was left internal jugular vein (40%) followed by right internal jugular vein (25.2%) and right femoral vein (16.5%). Left internal jugular vein was the most preferred line in ward and ICU. Femoral vein cannulation was higher in ward than ICU setting (30% vs 15%).

Table 4: Characteristics of Central Line Insertion Setting

Characteristics	Total	Wards	Intensive Care Unit	p- value
Mechanical Ventilation (%)	96 (60%)	3 (13%)	93 (67%)	6.909
Adequate analgesia (%)	153 (95.6%)	18 (78%)	135 (98%)	0.167
High PEEP (%)	22 (34.9%)	0 (0%)	22 (34.9%)	0.884
Central Line In-situ (%)	41 (30.6)	0 (0%)	41 (30.6%)	4.160
Experienced operator insertion (%)	101 (63.1%)	16 (70%)	85 (62%)	1.277
Location:				31.59
- Right internal jugular V.	64 (40%)	10 (39.1%)	54 (38.7%)	
- Left internal jugular V.	41 (25.2%)	5 (21.7%)	36 (25.6%)	
- Right subclavian vein	16 (9%)	1 (4.4%)	15 (10.9%)	
- Left subclavian vein	5 (3.1%)	0 (0%)	5 (3.7%)	
- Right femoral vein	28 (16.5%)	7 (30.4%)	21 (15.3%)	
- Left femoral vein	10 (6.2%)	1 (4.4%)	8 (5.8%)	

Comparison of baseline laboratory results at the time of insertion

Anemia as defined by WHO had already been defined previously. Review of laboratory results revealed 15% of our cohort did not have anemia at the time of line insertion. While 60% of our cohort had moderate anemia at the time of study, 10% had severe anemia with similar distribution in ward and ICU's.

35 (22.5%) of the cohort had thrombocytopenia as defined previously. All of the patients came from the ICU cohort with none of the patients in ward having thrombocytopenia.

60 (40.4%) of the cohort had renal failure. 50% of patient from ward had a renal failure while 38% of patients from ICU had renal failure.

The total number of patients who were coagulopathic were 133 (83%). The number of coagulopathic patients in ICU and ward who had underwent central venous catheter insertion were 110 (83%) and 23 (17%) respectively

Table 5: Characteristics of Baseline Laboratory Results

Characteristic	Total	Ward	Intensive Care Unit	p-value
Normal	25 (15.6%)	3 (13.1%)	22 (16.1%)	
Anemia: (%)				0.389
- Mild	20 (12.5%)	5 (21.7%)	15 (10.9%)	
- Moderate	96 (60%)	12 (52.1%)	83 (60.6%)	
- Severe	19 (11.9%)	3 (13.1%)	17 (12.4%)	
Thrombocytopenia (%)	96 (60.8%)	8 (38.1%)	88 (64%)	0.290
Renal Failure (%)	63 (40.4%)	11 (50%)	52 (37.9%)	0.728
Coagulopathy (%)	92 (57.5%)	11 (47.8%)	81 (59.1%)	0.868

Procedure-related events

The number of central lines which were successful at the first intended location were 156 (97.5%). 4 (2.5%) were abandoned and required change of location. The most common cause for change of location was inability to cannulate the vein. The most common cause for change of location was inability to cannulate the vein due to faulty procedural technique.

13.2% of the lines inserted in our cohort were required as an emergency with a higher prevalence in ward than in ICU's (27% vs 11%).

86.8% of the lines were elective line insertions, majority of them were done in ICU compared to ward (89% vs 73%).

Median number of attempts less than 5 for central line insertion was 90%(144) and 9.2% (14) required more than 7 attempts for line insertion.

The number of patients appropriately positioned assessed prior to insertion of central line were 83.8% (134). Patients were adequately positioned in only 73.9% in ward as compared to 85.4% in ICU's.

The number of patients who had the central venous catheter inserted under ultrasound guidance were 122 (76.2%). A higher percentage of patients in ICU had central line insertion done under ultrasound guidance compared to ward (80.2% vs 47.8%)

The number of procedures where the primary physician required assistance for insertion of central venous catheter were 16.3% (26).

The number of central venous catheters inserted where chest radiograph was required to confirm position were 121 (75.6%)

Position of central line was confirmed within 5 hours of line insertion in 60% of our cohort. While position of nearly 65% of lines inserted in ICU were confirmed within 5 hours, 60% of lines inserted in ward took more than 5 hours to confirm the same. Among the remaining central lines, most of which were at the femoral site not requiring a chest X-ray.

Table 6: Comparison of Procedure Related Events

Characteristics	Total	Ward	Intensive Care Unit	p- value
Successful 1st attempt	156 (97.5%)	22 (95.6%)	134 (97.8%)	NA
Emergency lines	21 (13.2%)	6 (27%)	15 (11%)	0.088
Elective lines	139 (86.8%)	17 (73%)	122 (89%)	0.312
Number of attempts less than 5	144 (90%)	18 (78.2%)	126 (92.4%)	0.0007
Adequate positioning	134 (83.8%)	17 (73.9%)	117 (85.4)	0.014
Ultrasound guided	121 (75.6%)	11 (47.8%)	110 (80.2%)	0.954
Required assistance	26 (16.3%)	5 (21.7%)	21 (15.3%)	0.605
X-ray required	121 (75.6%)	14 (60.8%)	107 (78.1%)	NA

Characteristics	Total	Ward	Intensive Care Unit	p- value
Time to confirm line				NA
-less than 1 hour	8 (7.4%)	1 (7.9%)	7 (7.4%)	
- 1 to 3 hours	25 (23.2%)	3 (23%)	22 (23.2%)	
- 3 to 5 hours	32 (29.7%)	1 (7.6%)	31 (32.6%)	
- more than 5 hours	43 (39.7%)	8 (61.8%)	35 (36.8%)	

Analysis of complications

The prevalence of complications occurred in 57 patients which accounted for 35.6% of our cohort. The most common of which was catheter malposition, local bleeding and local hematoma which together accounted for 65% of all complications.

The percentage of patients who developed complications of local bleeding as defined were 19.4% (31). 26% of patients had local bleeding in ward as compared to 18.3% from ICU. However, none of these patients had sever bleeding requiring blood transfusion or was associated with a drop-in hemoglobin.

The percentage of patients who developed complications of local hematoma as defined previously were 11.9% (19) with 34% of ward lines developing hematomas as compared to 8% from ICU's. None of these patients required any intervention such as product support.

The percentage of patients who had an arterial puncture during insertion of central venous catheter were 6.3% (10) with a slightly higher prevalence among ward inserted lines compared to ICU's (8.7% vs 5.9%)

The percentage of patients who on assessment with chest radiograph had central venous catheter migration were 5.7% (7) which were similar between lines inserted in both ward and ICU.

The percentage of patients who on assessment with chest radiograph had central venous catheter malposition were 33.6% (54)

The percentage of patients who had developed complication of pneumothorax as complication of central venous catheter were 1.3% (2) both of which had occurred in ICU.

The percentage of patients who had developed hemothorax as complication of central venous catheter insertion was 0.6% (1), the one case occurring in ICU.

The percentage of patients who had developed venous thrombosis which was evident at 24 hours following insertion was 0.6% (1), the one case which occurred in ward.

Table 7: Analysis of Complications

Characteristics	Total	Ward	Intensive Care Unit
Local bleeding	31 (19.4%)	6 (26%)	25 (18.3%)
Local hematoma	19 (11.9%)	8 (34.7%)	11 (8.0%)
Arterial puncture	10 (6.3%)	2 (8.7%)	8 (5.9%)
Catheter migration	7 (4.4%)	1 (4.35%)	6 (4.4%)
Catheter malposition	54 (33.8%)	6 (26%)	48 (35%)
Pneumothorax	2 (1.3%)	0 (0%)	2 (1.5%)
Hemothorax	1 (0.6%)	0 (0%)	1 (0.73%)
Venous thrombosis	1 (0.6%)	1 (4.4%)	0 (0%)

DISCUSSION

Central line insertion is a common and often essential intervention in hospitals around the globe. Its use for administration of life saving drugs and other medications allow for appropriate management of patients particularly the critically-ill. However, complications due to central line insertion are a major drawback. Infections due to prolonged use of central lines or poor catheter care can lead to hospital acquired infections and increase the hospital cost and stay as a result of this. Mechanical complications though often which occur during the time of catheter insertion, have drastically reduced over the last few decades due to better practices and safer techniques. However, they too have the potential to lead to similar complications that can affect patient care and prolong hospital stay.

Mechanical complications due to central line insertions have been studied before with many factors relating to patient body habitus to comorbidities and operator experience being the most important factors influencing outcome. The hospital where the study is conducted is a tertiary care medical school and a referral center for the district it serves. Hence there is a mix of trainees and physicians of varying experience level who perform these procedures. Also, it being a referral center means that both non-critical and critically ill patients are admitted and an assessment of the prevalence and factors which affect outcome of complications due to central lines are essential.

The cohort of patients in this study are patients admitted to medical wards and medical ICU's who require a CVC insertion for various indications at the discretion of the treating physician. Analysis of the baseline statistics revealed that a majority of the patients included in the cohort were from ICU than from wards. This however was not statistically significant to outcome of any complication. This observation implies that technical expertise of line insertion in wards and ICU's are similar though the setting maybe different. The average age and gender of the patients recruited were predominantly from the 40-60 age group and males respectively. The average time taken for line insertion was 10-20 minutes in 80% of the cohort. Nearly 20% of the remaining lines were inserted within 5-10 minutes however this was not associated with any statistical significance. Analysis of the indications for central line insertion revealed that administration of medication was the most common cause among the cohort. In ward, administration of drugs far exceeded the other indications with measurement of CVP and inotropic supplementation being the other indications. In ICU however, line insertion for administration for inotropes was much higher as expected in critically ill patients and this was reflected as expected in our data. Most of the lines placed in ICU in our cohort were for replacement of a previous inserted central line or change in position of line due to various reasons as judged by the treating physician. This maybe the reason why indications for CVC in the ICU cohort has a smaller prevalence for inotropic requirement than would be expected. Analysis of association between indication for the central lines with complications however were not statistically significant.

Analysis of data pertaining to setting in which central line was inserted revealed that a large cohort of patients whom were on ventilator as expected were from ICU. Ventilator settings of the patients were available for 63 of the 96 patients. We had previously reviewed that elevated intrathoracic pressure results in expansion of the pleura thereby placing the individual at risk for complications while introduction of the stiletto. Analysis of data classifying patients to have a high PEEP when settings were at or greater than 8 cmH2O were taken as high. It was observed that nearly 35% of patients requiring ventilation had a high PEEP during line insertion with all the cases coming from ICU admissions. However, during analysis to check for association with complications it was not found to be statistically significant. It may however be worth mentioning that the two cases of pneumothorax had occurred in this group. Level of analgesia for the cohort was assessed and only 80% of patients in the ward had received adequate analgesia. This could have been explained by the reasoning that ward had more emergency central lines than ICU. Analysis however did not reveal any statistically significant association with complications. Experience of the technician as previously defined were also analyzed which did not show any statistically significant association with complications. This can be explained due to many reasons. One reason maybe that despite the line being inserted by an inexperienced person, supervision of the line insertion as is common and mandatory would have occurred. The second reason is that the definition of ‘experienced’ operator is very stringent and therefore even junior physicians would have a high success rate. Common sites chosen for central vein cannulation were also assessed. We had found that the right internal jugular vein was the preferred site for central line insertion in both

ward and ICU. Neck lines are preferred over femoral vein due to less incidence of infection and that it does not prohibit ambulation. Neck lines are preferred over subclavian vein cannulation especially in coagulopathic patients as in the inadvertent event of puncture of the subclavian artery, compression of the punctured vessel is not possible however subclavian lines are the most comfortable for patients and are associated with a low rate of infection. It was also noticed that prevalence of femoral vein cannulation was higher in ward setting than in ICU. This is probable due to the fact that more emergency line insertions in the cohort were performed in ward and operator convenience. Statistical analysis for association between location of central vein cannulation and complications were not statistically significant to identify any risk factor.

Laboratory characteristics of the patients were also analyzed to identify any risk factors associated with complications. Anemia was the most common hematological abnormality witnessed in our cohort. About 85% of our cohort had anemia of varying severity with similar prevalence in ward and ICU. Further classification of anemia revealed a higher prevalence of moderate anemia in the ICU group probably related to the underlying illness for which they were admitted. Thrombocytopenia was present in 22.5% of our cohort with all representative patients from the subgroup from ICU. The cause of thrombocytopenia in these patients were varied with etiologies from infections like dengue, scrub typhus, sepsis, etc. to hematological disease like leukemias and myelodysplastic disorders. Thrombocytopenia is a common risk factor that predisposes to bleeding and previous studies had revealed a high prevalence of complications like

bleeding and hematoma formation. However, statistical analysis did not find any statistically significant association. This is probably due to the fact that most patients with a severe thrombocytopenia may have received platelet transfusion prior to line insertion which is a protocol followed in our hospital. Another possible explanation is that platelet count between 20,000-50,000 /cumm may not present with bleed if insertion line insertion is done by an experienced operator with adequate positioning and minimal attempts which was observed during the course of the study. We had also found that nearly 60% of our cohort had been coagulopathic thereby predisposing them to complications of bleeding and hematomas during the procedure with a higher prevalence in ICU's compared to wards (59% vs 47%). Surprisingly however statistical analysis did not find any positive correlation. This can be explained by the fact that most patients whom were coagulopathic undergoing any intervention including central line procedure could have received product support which was not taken into account in this study. There is also the possibility that complications may occur in patients with a severe coagulopathy with evidence of other sites of clinical bleed which were not assessed in this study.

Analysis of procedure related events showed that 97.5% of the lines inserted with the primary site intended and a total of 4 lines required change of position. The most common reason was difficulty in cannulating the vessel. Most of the lines assessed in the study were elective lines which accounted for 87% while 13% were inserted as an emergency. Most of the emergency lines were performed in ward as compared to ICU

(27% vs 11%) due to sudden deterioration of the patient or unexpected complications whereas patients admitted to ICU are commonly stabilized prior to transferring and would require a CVC line insertion done outside the ICU. One of the other risk factors which previous data had shown to strongly correlate with complications was attempts at insertion of central line. Our analysis had shown that patients who had more than 5 attempts at insertion of line had a strong association with complications particularly bleeding and hematoma formation ($p = 0.0007$). The most common reason for multiple attempts is failure to cannulate or catheterize the vein and inexperience of the operator. Appropriate positioning of the patient was also assessed at the time of line insertion with 83% of our cohort being done adequately. We had found that patients in ward had a lower prevalence of this as compared to ICU (74% vs 85%). Statistical analysis had shown that inappropriate positioning was associated with complications. Ultrasound visualization is a common technique used to improve success rate and reduce the number of attempts. We had found that the use of USG guided CVC insertion in wards was very low as compared to ICU's. Statistical analysis to check association with complications was not significant and this can be explained by the use of USG guidance commonly by inexperienced individuals and that most of the lines done without USG were by experienced operators.

Our study had identified the most common mechanical complications that occurred were catheter malposition and hemostatic complications. Among them, local bleeding and hematoma formation were the most common. However, it is to be noted that most of

these complications were conservatively managed and did not pose any direct life risk to the patient. Other life threatening complications like pneumothorax, hemothorax and venous thrombosis were rare.

Among the factors found to be associated with mechanical complications, the total number of attempts at insertion of the line and inadequate positioning of the patient were found to be associated with mechanical complications.

The most common indication for central line insertion was for drug administration in both ward and ICU with a higher number in ICU's also requiring lines for inotrope administration. The use of ultrasound to assist in insertion of central line was found to be high in our study, however more than half of central lines inserted in ward were without the assistance of USG. We had also found that nearly 60% of our cohort had the line position confirmed within 5 hours of line insertion. Further analysis revealed that in ward 60% of the line positions could be confirmed after more than 5 hours which is an area for improvement.

Figure 1: Indication for Central Line

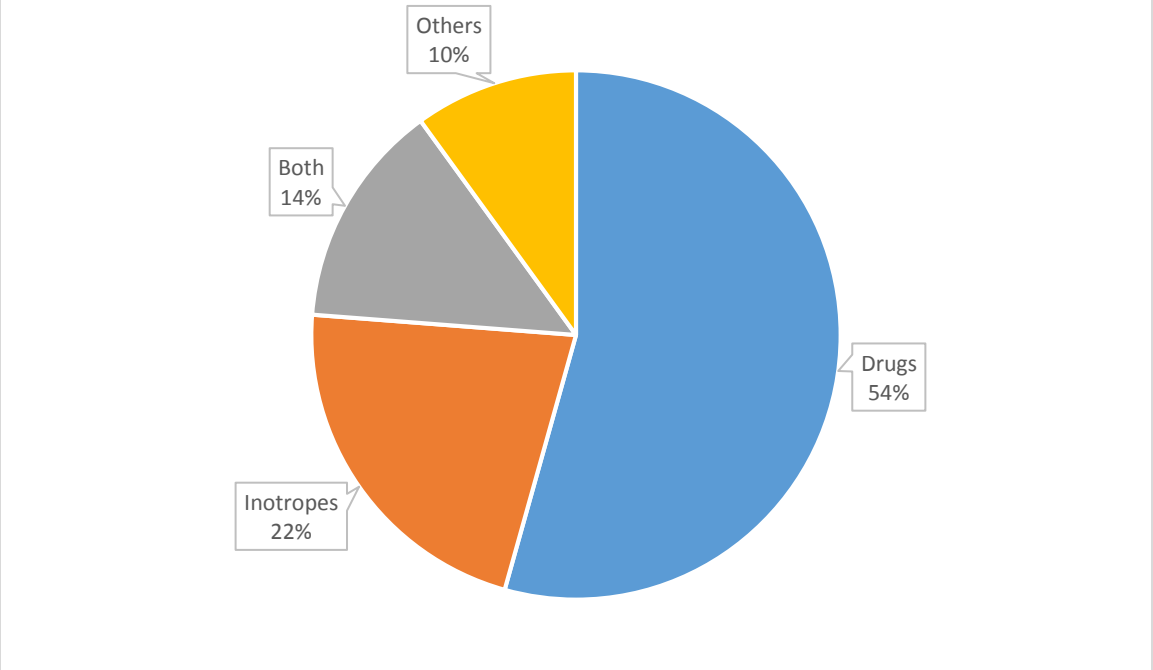
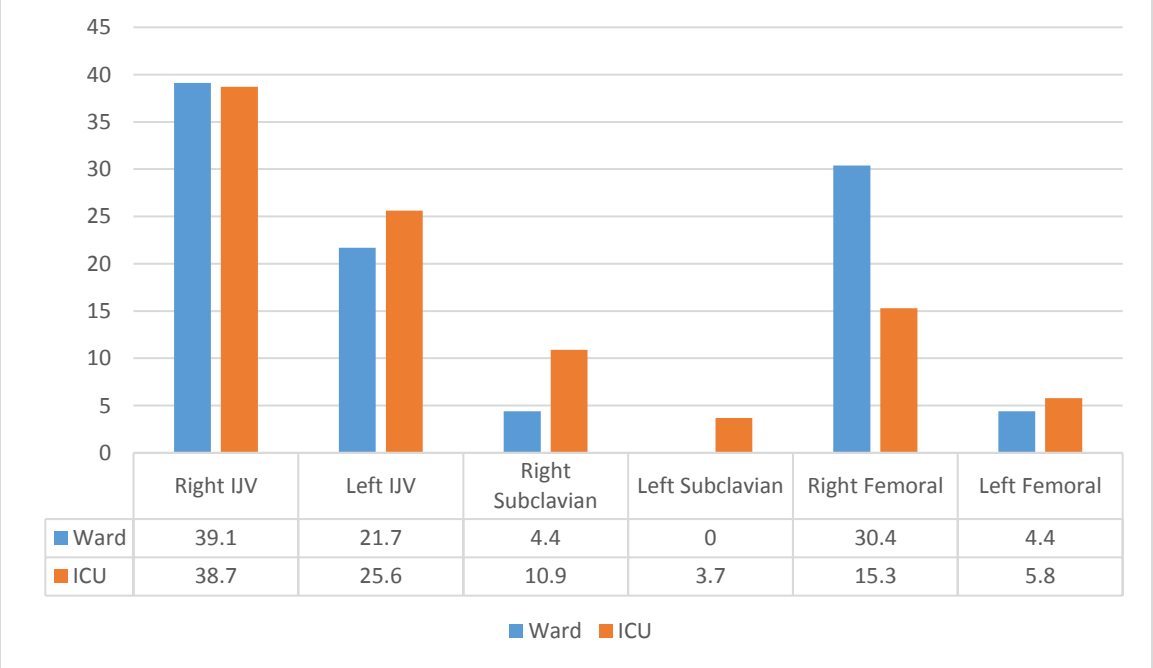


*Figure 2: Location of Central Line**



	Right IJV	Left IJV	Right Subclavian	Left Subclavian	Right Femoral	Left Femoral
Ward	39.1	21.7	4.4	0	30.4	4.4
ICU	38.7	25.6	10.9	3.7	15.3	5.8

*values expressed in percentages

Figure 3: Time to Confirm Line Position

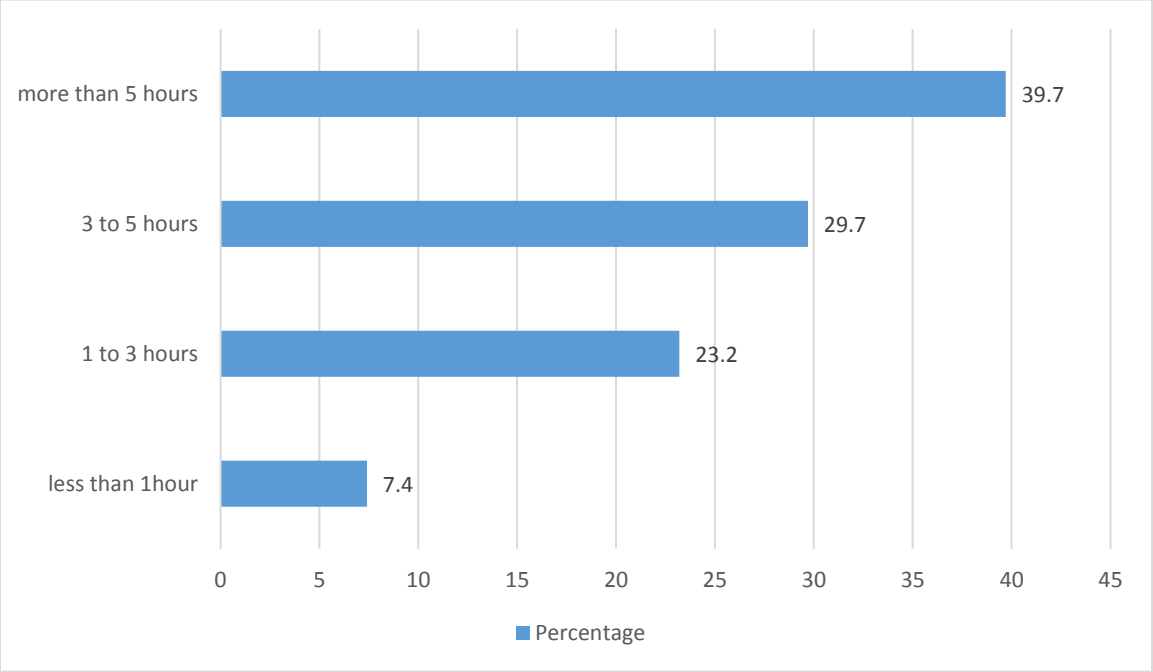
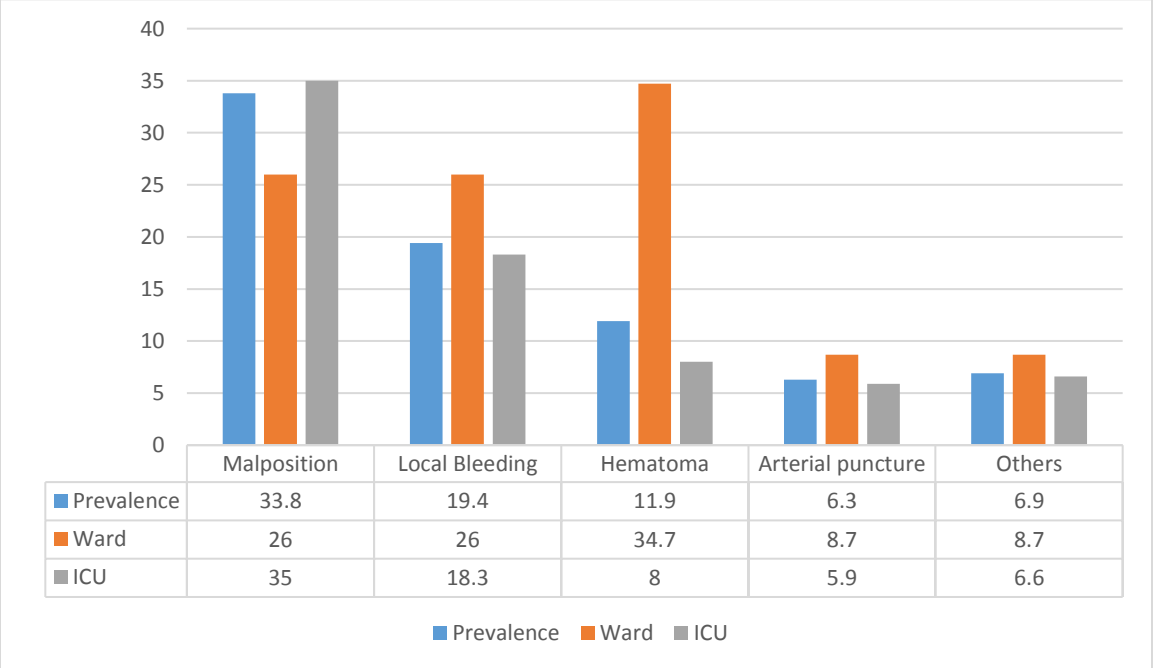


*Figure 4: Prevalence of Complication**



	Malposition	Local Bleeding	Hematoma	Arterial puncture	Others
Prevalence	33.8	19.4	11.9	6.3	6.9
Ward	26	26	34.7	8.7	8.7
ICU	35	18.3	8	5.9	6.6

*values expressed in percentages

LIMITATIONS

The calculated sample size was a total of 220 patients from medical wards and intensive care units. The total cases that were recruited were 160 cases. Hence conclusions have been concluded based on analysis of data available and knowledge of the fact that the study is underpowered at this time.

A re-analysis after achieving the required sample size may provide greater insight and understanding of the true incidence of complications and factors associated with them.

The cohort included patients from medical wards and intensive care units. Blinding of the physician performing the procedure could have been done to avoid bias.

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ANNEXURES

Information Sheet

CONSENT TO PARTICIPATE IN OBSERVATIONAL STUDY OF RISK FACTORS FOR CENTRAL VENOUS CATHETERISATION

தகவல்கள் அளிக்கப்பட்ட இந்த ஒப்புதலானது மத்திய சிரை நாளங்களுக்குள் சிலாகை ஏற்றுதலின் (கத்தீட்ரைசேஷன்) போது ஏற்படும் உடனடி சிக்கல்களை கணிப்பதற்கான ஆய்வில் பங்கேற்க பதிவு செய்பவர்களுக்கானது.

தகவல் ஒப்புதல் படிவம் இரண்டு பாகங்களை கொண்டது:

1) தகவல் படிவம் (ஆய்வு பற்றிய தகவல்களை உங்களுடன் பகிர்ந்துகொள்ள)
2) ஒப்புதல் சான்றிதழ் (பங்கேற்க நீங்கள் ஒப்புக்கொள்ளும் பொருட்டு கையெழுத்திடுவதற்காக)

பாகம் 1: தகவல் படிவம்:
நான் வேலூர் கிறிஸ்டியன் மருத்துவமனையில் பணிபுரிகிறேன். இரத்த நாளங்களுக்குள் சிலாகை ஏற்றும்பொழுது ஏற்படும் பிரச்சினைகள் குறித்த ஆய்வில் நாங்கள் ஈடுபட்டுள்ளோம். அது குறித்த தகவல்களை நான் உங்களுக்கு அளித்து அதில் பங்குபெற உங்களை வரவேற்கிறேன். இந்த ஆய்வில் பங்கு பெற நீங்கள் பதிவு செய்து கொள்ளலாம் அல்லது விலகிக்கொள்ளலாம். நீங்கள் முடிவெடுக்கும் முன் நீங்கள் இணக்கமாக உணருகிற ஒருவருடன் இந்த ஆய்வு குறித்து கலந்துரையாடலாம். இதில் எழுதப்பட்டவைகள் அல்லது அளிக்கப்பட்ட விளக்கங்கள் உங்களுக்கு புரியவில்லை என்றால் கருணைகூர்ந்து என்னை கேட்கவும். நான் உங்களுக்கு மறுபடியும் அது பற்றி விளக்க நேரம் செலவிடுவேன். இதன் பிறகு உங்களுக்கு ஏதேனும் கேள்விகள் இருக்குமானால் நீங்கள் என்னை அணுகலாம். நான் உங்களுக்கு விளக்கமளிப்பேன்.

ஆய்வின் நோக்கம்:
உங்களுக்கோ அல்லது உங்கள் உறவினருக்கோ, மருத்துவரின் தீர்மானத்தின் படி, இரத்த நாளங்களுக்குள் சென்றடைய வேண்டிய அடுத்த நிலை சிகிச்சை தேவைப்படுகிறது. இந்த நடைமுறையானது, மார்பு அடிவயிறு அல்லது கழுத்தில் வைக்கப்பட்ட ஒரு சிறிய குழாய் மூலம் மருந்துகளை அளித்து சிகிச்சை அளிப்பதில் அவருக்கு உதவுவதாகும். இந்த செய்முறையின் போது இயக்க முறை பிரச்சினைகள் மிக அரிதாகவே நேர்கிறது. அதிக சிக்கலை உருவாக்கக்கூடிய ஆபத்து காரணிகளை கண்டறிவதே இந்த ஆய்வின் நோக்கம்

ஆய்வு குறுக்கீடுகளின் வகை:
உங்கள் மருத்துவ பதிவேடுகளிலிருந்து தகவல்களும் செய்முறை விபரங்களும் இந்த ஆய்வில் சேகரிக்கப்படும். சிகிச்சை அளிக்கும் மருத்துவரால் பரிந்துரைக்கப்பட்ட சிகிச்சையில்--- செய்முறைகளில் அல்லது மருந்துகளில் – எந்த மாற்றமும் இருக்காது. இந்த தகவல் சேகரிப்பு எந்த விதத்திலும் உங்களது அல்லது உங்கள் உறவினரு ஆரோக்கியத்திற்கோ அல்லது சிகிச்சைக்கோ ஊறு விளைவிக்காது.

பங்கு பெறுவோரை தேர்வு செய்தல்:
இரத்த நாளங்களில் சிலாகை ஏற்றம் தேவைப்படும் எந்த ஒருவருக்கும் நாங்கள் அழைப்பு விடுக்கிறோம்.

தன்னார்வ பங்கேற்பு:
இந்த ஆய்வில் உங்கள் பங்கேற்பானது முற்றிலும் தன்னார்வம் கொண்டது. இதில் பங்கேற்பதும், பங்கேற்காமல் இருப்பதும் உங்கள் விருப்பம். நீங்கள் பங்கேற்க விரும்பினாலும் இல்லாவிட்டாலும் அனைத்து சேவைகளும் உங்களுக்கு வழங்கப்படும் அதில் ஒரு மாற்றமும் இருக்காது. பிறகு மனதை மாற்றிக்கொண்டு அதன் பின்னர் நீங்கள் பங்குபெற விரும்பவில்லை என்றாலும் அவ்வாறே செய்யலாம்.

இந்த ஆய்வில் பங்குபெறுவதில் உள்ள நன்மைகளும் ஆபத்துகளும்:
இது ஒரு கண்காணிப்பு வகையிலான ஆய்வு என்பதால் இதில் பங்கெடுப்பதில் உங்களுக்கு குறிப்பிட்ட எந்த விதமான ஆபத்துக்களும் நேரப்போவதில்லை. மற்றும் இதனால் உங்களுக்கு எந்தவிதமான உடனடி நன்மைகளும் நேரப்போவதில்லை. இருப்பினும் இந்த ஆய்வின் மூலம் பெறப்படும் தகவல்கள் மேம்பட்ட பாதுகாப்புடன் இந்த முறையை மேற்கொள்ள மருத்துவர்களுக்கு எதிர்காலத்தில் உதவிகரமாக இருக்கும்.

இந்த ஆய்வில் ஈடுபடுவதற்கான செலவினங்களும் இழப்பீடுகளும்:
உங்களின் சிகிச்சை இந்த மருத்துவமனை மருத்துவரின் வழமையான நடைமுறையில் அமையும். இந்த ஆய்வில் பங்கு பெறுவதற்கு உங்களுக்கு பணம் எதுவும் வழங்கப்படாது. இது ஒரு கண்காணிப்பு வகையிலான ஆய்வு என்ற காரணத்தினால் இந்த நடைமுறையின் போது ஏற்படும் எந்த ஒரு சிக்கலுக்கும் இழப்பீடு வழங்கப்படமாட்டாது.

தகவல்களின் இரகசிய காப்பு / மருத்துவ பதிவேடுகளை அணுகுதல்:
இந்த ஒப்புதல் படிவத்தில் கையெழுத்திடுவதன் மூலம் ஆய்வு மருத்துவரையும் அவரின் மருத்துவ அதிகாரிகளையும் இந்த ஆய்வுக்காக உங்கள் மருத்துவ பதிவேடுகளை பெற்றுக்கொள்ளவும் பயன்படுத்துவதற்கும் அனுமதியளிக்கிறீர்கள். இந்த ஆய்வின் முடிவுகள் மருத்துவ வெளியீடுகளில் இடம்பெறும் ஆனால் அவற்றில் நீங்கள் அடையாளம் காட்டப்படமாட்டீர்கள்.

यह सूचित सहमती पत्र उन प्रतिभागियों के लिए है जिन्होंने सेंट्रल वेनस कैथिटराईज़ेशन के दौरान तुरंत होने वाली जटिलताओं जैसिम का मूल्यांकन करने वाले अध्ययन अध्यन के लिए अपना नामांकन दिया है सूचित सहमती पत्र के दो भाग है

1. जानकारी पत्र (शोध की जानकारी आपसे साझा करने हेतु)
2. सहमती का प्रमाण पत्र (यदि आप हिस्सा लेना चाहते है तो हस्ताक्षर के लिए)

भाग -1 जानकारी पत्र

मैं क्रिस्चियन मेडिकल कॉलेज, वेल्लोर में कार्यरत हूँ। हम सेंट्रल वेनस कैथिटराईज़ेशन के बाद होने वाली जटिलताओं का अध्ययन कर रहे है। मैं आपको जानकारी देने के साथ-साथ इस शोध में हिस्सा लेने के लिए आमंत्रित करता हूँ। आप अध्ययन में नामांकन करें या नहीं करें का निर्णय ले सकते है। निर्णय लेने से पहले आप इस अध्ययन के विषय में आपको जो भी व्यक्ति उचित लगे उससे बात कर सकते है। यदि आपको लिखा हुआ या जो आपको समझाया जा रहा है, वह समझ नहीं आ रहा है तो कृपया मुझे पूछे, मैं इसे आपको दोबारा समझाने का प्रयास करूंगा। यदि आपको कोई प्रश्न है तो आप मुझ से बेझिझक मिल कर पूछ सकते है।

शोध का उद्देश्य
कई बार आपके संबंधी रोगी को डॉक्टर की सलाह पर आगे के उपचार के लिए सेंट्रल वेनस तक पहुँचने की आवश्यकता होती है। इस प्रक्रिया में एक छोटी नली को छाती, उस्फेजिया गले में लगाया जाता है जिससे की उसके उपचार के लिए दवा दी जा सके। कभी-कभार ही ऐसा होता है कि इस प्रक्रिया के दौरान कोई यांत्रिक जटिलता खड़ी हो जाए। इस शोध का उद्देश्य उन जोखिमों का पता लगाना है जिससे आगे चल कर समस्याएँ खड़ी हो सकती है।

शोध अन्तक्षेप का प्रकार

Data Collection Form

MECHANICAL COMPLICATIONS FOLLOWING CV CATHETER INSERTION

Proforma ver 1 **Consent Signed: Y / N**

Name: _____ Age: _____ Sex: M / F

Hospital No.: _____ Ward: _____

Date of Procedure: _____ Procedure: Elective ☐ Emergency ☐

Time of insertion: Start time _____ End Time _____

Patient Details

Height: _____ m Weight: _____ kg BMI: _____ kg/m^2

Clinical Diagnosis

Primary Diagnosis: _____

Secondary Diagnosis:

1. _____
2. _____
3. _____
4. _____

Reason for CV line insertion:

1. _____
2. _____

Patient Status: Awake ☐ Sedated ☐ Restless ☐ Intubated / Paralysed ☐

Chest wall / spine Abnormality: Y / N

Blood Parameters: Hb_____ Platelet _____ Creatinine _____

INR _____ aPTT _____

Previous CV line: Y / N If Y, Location: _____ Removed on: _____

Procedure-Related Events

S. No.		1st Location* _____	2nd Location* _____
1.	Successful	Y / N	Y / N
2.	No. of attempts**		
3.	Patient positioned	Y / N	Y / N
4.	Local Bleeding	Y / N	Y / N
5.	Local Hematoma	Y / N	Y / N
6.	Arterial Puncture	Y / N	Y / N
7.	Nerve Injury	Y / N	Y / N
8.	Thoracic Duct Injury***	Y / N	Y / N
9.	Catheter – migration	Y / N	Y / N
10.	Catheter Malposition	Y / N	Y / N
11.	Pneumothorax	Y / N	Y / N
12.	Hemothorax	Y / N	Y / N
13.	Ultrasound Guided Procedure	Y / N	Y / N
14.	Venous thrombosis	Y / N	Y / N
15.	Required assistance	Y / N	Y / N

Chest X-Ray: Y / N If Y, Date - _____ Time - _____

Position confirmed – Y / N

Complications within 24 hours

S. No.	Complication	Related to CV insert
1.		Y / N
2.		Y / N
3.		Y / N
4.		Y / N

Action taken if complication detected:

*Location – Right / Left Internal Jugular Vein - RIJV / LIJV

Right / Left Subclavian Vein - RSC / LSC

Right / Left Femoral Vein - RFV / LFV

**No. of attempts – Number of times needle re-introduced for cannulation

***Only with LIJV / Left Subclavian Insertion

Data Sheet

sno	age	sex	location	setting	tinsert	tdur	ht	wt	bmi	indi	status1	status2	data	fio2	peep	ps	hb	plt	creat	inr	aptt	line	exp	chestwall	loc1	attempt	position	bleed	hematoma	arterial	nerve	duct	usg	assist	migration	malpositio	pneumo	hemo	thromb
1	56	1	2	1	22	10	1.5	60	26.7	3	2	1	3				8	129000	1.47			1	1	1	2	1	2	1	1	1	1	2	1	1	1	1	1	3
2	78	2	2	1	12.2	40	1.5	55	22.6	4	1	1	3				9	186000	5.13	1.09	28	1	1	1	2	4	1	1	2	1	1	1	2	1	1	2	1	1	1
3	64	2	2	1	15.3	12				1	2	1	3				8.1	350000	4.94			1	1	1	2	7	1	1	2	1	1	1	1	1	3	3	1	1	3
4	76	1	1	1	15	10	1.5	48	20	1	2	2	2	40	8	15	8.8	248000	0.87	1.14	31.7	2	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1
5	59	1	1	1	14.12	15	1.5	48	20	3	2	2	1				10.7	273000	1.22	1.24	33.4	1	2	1	1	4	1	1	3	1	1	1	2	2	1	2	1	1	1
6	56	1	2	1	23.2	10	1.5	65	27.1	4	1	1	3				10.1	176000	1.03			1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	3
7	56	1	2	1	12	15	1.5	54	22.5	4	2	1	3				8.7	184000	1.89			1	1	1	1	3	1	1	1	1	1	1	2	1	1	2	1	1	3
8	35	2	1	2						3	2	2	1				5.3	74000	1.32	3.5	120	1	2	1	1	3	2	1	2	1	1	1	2	1	1	2	1	1	3
9	45	2	1	1	18	10	1.7	73	23.3	1	2	2	1				8.3	119000	1.55	2.19	83	1	1	1	5	1	2	1	1	1	1	1	2	1	3	3	3	3	1
10	65	2	1	1			1.8	80	23.4	1	2	2	2	30	6	10	10.2	191000	5.93			2	1	1	2	1	2	1	1	1	1	2	1	1	2	1	1	1
11	48	2	1	1	17.3	10	1.6	59	22.5	1	2	1	3				10.3	4000	8.03	1.39	41.5	1	3	1	5	1	2	1	1	1	1	3	2	1	3	3	3	3	1
12	42	2	1	1	13.3	30	1.6	55	21	2	2	1	3				7.1	5000	2.23	1.41	40.1	1	2	1	1	12	1	2	2	1	1	1	2	2	3	1	1	1	3
13	78	2	1	1	10.4	10	1.6	65	23	1	2	2	1				8.2	230000	1.03	1.46	30.7	2	2	1	2	1	1	1	1	1	1	1	2	1	1	2	1	1	1
14	22	1	1	1	11	15	1.5	46	19.9	1	2	2	1				6.4	14000	0.48	1.31	26.5	2	2	1	2	2	1	1	3	1	1	1	2	1	3	3	3	3	3
15	32	2	1	1	11.3	15	1.6	58	22.7	1	2	1	3				8	40000	0.77	1.28	44.2	1	1	1	5	1	2	1	1	1	1	1	2	1	3	3	3	3	3
16	55	1	1	1			1.6	57	20.9	2	2	2	2	40	5	15	11.4	272000	1.51	0.96	31.1	2	3	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
17	67	2	2	2	5.45	15	1.5	60	24	2	2	1	3				9.8	192000	9.31	1.16	50.5	1	1	1	5	2	2	1	1	1	1	1	2	1	3	3	3	3	1
18	50	2	1	1			1.6	62	22.8	1	2	2	2	30	7	15	8.6	33000	3.06	2.23	51.6	1	3	1	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1
19	36	2	1	1	12.3	15	1.7	66	22.8	2	2	2	1				8.9	440000	10.82			1	1	1	6	1	1	1	1	1	1	1	1	2	3	3	3	3	3
20	44	2	1	1	15	20	1.6	57	22.3	2	2	2	1				6.3	137000	1.14	1.28	73	1	1	1	6	1	2	1	1	1	1	1	2	1	3	3	3	3	3
21	64	2	1	1	11.45	15	1.5	55	22.3	2	2	2	2	80	8	15	11.6	126000	5	2.54	49	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	3
22	76	2	1	1	12.3	15	1.7	68	23	3	2	2	2	40	8	15	9.8	111000	0.69	1.52	42	1	2	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1
23	71	1	1	2	11.3	15	1.4	42	19.2	1	2	2	2	30	7	15	9.4	289000	2.3	1.13	36	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
24	76	2	1	2	19.5	30	1.7	68	23	3	2	1	2	30	6	7	8.5	91000	0.54			1	1	1	2	6	2	2	1	2	1	1	1	1	1	1	1	1	3
25	35	1	1	1	13	10	1.6	48	20	1	2	2	2	80	9	21	12.2	38000	0.95	0.97	36.2	1	1	1	1	1	1	1	3	1	1	1	2	1	1	1	1	1	3
26	40	1	1	1	16.4	15	1.6	60	23.7	3	2	2	1	30	9	15	9.1	140000	1.91	1.14	39	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
27	54	2	2	2	16.3	15	1.6	53	21.8	1	1	1	3				7.4	275000	4.56	1.03	33.1	1	2	1	6	2	2	1	1	1	1	1	3	2	1	3	3	3	3	1
28	67	1	1	2	21.3	10	1.5	48	20.8	2	2	2	2	60	7	12	10.7	82000	0.66	1.35	34	1	1	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1
29	28	2	1	1	10.45	15	1.8	61	19.7	1	2	2	2	75	9	15	12.6	66000	6.6	3.94	78	1	1	1	5	1	2	1	2	1	1	1	2	1	3	3	3	3	1
30	61	1	1	1	21.4	10	1.6	52	20.3	1	2	2	1				6.4	60000	2.62	1.54	53.7	1	1	1	2	2	2	2	2	1	1	1	2	1	1	1	1	1	3
31	43	1	1	1	12.1	10	1.5	46	19.9	1	2	2	2	35	7	15	9.1	71000	0.31	0.96	31.3	1	1	1	4	1	2	1	1	1	1	1	1	1	1	1	1	1	1
32	57	2	1	1	14	15	1.7	68	23	1	2	1	3				11	40000	0.48	1.05	31.7	1	1	1	5	1	2	1	1	1	1	1	2	1	3	3	3	3	1
33	78	2	1	1	18.3	15	1.7	65	23	1	2	2	2	25	7	7	9.4	102000	0.7	1.38	31.5	1	1	1	4	3	2	1	1	1	1	1	1	1	1	1	1	1	1
34	44	2	1	1	21.15	10	1.6	77	27.3	1	2	2	1				6.9	50000	2.31	1.54	45	1	1	1	6	1	2	1	1	1	1	3	2	1	3	3	3	3	1
35	55	2	1	1	18.3	15	1.7	68	23	1	1	1	3				9.3	100000	5.78	2.11	58	1	2	1	1	1	2	1	3	1	1	1	2	2	1	1	1	1	1
36	57	2	1	1	18.5	10				1	2	2	1				7.8	10000	0.47	1.18	45.5	1	1	1	1	1	2	2	1	1	1	1	2	1	3	3	3	3	3
37	51	2	1	1	9.35	10	1.7	66	22.8	1	2	2	1				7.9	159000	1.69	1.93	69	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
38	66	2	1	1	15	15	1.6	60	22.6	1	2	2	2	35	5	7	9.7	197000	1.21	1.27	42.3	1	1	1	5	2	2	1	1	1	1	1	1	1	3	3	3	3	1
39	70	2	1	1			1.7	66	22.8	3	2	1	3				9	24000	1.46	1.69	43.2	1	1	1	2	1	2	1	1	1	1	1	2	1	1	1	1	1	3
40	55	1	1	1	11.2	15				2	2	2	2	95	9	15	7.3	186000	7	1.25	36.8	1	2	1	2	3	2	1	1	2	1	1	2	1	2	2	2	2	3
41	66	1	1	1	21.45	15	1.5	46	19.9	1	2	2	1				6.3	10000	1.73	1.01	41.4	2	1	1	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1
42	66	2	1	1	15	15	1.7	66	22.8	1	2	1	3				8.7	129000	1.62	1.52	36.6	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	3
43	42	2	1	1	20.5	20	1.6	59	22.5	3	2	2	2	28	6	15	16.6	305000	0.88	1.16	36.4	1	1	1	3	12	2	1	1	1	1	1	2	1	2	1	1	1	3
44	43	1	1	1			1.7	64	20.3	1	1	2	1				7.6	306000	0.51	2.7	53.2	1	2	1	5	14	2	1	2	1	1	3	2	2	3	3	3	3	3
45	35	1	1	1	21.2	40	1.5	43	19.1	1	2	1	3				9.2	304000	0.53	0.98		1	2	1	1	4	2	1	1	1	1	1	2	1	1	1	1	1	1
46	56	1	1	1	21	15	1.7	60	20.03	3	2	1	3				6.7	16000	0.47	1.05	35.7	1	2	1	5	2	2	1	2	1	1	3	2	2	3	3	3	3	1
47	26	2	1	1	14.4	20	1.7	68	23	1	2	2	2	30	5	7	13.4	266000	0.73			1	2	1	3	3	2	1	1	1	1	1	1	1	1	1	1	1	1
48	68	2	1	2	15.2	30	1.7			3	2	2	2	99	6	15	10.6	25000	7.3	1.14	40.8	1	2	1	2	6	1	1	2	1	1	1	2	2	1	1	1	1	1
49	30	2	1	1	20.3	15				1	2	2	2	30	5	15	13.6	20900	0.9	1.02	32.3	1	1	1	3	4	2	1	1	1	1	1	1	1	1	1	1	1	1
50	61	1	1	1	1.05	10	1.6	52	20.3	4	2	1	3				6.2	55000	3	2.12	32	1	1	1	5	1	1	1	2	1	1	3	2	1	3	3	3	3	1
51	42	1	1	1			1.6	52	20.8	1	2	1	3				7.9	171000	0.48	1.04	36.3	1	1	1	3	12	2	2	1	2	1	1	1	2	1	1	1	1	1
52	62	2	1	1	15.3	15	1.6	70	24.5	1	2	1	3				9.2	15000	0.9	1.24	41.8	1	1	1	2	2	2	1	1	1	1	1	2	1	2	2	1	1	1
53	74	2	1	2	19.3	30				2	2	2	1				12.3	201000	1.38	2.1	47.7	1	1	1	2	5	2	2	1	2	1	1	1	1	2	2	1	1	1
54	74	2	1	1	19.2	10				4	2	2	1				12.3	201000	1.38	2.1	47.7	1	1	1	6	4	2	2	1	1	1	3	1	1	3	3	3	3	1
55	66	1	1	1	14.5	10	1.6	52	20	1	2	2	2	35	7	5	7.1	243000	1.7	1.17	48.4	2	2	1	3	7	1	1	1	2	1	1	1	2	1	2	1	1	1

sno	age	sex	location	setting	tinsert	tdur	ht	wt	bmi	indi	status1	status2	data	fio2	peep	ps	hb	plt	creat	inr	aptt	line	exp	chestwall	loc1	attempt	position	bleed	hematoma	arterial	nerve	duct	usg	assist	migration	malpositio	pneumo	hemo	thromb
56	68	2	1	1			1.7			3	2	1	3				7.4	51000	1.75	1.1	37	2	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
57	29	1	1	1	13	10	1.5	47	20.1	1	2	1	3				7.2	51000	0.42	1.27	32	1	1	1	3	1	2	1	1	1	1	1	1	1	2	1	1	1
58	78	2	1	1	14.2	20				1	2	2	2	99	5	5	7.7	34000	0.75	16.3	50	2	2	1	4	4	2	1	1	2	1	1	1	2	1	2	1	1	1
59	49	1	2	1	20	20				1	1	1	3				6.7	217000	5.57			1	2	1	2	15	2	2	2	1	1	1	2	2	1	2	1	1	1
60	34	1	2	1	16	20				1	2	1	3				7.4	93000	3.35	1.27	122	1	1	1	1	3	1	1	2	1	1	1	2	1	1	1	1	1	2
61	57	2	2	1	10.2	40	1.7	75	26	1	2	1	3				9.4		0.86			1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
62	31	1	2	1	13.1	30				1	2	1	3				12.1	99000	0.6	1.14	31	1	2	1	2	9	1	1	2	1	1	1	1	2	1	1	1	1	1
63	27	2	1	1	14.2	15	1.7	68	23	1	2	2	1	30	7	10	8.5	11000	1.42	1.3	51.3	2	1	1	2	1	2	1	1	1	1	1	2	1	1	2	1	1	1
64	55	2	1	2	10.45	25	1.7	70	23.7	2	2	2	1				10.8	69000	1.65	1.01	34.6	2	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
65	80	2	1	2	12	20		70		1	2	2	1				8.8	384000	2	1.4	32	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
66	55	1	2	2	11	10	1.4	57	25.7	1	1	1	3				10.8	148000	0.64			1	1	1	1	1	2	1	1	1	1	1	2	1	2	2	1	1	1
67	61	2	1	1						2	2	2	1				7.7	408000	3.07	1.3	33.7	1	2	1	1	0	1	1	1	1	1	1	2	1	1	2	1	1	1
68	47	1	2	1	14	30	1.5	45	18.5	1	2	1	3				9.7	385000	1.4			1	1	1	1	1	2	1	1	1	1	1	2	1	3	3	3	3	3
69	35	1	2	2	12	30				1	2	2	1				12.4	144000	0.2			1	2	1	1	3	2	1	1	1	3	3	1	1	3	3	3	3	1
70	56	2	2	1	9.3	15	1.5	50	20	1	2	1	3				6.4	550000	1.09	1.06	33.9	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
71	50	2	1	1	1.3	15				1	2	1	3				7.9	15000	0.89	1.2	27	2	2	1	2	3	1	1	1	2	1	1	2	1	1	1	1	1	1
72	28	2	1	1	14	25	1.5	50	20.5	2	2	1	3				12.7	104000	1.4	1.46	30.9	1	2	1	1	2	2	1	1	1	1	1	2	1	1	1	1	1	1
73	42	2	1	1	16	30	1.8			1	2	1	3				7.8	37000	1.23	1.19	40.2	2	2	1	2	2	2	1	1	1	1	1	2	2	1	2	1	1	1
74	74	1	1	1	13.4	20	1.6	58	20.64	1	2	1	3				10.6	167000	2.9	1.74	33	1	1	1	1	2	2	1	1	1	1	1	2	1	1	1	1	1	1
75	35	2	1	2	16.15	45				2	2	2	1				11.5	427000	0.84	1.87	41.9	1	3	1	2	2	2	1	1	1	1	1	2	1	2	2	1	1	1
76	49	1	1	1	21.1	30	1.5	50	21	2	2	2	2	30	7	15	9.8	51000	0.54	1.32	33.4	2	3	1	1		2	1	1	1	1	1	1	1	2	1	1	1
77	50	1	1	1	8.3	30	1.5	50	20.1	1	2	2	1				14	96000	4.3	1.2	29	1	3	1	5	1	1	1	1	1	3	3	2	1	3	3	3	3	1
78	50	1	1	1	15	15	1.5	50	21.5	4	2	1	3				13.3	126000	6.01	1.1	61.5	1	1	1	5	3	2	1	1	1	1	1	2	1	3	3	3	3	1
79	77	2	1	1	13.5	40	1.7	66	19.8	1	2	1	3				8.4	141000	0.92	1.01	24.5	2	3	1	1	3	2	1	1	1	1	1	1	1	1	1	1	1	1
80	67	2	1	1	14.3	15				1	2	1	3				13	145000	0.88	1.03	25	1	1	1	5	1	2	1	1	1	1	3	2	1	3	3	3	3	1
81	60	2	1	1	14.45	20				3	2	2	2	30	6	5	12.5	500000	1.14	1	27.9	2	1	1	1	2	2	1	1	1	1	1	2	1	1	2	1	1	1
82	58	2	1	1	21.1	10	1.6	57	22.3	1	2	2	2	40	7	15	9.1	105000	3.95	3.48	71.5	2	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
83	67	1	1	1	0.1	10	1.5	48	20	1	2	2	2	40	7	18	9.1	207000	0.44	0.99	28.4	1	1	1	2	1	2	1	1	1	1	1	2	1	1	2	1	1	1
84	29	1	1	2	16.3	15	1.4	40	20.4	3	2	2	2	99	9	20	8.5	217000	0.68	0.96	72	1	1	1	2	1	2	1	1	1	1	1	2	1	1	2	1	1	1
85	40	2	1	2	0.4	15				3	2	2	1				11.9	128000	0.86	1.32	24.6	1	1	1	5	3	2	2	1	1	1	1	1	1	3	3	3	3	1
86	52	2	1	1	2.3	45	1.7	65	22.5	1	2	2	2	40	5	12	13.4	169000	0.76	1.04	26.2	1	1	1	3	12	2	2	1	1	1	1	2	2	1	1	1	1	1
87	56	2	2	1	16	45				1	2	1	3				8.6	178000	2.9	1.12	27.1	1	2	1	5	8	2	2	1	1	1	3	1	2	3	3	3	3	1
88	80	1	2	2	17.4	40				2	2	2	1				13	308000	1.08	1.09	29.9	1	1	1	5	16	2	2	2	2	1	3	1	1	3	3	3	3	1
89	60	2	1	1	16	15	1.7	66	22.8	1	2	2	2	30	7	12	9.1	90000	4.65	1.17	26.2	2	2	1	2	10	2	1	1	1	1	1	2	2	1	2	1	1	1
90	29	2	1	1	11	30	1.7	66	22.2	3	2	1	3				7.4	9000	1.42	1.4	71.7	1	2	1	5	1	2	2	2	1	1	1	2	1	3	3	3	3	1
91	46	1	1	1						1	2	1	3				6.5	27000	0.57	1.02	30.4	1	1	1	5	1	2	1	1	1	1	1	2	1	3	3	3	3	1
92	58	2	1	1	13.3	20	1.7	57	20.4	1	2	2	2	30	7	25	7.3	78000	1.35	1.45	58.7	2	1	1	5	3	2	2	1	1	1	3	2	1	3	3	3	3	1
93	59	1	2	2	13.3	30				1	2	2	1				6.4	145000	2.95	1.32	43.9	1	1	1	5	1	2	1	1	1	1	3	1	1	3	3	3	3	1
94	47	2	2	1	14	10				1	2	1	3				10.5	137000	4.72	4.12	39.4	1	1	1	5	1	2	1	1	1	1	3	2	1	3	3	3	3	1
95	28	2	2	1	16	15				1	2	1	3				10.7	189000	1.53			1	1	1	3	1	2	1	1	1	1	1	1	1	1	1	1	1	1
96	30	1	2	1	21.2	10				1	2	1	3				7.3					1	1	1	1	2	2	2	2	1	1	1	1	1	1	2	1	1	1
97	61	1	2	1	14.1	20				1	2	1	3				10.8	276000	0.19			1	2	3	5	4	2	2	2	1	1	3	1	2	3	3	3	3	1
98	70	1	2	1	13.15	15				2	2	1	3				9.6	131000	2.6	1.45	35.8	1	2	3	5	4	2	2	1	2	1	3	3	2	3	3	3	3	1
99	33	1	1	1	1.1	10	1.5	46	20	1	2	1	3				7.4	97000	1.81	1.07	29.7	1	2	1	3	1	2	1	1	1	1	1	1	1	1	1	1	1	1
100	51	1	1	2	7.4	20	1.6	57	22.3	2	2	2	2	80	5	15	8.4	238000	1.1	1.4	49.2	1	2	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
101	36	2	1	1	6	10				2	2	2	1				8.1	80000	1.67	2.02	47	1	1	1	2	2	2	2	1	1	1	1	2	1	1	2	1	1	1
102	62	1	1	1	19	15	1.6	55	22.3	2	2	2	2	30	5	9	9	291000	0.32	1.17	30.5	2	2	1	2	2	2	1	1	1	1	1	2	1	1	2	1	1	1
103	29	2	1	1	19.3	15	1.7	66	22.3	1	2	1	3				8.6	26000	1.25	1.3	35.8	2	1	1	2	1	2	2	1	1	1	1	2	1	1	2	1	1	1
104	45	2	1	1	22	20				1	2	1	3				8.8	11000	1.03	1.5	35.9	1	1	3	5	2	2	2	2	1	1	1	2	1	3	3	3	3	1
105	49	2	1	1	8.3	30				2	2	2	1				17.2	10400	2.18	1.35	57	1	2	1	1	1	2	1	1	1	1	1	2	1	2	2	1	1	1
106	44	1	1	1	13.4	10				1	2	1	3				10.8	136000	0.52			1	2	1	2	2	2	1	1	1	1	1	2	1	1	1	1	1	1
107	75	2	1	1	11.3	15	1.6	62	22	2	2	1	3				9.2	54000	5.4	1.2	48.2	1	2	1	5	1	2	1	1	1	1	3	2	1	3	3	3	3	1
108	61	1	1	1	9	15				2	2	2	2	70	7	15	10.2	145000	7.11	0.96	29.3	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
109	36	2	1	1	15	30				2	2	2	1				7.4	19000	0.47	1.02	34.5	2	1	1	6	2	2	1	1	1	1	3	2	1	3	3	3	3	1
110	58	2	1	1	13	15				2	2	1	3				8	83000	1.14	2.67	54.9	1	2	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1

sno	age	sex	location	setting	tinsert	tdur	ht	wt	bmi	indi	status1	status2	data	fio2	peep	ps	hb	plt	creat	inr	aptt	line	exp	chestwall	loc1	attempt	position	bleed	hematoma	arterial	nerve	duct	usg	assist	migration	malpositio	pneumo	hemo	thromb
111	49	2	1	1	13.3	10	1.8	74	23.4	1	2	2	2	25	8	9	12.8	57000	4.3	1.01	33.6	1	1	1	2	3	2	1	1	1	1	1	2	1	1	2	1	1	1
112	29	2	1	1	4.3	15	1.7	66	22.3	1	2	2	2	25	8	12	7.3	16000	0.65	1.46	42.6	2	2	1	1	5	1	1	1	1	1	1	2	1	1	2	1	1	1
113	36	2	1	1	16.3	15	1.7	71	23	1	2	2	2	50	9	15	7	41000	0.46	1.02	33.7	2	1	1	2	1	2	1	1	1	1	1	2	1	1	2	1	1	1
114	51	1	1	1	16	30	1.6	50	21.8	1	2	1	3				9	430000	0.91			2	2	1	2	1	1	1	1	1	1	1	2	1	2	2	1	1	1
115	60	2	1	1	12	20	1.7	64	22.9	1	2	1	3				6.1	317000	1.61	1.16	29.1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
116	45	1	1	1	22.5	20	1.8	66	21.1	2	2	2	2	55	9	22	8.8	11000	1.03	1.5	35.9	2	3	1	6	1	2	2	1	1	1	3	2	1	3	3	3	3	1
117	27	2	1	2	23.3	15	1.7	75	26.6	3	2	2	1				9	80000	1.31	1.62	51.4	1	3	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
118	56	2	1	1	6	20	1.8	74	23.4	1	2	2	2	30	7	7	9.6	65000	0.78	1.51	52.3	2	1	1	3	1	2	1	1	1	1	1	1	1	2	1	1	1	1
119	52	2	1	1	9.3	10				3	2	2	2	95	9	15	8.9	211000	0.99	1.07	41	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
120	53	1	1	1	5.3	60				4	2	1	3				9.2	337000	0.62	1.24	28	1	1	1	3	3	2	2	1	1	1	1	1	2	3	3	1	1	1
121	43	1	1	1	6.3	15	1.6	50	20.3	3	2	2	2	90	9	17	8.7	5000	5.37	1.17	44.9	1	1	1	1	2	2	1	1	1	1	1	2	1	1	1	1	1	1
122	35	1	1	1	10	20	1.6	50	18.5	1	2	2	2	24	5	5	7.9	230000	5.2			1	1	1	3	1	2	1	1	1	1	1	1	1	2	1	1	1	1
123	18	1	1	1	22.15	10				1	2	1	3				7.6	10000	0.57	1.66	36.5	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
124	35	2	1	1	20.5	15	1.6	54	20.6	2	2	2	2	65	9	15	7.2	324000	0.56			1	2	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
125	36	2	1	2	3	15				2	2	2	1				7.7	95000	5.81	1.63	145	1	2	1	5	1	2	1	1	1	1	1	2	1	3	3	3	3	1
126	52	2	1	1	16	30	1.7	71	23.2	2	2	2	2	25	7	15	9.4	84000	6			2	2	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
127	85	2	1	1	17	15				2	2	2	2	30	6	5	5.6	352000	4.85	1.06	34.5	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
128	67	2	1	1	14	20				1	2	1	3				8.3	76000	0.41	1.63	37.3	2	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
129	35	2	1	1	12	30	1.6	54	20.6	2	2	2	2	40	9	15	5.5	220000	1.64			1	2	1	2	2	2	1	1	1	1	1	2	2	3	3	3	3	3
130	50	1	1	1	15.3	15	1.6	46	18.7	1	2	2	2	28	5	10	5.8	187000	0.75	1.11	59.4	2	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
131	54	1	1	1	2.15	30				1	2	2	2	30	7	8	8.4	104000	5.26	1.08	39.1	1	1	1	2	1	2	1	1	1	1	1	2	1	1	1	1	1	1
132	18	1	1	1	3	30				1	2	2	2	30	6	15	8.7	134000	0.82			1	1	1	4	2	2	1	1	1	1	1	1	1	3	3	3	3	3
133	59	2	1	1	4	20	1.7	57	20.4	3	2	2	2	28	7	20	8	13000	3.71			1	2	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
134	31	1	1	1	19	30				1	2	2	2	30	8	15	7.3	348000	0.24	1.06	36.5	1	2	1	3	3	2	1	1	1	1	1	2	1	2	1	1	1	1
135	65	1	1	1	21.1	25	1.7	71	24.3	1	2	2	2	21	8	12	8.1	61000	2.52	1.08	43.9	1	2	1	2	18	2	2	1	2	1	1	2	2	1	2	1	1	1
136	18	1	1	1	21	30	1.5	49	23	4	2	2	2	40	6	15	8.4	116000	0.38	1.92	51.8	1	2	1	6	2	2	1	1	1	1	1	2	2	3	3	3	3	1
137	35	1	1	1	17	20				2	2	2	2	30	7	15	10.7	80000	0.79	1.43	52.4	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
138	45	1	1	1	15.3	50	1.6	57	22.5	4	2	2	2	45	8	10	8.1	14000	0.29	1.3	34.5	1	1	1	2	5	2	2	1	1	1	1	2	1	1	2	1	1	1
139	54	1	1	1	11.3	30				4	2	2	1				7.6	176000	1.98	1.2	38	2	1	1	3	1	2	1	1	1	1	1	2	1	1	1	1	1	1
140	57	1	1	1	10.3	20				1	2	2	2	25	5	12	7.9	201000	0.59	0.95	26.3	2	1	1	2	1	2	1	1	1	1	1	2	1	1	1	2	1	1
141	52	2	1	1	16	10				3	2	2	1				15	184000	1.45	8.08	30.5	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
142	29	2	1	1	2	20				1	2	2	2	30	6	15	15.2	197000	0.94	1.03	28.8	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
143	27	2	1	1	1	30	1.7	73	23.3	3	2	2	2	65	8	15	12	400000	3.06			1	1	1	2	2	2	1	1	1	1	1	2	1	1	2	1	1	1
144	20	1	1	1	5	20	1.6	57	22.5	1	2	1	3				8.1	184000	0.78	0.62	26.9	1	1	1	1	1	2	1	1	1	1	1	2	1	3	3	3	3	3
145	57	1	1	1	3.3	15	1.5	56	25.9	4	2	2	2	25	6	9	8.5	102000	0.52			2	1	1	3	1	2	1	1	1	1	1	1	1	1	1	1	1	1
146	47	2	1	1	4.3	30	1.6	57	22.3	4	2	2	2	30	7	9	11.6	95000	0.82	1.14	33.9	2	1	1	2	1	2	1	1	1	1	1	2	1	1	2	1	1	1
147	55	2	1	1	3.3	30				4	2	2	2	30	7	6	7.4	95000	4	1.61	66.6	2	1	1	6	1	2	1	1	1	1	3	2	1	3	3	3	3	1
148	62	2	1	1	4	15	1.7	73	23.3	2	2	2	2	30	8	15	6.7	101000	4.29	1.01	43.8	1	1	1	1	2	2	1	2	1	1	1	2	1	2	1	1	1	1
149	43	2	1	2	12.4	20				2	2	2	2	60	9	15	10.9	140000	1.06	1.68	38.2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
150	23	2	1	1	15.3	15				1	2	1	3				17.2	263000	0.8	0.88	21.1	1	1	1	4	2	2	1	1	1	1	1	1	1	1	2	1	1	1
151	22	1	1	1	11	20	1.5	43	19.2	1	2	1	3				9	188000	0.42	1.03	38.7	1	1	1	5	1	2	2	1	1	1	3	2	1	3	3	3	3	1
152	32	1	1	1	17	75	1.7	71	21	1	2	2	1				9.4	484000	0.4	1.14	27	2	1	1	2	1	2	1	1	1	1	1	2	1	1	1	1	1	1
153	63	2	1	1	13.3	15	1.7	66	22.8	1	2	1	3				8.9	78000	3.4	1.12	49.6	1	1	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1
154	34	2	1	1	16	30	1.7	69	22.8	4	2	2	1				7.8	27000	1.95	1.17	37.1	2	3	1	2	1	2	2	1	1	1	1	2	1	1	1	1	1	1
155	18	1	1	1	13	20	1.5	48	20	4	2	1	3				6.6	10000	0.91	2.01	43.5	2	1	1	5	2	2	2	1	1	1	1	2	1	3	3	3	3	1
156	67	2	1	1	16.1	20	1.6	60	22.6	3	2	2	1				10.5	288000	7.2	1.03	29.6	1	2	1	1	1	2	2	1	1	1	1	2	2	1	1	1	1	1
157	40	2	1	1	19.2	25	1.6	64	22.9	2	2	1	3				8.7	110000	0.45	1.13	37.4	2	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
158	35	2	1	1	15.3	15	1.8	73	23.3	2	2	1	3				8.5	67000	5.67	2.36	64.3	1	2	1	1	1	2	2	1	1	1	1	2	1	1	2	1	1	1
159	19	1	1	1	15	20	1.6	50	19.5	4	2	1	3				8.3	162000	0.43			2	2	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
160	58	2	1	1	21	5	1.7	71	22	1	2	1	3				6.8	47000	0.47			1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1

sno	success	loc2	success1	attempt1	position1	bleed1	hematoma1	arterial1	nerve1	duct1	usg1	assist1	migration1	malpositi1	pneumo1	hemo1	thromb1
1	2																
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3	1	1	2	2	1	1	1	1	1	1	2	1	1	1	1	1	3
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sno	success	loc2	success1	attempt1	position1	bleed1	hematoma1	arterial1	nerve1	duct1	usg1	assist1	migration1	malpositi1	pneumo1	hemo1	thromb1
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sno	success	loc2	success1	attempt1	position1	bleed1	hematoma1	arterial1	nerve1	duct1	usg1	assist1	migration1	malpositi1	pneumo1	hemo1	thromb1
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sno	required	position2	date	time	totalt	compl	action	pdx	sdx	diag1	diag2	diag3
1	2	2	12/06/2016	4.4	6.7	Nil	Nil	Community acquired pneumonia	Ischemic heart disease			
2	2	2	16/06/2016	17	4.5	Haematoma, malposition	Nil	Congestive cardiac failure	Diabetes mellitus, HTN, OA	BPH		
3	2	2	18/06/2016	18	2.5	Haematoma		Acute pyelonephritis + abscess	Chronic kidney disease	COPD	DM	
4	2	2	29/06/2016	18	3	Nil	Nil	Ventricular fibrillation	Diabetes mellitus, HTN			
5	2	2	05/07/2016	16.45	2.5	Malposition	Nil	Septic shock	ILD			
6	2	2	13/07/2016	1.47	2	Nil	Nil	Lower respiratory tract inf	DM	HTN	IHD	
7	2	2	13/07/2016	21.4	9.5	Malposition	Nil	Uncontrolled DM	Multiple myeloma	Ischemic heart disease		
8	2	2	13/07/2016	21		Haematoma, Malposition	Nil	Septic shock	Tuberculosis with LRI			
9	1					Nil	Nil	Disseminated TB	Chronic liver disease	ARDS	Acute renal failure	
10	2	3				Malposition	Nil	Complicated pyelonephritis	Acute on chronic KD			
11	1					Nil	Nil	Febrile neutropenia	Ca bladder post chemo			
12	2	2	23/07/2016	23	9.5	Bleeding, haematoma	Nil	Leukemia relapse	Post chemo neutropenia	Septic shock		
13	2	2	25/07/2016	15	4.3	Malposition	Nil	Urosepsis	Septic shock			
14	2	3				Nil	Nil	Aplastic anemia	Septic shock	ARDS		
15	1					Nil	Nil	Still's disease	Macrophage activation syndr			
16	2	1				Nil	Nil	Acute coronary syndrome	Cardiogenic shock	Acute pulmonary edema		
17	1					Nil	Nil	Septic shock	Chronic kidney disease			
18	2	3				Patient expired	Patient expired	Hairy cell leukemia	Febrile neutropenia	Cardiac tamponade		
19	1					Nil	Nil	Severe pancreatitis	Acute kidney injury	Ischemic stroke		
20	1					Nil	Nil	Inflammatory bowel disease	Septic shock			
21	2	2	05/08/2016	16.5	5	Nil	Nil	Urosepsis	Acute kidney injury			
22	2	2	07/08/2016	21	8.5	Nil	Nil	PLHIV	Aspiration pneumonia	SIADH		
23	2	2	12/08/2016	1	13	Nil	Nil	Accelerated HTN	Pulmonary edema	Ischemic heart disease		
24	2	2	13/08/2016	5.2	7.5	Local bleeding, arterial punct	Nil	PLHIV	Acute onset seizure	Aspiration pneumonia		
25	2	2	12/08/2016	16.1	3	Nil	Nil	Scrub typhus	ARDS			
26	2	2	15/08/2016	19.4	3	Nil	Nil	Acute febrile illness	Septic shock	ARDS	Acute kidney injury	
27	1					Nil	Nil	Community acquired pneumonia	Congestive cardiac failure			
28	2	2	17/08/2016	1.2	4	Local bleeding	Nil	Scrub typhus	Acute respiratory distress			
29	1					Haematoma	Nil	Pancreatitis	Diabetic ketoacidosis	Septic shock		
30	2	2	18/08/2016	2	5	Local bleed and haematoma	Nil	Hepatitis C	Chronic liver disease	Acute kidney injury	Septic shock	
31	2	2	22/08/2016	1.4	12	Nil	Nil	Disseminated TB	Acute kidney injury	Acute respiratory distress syn		
32	1					Nil	Nil	Massive pulmonary embolism	Left LL DVT	Prostatic abscess		
33	2	2	24/08/2016	2	7.5	Nil	Nil	Urosepsis	Parkinson's disease	Septic shock		
34	1					Nil	Nil	Necrotising pancreatitis	Acute kidney injury	Sepsis		
35	2	2	25/08/2016	1.2	6	Nil	Nil	Decompensated CLD	Septic shock	Hepatic enceph		
36	2	1				Local bleeding	Nil	Pulmonary embolism	Cauda equina syndrome	Cardiogenic shock		
37	2	2	26/08/2016	16.18	7.5	Nil	Nil	Unknown poison	Acute kidney injury	Severe metabolic acidosis		
38	1					Nil	Nil	Acute cholecystitis	Acute coronary syndrome	Cardiogenic shock		
39	2	1				Nil	Nil	Chronic lymphoid leukemia	Acute kidney injury	Acute coronary syndrome		
40	2	2	01/09/2016	1.1	2.5	Arterial puncture	Nil	chronic renal failure	Sepsis/pneumonia			
41	2	2	09/09/2016	1.45	3.8	Nil	Nil	Diabetic ketoacidosis	Septic shock			
42	2	2	12/09/2016	15.45	0.8	Nil	Nil	Pulmonary embolism				
43	2	2	19/09/2016	1.25	4	Malposition	Nil	Meningoencephalitis				
44	1					Heamatoma	Nil	Acute coronary syndrome	Undifferentiated CTD	APLA		
45	2	2	21/09/2016	1.46	4.5	Nil	Nil	Cortical vein thrombosis				
46	1					Haematoma	Nil	Lymphoma	? CNS involvement			
47	2	2	27/09/2016	19	4	Nil	Nil	OP poisoning				
48	2	2	28/09/2016	1.2	9	Local haematoma	Nil	Urosepsis	Septic shock			
49	2	2	30/09/2016	1.4	4.5	Nil	Nil	Meningoencephalitis				
50	1					Haematoma	Nil	Decompensated CLD	Metabolic acidosis			
51	2	2	11/10/2016	16		Local bleed, Arterial puncture		Diseminated TB	Tuberculous Meningitis			
52	2	2	11/10/2016	17.5	2.5	Migration, malposition		Burkitt's Lymphoma	Hospital acquired infection			
53	2	2	11/10/2016	23.59	4.5	Migration, malposition		Acute coronary syndrome	Post cardiac arrest			
54	1					Local bleed		Acute coronary syndrome	Post cardiac arrest			
55	2	2	15/10/2016	12.5	8	Arterial puncture, Malposition		Acute exaccerbation of COPD	Pneumonia	Chronic pulmonary embolism		

sno	required	position2	date	time	totalt	compl	action	pdx	sdx	diag1	diag2	diag3
56	2	2	18/10/2016	14.5		Nil		Acute coronary syndrome	Pneumonia	Type 2 diabetes mellitus	Systemic hypertension	
57	2	2	18/10/2016	14.3	1.5	Malposition		Encephalitis				
58	2	2	19/10/2016	1.45	11.2	Arterial puncture, malposition		Parkinson's				
59	2	2	27/10/2016	23	3	Bleeding, haematoma, malpositi		Dermatomyositis	polycystic kidney disease	Type 2 diabetes mellitus	Systemic hypertension	
60	2	2	16/02/2017	23	7	Haematoma, venous thrombosis		APLA				
61	2	2	06/02/2017	13.5	5.5	Nil		Chronic liver disease				
62	2	2	07/12/2016	18.3	5.3	Haematoma		Bacterial Meningitis				
63	2	2	03/12/2016	1.5	11.5	Malposition		Acute myeloid leukemia				
64	2	2	05/11/2016	15.45	5	Malposition		Pneumonia	Septic shock	MRSA septicemia	Acute kidney injury	
65	2	2	24/12/2016	14	4	Nil		Chronic kidney disease	Complete heart block			
66	2	2	30/12/2016	16.3	5.5	Migration, malposition		Pneumonia	Diabetic ketoacidosis			
67	2	2	28/12/2016	17.3		Malposition		Acute pulmonary edema	AKI on CKD			
68	2	1						Carcinoma bladder	Hypercalcemia			
69	1					Nil		Tubercular meningitis	Bronchial asthma			
70	2	2	30/12/2016	2	16.5	Malposition		Disseminated tuberculosis				
71	2	2	20/01/2017	14.3	1	Arterial puncture		Diffuse large B cell lymphoma				
72	2	2	03/12/2016	23.5	11.8	Nil		Acute lymphoid leukemia	Acute pancreatitis	Acute kidney injury	Post cardiac arrest	
73	2	2	04/12/2016	19.1	3.2	Malposition		Aplastic anemia	Septic shock			
74	2	2	29/11/2016	5.3	15	Nil		H1N1 positive	Bronchial asthma	Acute kidney injury		
75	2	2	30/12/2016	19.3	3.5	Malposition, Migration		Community acquired pneumonia	Septic shock	Diabetes mellitus		
76	2	2	13/01/2017	1	4	Malposition		Acute febrile illness	Acute respiratory distress			
77	1					Nil		H1N1	Acute respiratory distress			
78	1					Nil		H1N1	Acute respiratory distress	Acute on chronic renal failure		
79	2	2	03/01/2017	1.1	9.4	Nil		Exaccerbation of COPD	Multifocal atrial tachycardia	Critical illness polyneuropath		
80	1							Malignant MCA infarct				
81	2	2	20/03/2017	16.57	2.3	Malposition	Reposition	Status epilepticus				
82	2	2	21/03/2017	1.35	4.3	Malposition	Repositioning	NFGNB sepsis	Post cardiac arrest	Diabetes mellitus	Systemic hypertension	
83	2	2	21/03/2017	1.3	1	Malposition	None	Anaphylactic shock	Hypoxic ischemic encephalopath			
84	2	2	23/03/2017	1.1	7.5	Malposition	Reposition	Acute febrile illness	ARDS			
85	1					Hematoma	Nil	Tubercular meningitis				
86	2	2	04/04/2017	14.26	12	Malposition	None	Cerebrovascular accident	Aspiration pneumonia	Type 2 diabetes mellitus	Systemic hypertension	
87	1					Bleeding	Local compression	Multiple myeloma	Hypercalcemia of malignancy	Acute kidney injury		
88	1					Bleed, Hematoma, Arterial punc	Local compression	COPD	Septic shock			
89	2	2	09/04/2017	1.27	9.5	Malposition	Repositioning	Acute myocardial infarction	Post cardiac arrest			
90	1					Bleeding, hematoma	Local compression	Myelodysplastic syndrome	Septic shock			
91	1					Nil	Nil	DLBCL	Febrile Neutropenia	Hypothyroid		
92	1					Bleeding	Local compression	Recurrent seizure	Hospital acquired infection	Post cardiac arrest		
93	1					Nil	Nil	Multiple myeloma				
94	1					Nil	Nil	Congestive cardiac failure				
95	2	2	24/04/2017	16.45	0.7	Nil	Nil	Cryptococcal meningitis				
96	2	2	02/05/2017	20.14	96	Bleeding, hematoma	Local compression	Disseminated staph septicemia				
97	1					Bleeding, hematoma	Local compression	Hospital acquired infection	Deep venous thrombosis			
98	1					Bleed, arterial puncture	Local compression	Chronic pulmonary embolism	Cardiogenic shock			
99	2	2	30/04/2017	6.4	5.5	Nil	Nil	Mixed connective tissue disord				
100	2	2	04/05/2017	4.3	60	Nil	Nil	Hypoxic ischemic encephalopath				
101	2	2	02/05/2017	19.11	11	Bleeding	Local compression	Carcinoma rectum	Septic shock			
102	2	2	05/05/2017	1.01	3	Malposition	Nil	Choledocolithiasis	Septic shock			
103	2	2	#########	21.3	4	Bleeding, malposition	Local compression	Myelodysplastic syndrome	Graft versus host reaction			
104	1					Bleeding, hematoma	Local compression	Mantle cell lymphoma	Graft versus host reaction			
105	2	2	06/05/2017	10.5	2.3	Migration, malposition	Reposition	Acute febrile illness	Acute respiratory distress syn			
106	2	2	09/05/2017	14.3	1	Nil	Nil	Meningoencephalitis				
107	1					Nil	Nil	Urosepsis	Type 2 diabetes mellitus			
108	2	2	10/05/2017	11.1	2.3	Malposition	None	Chronic kidney disease	Post cardiac arrest			
109	1					Nil	Nil	Carcinoma rectum	Septic shock			
110	2	2	10/05/2017	13.5	1	Nil	Nil	Decompensated CLD	Hepatic encephalopathy	Septic shock		

sno	required	position2	date	time	totalt	compl	action	pdx	sdx	diag1	diag2	diag3
111	2	2	13/05/2017	3.55	1.5	Malposition	Nil	Organophosphorous poisoning	Intermediate syndrome			
112	2	2	13/05/2017	7	2.5	Mslposition	Nik	Post bone marrow transplant	Graft versus host reaction			
113	2	2	13/05/2017	10.2	5.7	Malposition	Nil	Carcinoma rectum	Septic shock			
114	2	2	13/05/2017	19.45	3.8	Migration, malposition	Nil	Pyrexia of unknown origin	Post cardiac arrest			
115	2	2	02/05/2017	13.32	1.5	Nil	Nil	COPD exaccerbation	Type 2 diabetes mellitus	Anemia under evaluation		
116	1					Bleeding	Local compression	Mantle cell lymphoma	S/p allogenic BM transplant	GVHD		
117	2	2	03/05/2017	1.24	2	Nil	Nil	Non hodgkin's lymphoma	Septic shock	Acute kidney injury		
118	2	2	15/05/2017	13.38	5.6	Malposition	Nil	Organophosphate poisoning	Gram negative septicemia			
119	2	2	16/05/2017	11.2	1.8	Nil	Nil	Hepatocellular carcinoma	NAFLD			
120	1					Failed insertion, artery punct	Changed location,loca pressure	Accelerated HTN	Type 2 diabetes mellitus			
121	2	2	17/05/2017	7.5	1	Nil	Nil	Right lower lobe pneumonia	Acute kidney Injury	ARDS		
122	2	2	17/05/2017	11.45	1.7	Malposition	Nil	Young hypertensive	Hypertensive emergency			
123	2	2	18/05/2017	0.5	14.8	Nil	Nil	Aplastic anemia	Febrile neutropenia	Lower respiratory infection		
124	2	2	18/05/2017	0.5	5	Nil	Nil	Autoimmune haemolytic anemia	Sepsis			
125	1					Nil	Nil	Chronic kidney disease	Septic shock			
126	2	2	19/05/2017	19.1	3.1	Nil	Nil	Meningoencephalitis	Septic shock			
127	2	2	19/05/2017	19.1	4.1	Malposition	Nil	Urosepsis	Septic shock	COPD		
128	2	2	24/05/2017	16.3	4	Nil	Nil	Lower Respiratory Tract Infect	Sepsis			
129	2	1						Autoimmune hemolytic anemia	Acute respiratory distress	Sepsis		
130	2	2	29/05/2017	18.45	3.3	Nil	Nil	Acute CVA	Rheumatic heart disease			
131	2	2	29/05/2017	6.45	4.5	Nil	Nil	Multiple myeloma	Lower respiratory tract inf			
132	2	2	30/05/2017	7.4	4.7	Nil	Nil	Refractory seizures	Suspected viral encephalitis			
133	2	2	31/05/2017	11.4	7.5	Nil	Nil	Decompensated CLD	AKI on CKD	Status post cardiac arrest		
134	2	2	31/05/2017	22.2	5	Nil	Nil	POEMS syndrome				
135	2	2	02/06/2017	21.1	3.5	Bleeding, Arterial puncture	Local compression	Varicella encephalitis	Toxic epidermal necrolysis			
136	1					Nil	Nil	Refractory status epilepticus				
137	2	2	04/06/2017	18.5	1.5	Malposition	Nil	Suspected meningoencephalitis				
138	2	2	04/06/2017	21.3	6	Bleeding	Local compression	Acute febrile illness	Thromobytopenia	ARDS		
139	2	2	06/06/2017	18.3	7	Nil	Nil	Multiple myeloma	Post BMT	Status post cardiac arrest		
140	2	2	08/06/2017	14.5	4.2	Pneumothorax & Subcut emphysem	ICD	Meningoencephalitis	Communicating hydrocephalous			
141	2	2	09/06/2017	1.4	7.7	Malposition	Nil	Rheumatic heart disease	Atrial fibrillation	Lateral medullary syndrome		
142	2	2	09/06/2017	5.05	3	Nil	Nil	Meningoencephalitis				
143	2	2	14/06/2017	1.3	0.5	Malposition	Nil	Paraquat poisoning				
144	2	1				X-ray not done		Pre-ecclampsia	S/p LSCS			
145	2	2	16/06/2017	12.2	9	Nil	Nil	Tuerculous Meningitis				
146	2	2	16/06/2017	12	7	Malposition	Nil	Oduvanthalai poisoning	CRO HAI			
147	1					Nil	Nil	Churg Strauss Syndrome	Chroni Kidney Disease			
148	2	2	21/06/2017	10.3	6.5	Hematoma; malposition	Local compression; nil	Aspiration pneumonia	Type 2 diabetes mellitus	Systemic hypertension	Chronic kidney disease	
149	2	2	23/06/2017	1.3	10	Malposition	Nil	Complicated pneumonia	Septic shock			
150	2	2	23/06/2017	1.3	8	Malposition	Nil	Left MCA infarct	Young onset diabetes			
151	1					Bleeding	Local compression	Cushing's Syndrome	Pituitary microadenoma			
152	2	2	22/04/2017	7	14	Nil	Nil	H1N1 infection	ARDS			
153	2	2	11/05/2017	15	1.5	Local Bleeding	Local compression	Hypercalcemia with enceph	Chronic kidney disease			
154	2	2	23/10/2016	19.5	3.8	Bleeding	Local compression	S/p BMT	GVHD	Febrile neutropenia		
155	1					Local bleeding	Local compression	Febrile neutropenia	Fungal pneumonia			
156	2	2	25/10/2016	3	11	Bleeding	Local compression	Pulmonary edema	CKD-V	Diabete mellitus	Systemic hypertension	
157	2	2	23/10/2016	0.5	5	Malposition	Nil	T-cell Lymphoma	Septic shock			
158	2	2	21/10/2016	15.3	2	Local Bleeding, Malposition	Local compression, Nil	Chronic liver disease - decomp	Hepatorenal SYndrome			
159	2	2	21/10/2016	17.3	2.5	Nil	Nil	Hepatocellular carcinoma	Liver abscess			
160	2	2	23/05/2017	2	5	Nil	Nil	Disseminated TB	Pancytopenia	GNB sepsis		