IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 21, Issue 10 Ser.6 (October. 2022), PP 24-28
www.iosrjournals.org

Femoral Vein versus Jagular and Sub-clavian Vein Catheterization in ICU

Dr.Khaled Mohamed, Dr.Altaf Rashad Ashour,
Specialist intensive care/Interist, Medcare Hospital, UAE
Specialist Cardiology , SKMCA UAE

Abstract:
The rise in cases of infections resulting from the bacteria has created the need for more investigation to be done. In addition,conditions from the bacteria are common in critically ill patients and those immune-compromised individuals; thus, it isprimarily an opportunistic pathogen. Patients at risk can also be given antibiotics for prophylaxis to prevent them fromcontracting the infection. For those patients who have infections from pseudomonas aeruginosa, frequent assessment shouldbe done to note the progress of the diseases and determine the effectiveness of the drugs; this will also help detect resistancetothedrug.
Key Words: *Jugularvein,subclavinvein,femoralvein,centralvenouscatheterization*

Date of Submission: 09-10-2022 Date of Acceptance: 22-10-2022

I. Introduction:

Patients in intensive care or immunocompromised patients with CVC lines are at higher risk of developingHAI. APIC and many others are urging national and even international efforts to reduce this risk andminimize the possibility of device-related infections. Infection control programs everywhere should adoptpractices that demonstrate constant precautions to keep patients safe. CVC lines are an essential tool forprovidingspecificmedicaltreatments,butallhealthcareprofessionals mustbeprovidedwiththeequipmentto ensure patient safety and satisfaction (Kim et al., 2022). There is no excuse for infection. We have tospeak up, and we have to work to protect our entire patient population. The first rule in health care is "noharm" (Gupta et al., 2018). Our patients come to us to alleviate the disease, not acquire a new one. So if wecan all follow simple precautions like washing hands before and after helping our patients, we can all makeadifference.

In the ICU, large epidemics concerning colonization of the bacteria due to contaminated respiratoryequipment have greatly decreased. Most of the transmissions are have attributed to health care workers with24% in hand cultures and about 30% being from the uniform cultures and the health care environment(Kinseyetal.,2017).Theriseincasesofinfectionsresultingfromthebacteriahascreatedtheneedformorein vestigation to be done. In addition, conditions from the bacteria are common in critically ill patients andthoseimmune-compromisedindividuals;thus,itisprimarilyan opportunisticpathogen.

II. Analysis/Discussion

Epidemiological method

In the United States, pseudomonas aeruginosa can be rated as the number one cause of ICU relatedpneumonia. It has also been ranked as the significant cause of osteochondritis and other infections such asurinary tract infections, nosocomial infections, surgical site infections, and bacteremia (Zhou et al., 2022).According to data from the Centers for Disease Control and Prevention National Nosocomial InfectionsSurveillance System, this is according to data. A retrospective analysis done by the united states nationalhospital discharge surveys done between 1996 to 2010, indicates that the incidences of septicemia resultingfrom the pseudomonas aeruginosa declined from 6.5 per 10,000 in 1996 and settled at 3.1 per 10,000 in2001. Still, in 2010 it raised to 6.5 per 10,000. The mortality rates associated with the bacteria are high, withthe mortality rates of pseudomonas aeruginosa exceeding 50% (Noaman et al., 2018). The mortalityinvolving pseudomonal pneumonia typically happens within 3-4 days after the initial symptom ofpulmonary involvement. Ventilator-associated pneumonia resulting from pseudomonas aeruginosa has beenestimatedto beashigh as 68% morethanthosecaused byother pathogens.

The infections affect individuals of all races, but the black race has an increased incidence rate inpseudomonalendocarditis.Theratioofpseudomonasaeruginosaendocarditisinmentowomenhasbeenindicatedby moststudiesat5.4:1 (Deere, Singh&Burns, 2021).

Casedefinition of Pseudomonas Aeruginosa

Theconfirmedcaseforpseudomonas aeruginosais isolationofthebacteriafromthebloodorcerebrospinalfluid. There is confirmed presences of grape-like or fresh-tortilla odour on the bacteriological media andproduction a blue-green pigment pyocyanin and growth at 42°C on a cetrimide agar in the lab (Kolikof,Peterson&Baker, 2020).

The pseudomonas aeruginosa is often carried by the individual who has the infections, and it can be found inhospital equipment,sewerage,plants,animals,food,waterandsoil.Theindividualwhohastheinfectioncancontaminatethehospitalequipmentoreventransmititthothenurses orthehealthcareworkers,whothenbecome the source for transmission. The bacteria can survive in very harsh conditions and therefore stay onthe surfaces for a very long time (Dalip et al., 2018). The healthcare workers' hands and even the uniformscan also act as bacteria reservoirs. The vectors for the bacteria is a common human being as they areinvolved in the day to day transmission of the bacteria. The bacteria are transmitted from one person toanother through contact following a decrease in defence of the susceptible individual. If a person comes incontact with contaminated water, soil or even contaminated medical equipment, they become a vector andtherefore,theycantransmittootherindividuals through contact(Millingtonetal., 2019).

Lifecycle

There is the initial attachment of the bacteria which requires the need of the flagella to promote theattachment of the surface. During this phase of attachment, particular genes, such as algC, algD and algU,are necessary for forming the extracellular polysaccharide involved in encasing the biofilm (Tjiang &Prayoga, 2021). Their next thing is the formation of microcolonies, specifically a small group of bacteria.This formation requires the presence of type IV pili which is then involved in a 'twitching', believed to beimportantin aggregating thecells into themicrocolonies.

Themicrocoloniesarethendifferentiatedintoactualbiofilms.Thequoruminvolvedinthesensingofsignalsbetween the cells may affect the timing of the differentiation and coordination building of the biofilm intomore complex structures (Lee & Zhang, 2015). Lastly, planktonic cells separate and differentiate from thebiofilms. This might occur such that a part of the biofilm breaks from it, this can be regulated detachment,anditlookslikeaprogrammed separationfromtheplanktonicbacteria.

Pathophysiology

Pseudomonas aeruginosa is a bacteria commonly found on the skin's surface, especially the axillary andanogenital region. Most of the infections occur in immune-compromised patients, including those withintravenous lines, burns, dialysis patients, and those with a dysfunctional immune system (Lockwood &Desai, 2019). When the skin integrity interferes, for example, through the insertion of the central venousdevice, the microorganism enters the body through the skin, resulting in the release of toxins and proteases.Itisbothinvasiveandtoxigenic.Theorganismfirstattachesitselftothesiteofinvasion.Thencolonizationoccurs, thus causing a local infection of the skin. It can spread through the bloodstream and cause systemicdiseases such as pneumonia, peritonitis, meningitis, endocarditis, ecthyma gangrenous, and bacteremia(SafetyCommitteeof JapaneseSociety ofAnesthesiologistsanzen@anesth, 2019).

Manifestation

The bacteria are prevalent in the hospital environment, and it is sometimes difficult to distinguish betweeninfections from colonization. The bacteria emit a characteristic sweet odour and are responsible for manydiseases. It is involved in AIDS-related conditions such as pneumonia infection. In the case of bacteremiaand sepsis, it can present with fever which usually comes as the initial symptoms and may be accompaniedby tachycardia and tachypnea (Kang & Ma, 2021). There are also signs of shock such as sweating,confusion,rednessoftheeyes,vomitingandhypotension.Thepatientcanalsopresentwithyellowingoftheskin and eyes. In the case of meningitis, the client can present with non-specific symptoms, including a stiffneck, lethargy, disorientation, nausea, vomiting, and fever. It can also present with purulent cough, chills,fever, severe dyspnea and can also present with cyanosis and mental confusion in extreme cases (Patel et al.,2019).

SitesofaCentralLine Placement

Therearecommonestcenterlineinsertionpoints.Theseplaces aretheveinsundertheclavian,innerneckandfemur.

The SubclavianVein

The subclavian vein is one of the commonest sites for midline insertion. Subclavian vein is a continuance ofaxillaryvein.Attheadjacentborderofthefirstrib,theaxillaryveinwillbecomeasubclavianvein.Theveinthen endures down the scapula towards the sternum until it captures the central edge of the scalene anterior(Garcia-Leal et al., 2021). A vein under the jugular vein merges with an internal jugular vein and becomes ajugular vein. Centerline insertion is usually performed with a subclavian approach. The physician stands onthe same side of the desired vein and shifts the patient's head in the opposite direction. The skin is thenpiercedaboutone centimetrewiththe neckatthe junctionofthe middlepartandthemiddlethirdoftheskull with the needle directly to the sternum. The right midline of the lower back has fewer defects than theleftmidlineof thelower bone(Baker, Anjum&delaCruz,2021).

TheInternalJugular Vein

Theinternalcarotidarteryisanother sitewherethemidlineisinserted.Theinternaljugular veinoriginatesin the sigmoid sinus in the posterior fossa and then exits the skull using the jugular foramen. It then slopesfurther down, at the junction of the neck and chest, where it will merge into a vein for developing abrachiocephalic vein. At its dissection, several vital structures are located near a vein. The internal jugularvein is located in front of the vagus nerve during the operation. It is also located laterally and anterior to theinteriorandcommoncarotidarteries(Kochuba,Rozycki&Feliciano,2021).Anyerrorsintheinstallationofthe centerline elevate the risk of injury to these mechanisms. The supplement of the midline into the internaljugular vein was performed using a central approach. The indicator was aimed at the ipsilateral papilla andinserted into the top of the triangle. With the increasing use of ultrasound-guided insertion, centralizedapproach technology has become obsolete. The right jugular vein is used more often than the left jugularvein because the right jugular vein flows directly into the upper jugular vein, but the left jugular vein doesnot. The left lung apex is also located higher than the right lung. This anatomical difference indicates anincreasedriskofpneumoniaatthecentreoftheleftneck(Leibowitz, Oren-Grinberg&Matyal,2020).

TheFemoralVein

The joint femoral vein, also known as the femoral vein, is the last of the most typical sites for midlineinsertion. The femoral vein obtains drainage from the junction of superficial and deep femoral arteries in theupper thigh. When the pubic ligament is crossed, the femoral vein endures as the external pelvic vein(Gutiérrez,Sánchez&Patiño,2019).Internalhiphaemorrhageisrelatedtotheexternalhiphaemorrhageforforming a common pelvic vein, which merges with the opposite pelvic vein to create a lower venous artery(IVC). IVC flows into the right atrium. The femoral vein is positioned in the femoral triangle. This is ananatomical area with the groin above, the adductor longus muscle centrally and the sartorius muscle to theside(Mengetal.,2022). Thedoctorwillfirstpalpatethefemoralartery utilizingthelumbarligamentandthe anatomical point between the anterior lumbar spine and puberty. Once the pulse has been detected, it iseasy to determine a location where the femoral artery is always central to the femoral artery in the femoraltriangle.Anultrasoundcanguidetheoperationifthetestresults needtobeconfirmedbeforeproceeding.

Treatments

Different interventions are usually employed to treat the condition depending on the severity of the infectionand even the system affected. In drug administration, antimicrobials are generally used, and combinedtherapy is usually prescribed for the initial empiric treatment for the infection. A beta-lactam antibiotictogether with an aminoglycoside is the one mainly used, and they are used to cover the infection involvingthe upper respiratory system, bacteremia, sepsis and even neutropenia (Wagner et al., 2016). All the centralline catheters should be removed immediately, and also treatment is prompt to avoid the incidences of highmortality.

Itisnecessarytoinitiatecombinationtherapyforpatientswithsevereinfectionsandhighrisk.Thetreatmentneeds two anti-pseudomonal antibiotics that do not have the same mode of action and are mostly combinedwithanaminoglycoside.Thecombinationtherapywillreducethechanceofchoosingtheresistantmutant, which is usually reserved for more severe cases and renal disease to avoid nephropathy related toaminoglycoside (Wagner et al., 2016). It is also important to note the current pseudomonas drug resistancewhen prescribing. In the case of bacteremia, empiric antibiotics are usually initiated before identifying themicroorganism for at least two weeks. In the presence of skin infections and bone, aminoglycosideantibiotics course for four weeks. It is effective in managing osteomyelitis. For the more severeosteomyelitis, a

combination of aminoglycoside and anti-pseudonomal penicillin and surgical interventionsis indicated.
Surgical care is also done in the most severe case to promote good health; for example, those who develop abrain abscess will require surgical drainage. Other surgical procedures done include surgical debridement ofwounds, tympanomastoid surgery, valvulectomy in case of persistence of bacteremia beyond two weeks,heart and lung transplant. Regular consultation is also necessary with diet to prevent malnutrition andprevent complications that may result from it. Individual activity restriction depends on the nature ofinfection.

Prognosis

Depending on the severity of the disease, a good prognosis can be made concerning the condition becausemostoftheinfectionsconcerningthebacteriacanbesuccessfullytreatedwithantibioticsandsurgery.

However, immune-compromised patients such as those living with HIV have a high mortality rate,especially in the case of bacteremia and infections of the lower lung. Those with severe heart infections alsohave significant mortality of 15 to 20% while it can reach mortality of 89% or those with the left side of theheartinfections.

Riskfactors

ThecompromisedimmunesystemindividualswithHIV,andthosewhohaveundergoneanorgantransplantor those on immunosuppressive agents usually have lowered body defence system and thus they are likely todevelop infections that a result from the pseudomonas aeruginosa because it is almost everywhere in thehospital (Taj et al., 2018). Another risk factor is recent hospitalization; recent studies show that healthcareworkers play a key role in transmitting the bacteria to other patients. So, recent hospitalization will put thepersonathigher risk fordeveloping pseudomonasinfection.

Insertion of central venous devices is also a risk factor for pseudomonas aeruginosa infection. Usually, thebacteria are found on the skin surface, and a break created by the insertion of the central venous devicepromotes the entry of the bacteria into the bloodstream. Thus it is a high-risk factor. The length of stay in thehospital also facilitates the spread of the microorganism to the person because the contact period has alsobeenprolonged.

Indwelling devices also puts the patient at higher risk because it provides a surface for colonization whichthen facilitates the entry of the microorganism from the skin surface into the body, resulting in infections.Icu patients are also at higher risk due to the presence of numerous devices used to provide support to theclient. This might include prolonged intubation and enteral feeding, which provides the surface forcolonization. Individuals with a previous history of pseudomonas aeruginosa infections are also at higherrisk of recurrent infection. This might be due to ineffective treatment or immunosuppression, resulting fromdisorders or drug therapy.

Confirmationofdiagnosis

Laboratorystudies thatweredonesuggestpseudomonalinfectiondueto thefollowingfindings

- CBCrevealsbandemiaandleukocytosiswiththeleft

shift.Thisshowsthepossibleavailabilityoftoxicvacuolesor granulations

- ElevatedlevelsofESRandCRP
- Presencesofelectrolyteabnormalitiesinthemetabolicprofilewithdehydration
- Cultureofshows involvementofthepseudomonas aeruginosa

Fromthedataabove,itis clearthattheincidenceoftheinfectionincreasedfrom19toabout41%.Thisshows thattheremightbeanincreasein theamount,virulenceand transmissionofthebacteria.

RecommendedInfectionPreventionand Control Strategies

Pseudomonas aeruginosa is very common in the hospital, and therefore it is a bacteria almost presenteverywhereinthehospitalfacility.Provisionofinformationconcerningtheconditionwill initiatekeenness in using the protective measures. Patients and other clients can also perform personal efforts to preventinfections to other high-risk patients (Simões et al., 2016). Appropriate steps, including client education, areessentialin thiscase.

Samples should be taken for all the individuals suspected to have the condition and lab tests should be doneto rule out the presence or confirm diagnoses for the condition. Notification of the healthcare staff is alsoessential, including the support staff. This will help reduce the transmission rate and lower the rate of newincidencesinthehospital.Initialscreeningisalsodoneforallnewlyadmittedindividuals tothefacility;thiswill act as baseline data to determine the hospital-acquired cases and those who came to the facility with theinfection (Taj et al., 2018). It also enables the caregivers in the hospital to initiate the necessary treatmentearlier to prevent the development of complications. Isolation of the individuals and Sterilization of theequipment is vital in lowering the number of bacteria in the environment. It also reduces the chances oftransmission from the

infected individuals to the uninfected patients at risk. The nurses and other health carestaff who will be involved in the care delivery to the clients should use protective equipment, practice handhygiene and be involved in all aseptic techniques when providing care to the clients. This will preventtransmission. Patients at risk can also be given antibiotics for prophylaxis to prevent them from contractingthe infection. For those patients who have infections from pseudomonas aeruginosa, frequent assessmentshould be done to note the progress of the diseases and determine the effectiveness of the drugs; this willalsohelp detectresistanceto thedrug.

III. Conclusion:

Pseudomonas aeruginosa is common bacteria in the hospital and patients in the ICU and those with centralvenous catheters are at high risk for developing complications from its infection. Therefore, it is necessary toperform necessary preventive measures to prevent the spread to other patients and lower the incidences inhospital.

References:

[1]. Baker, M., Anjum, F., & dela Cruz, J. (2021). Deep Venous Thrombosis Ultrasound Evaluation. *StatPearls[Internet]*.

[2]. Dalip, D., Iwanaga, J., Loukas, M., Oskouian, R. J., & Tubbs, R. S. (2018). Review of the variations of thesuperficialveinsof theneck.*Cureus*, *10*(6).

[3]. Deere, M., Singh, A., & Burns, B. (2021). Central Venous Access of The Subclavian Vein. *StatPearls[Internet]*.

[4]. Garcia-Leal, M., Guzman-Lopez, S., Verdines-Perez, A. M., de Leon-Gutierrez, H., Fernandez-Rodarte, B.A., Alvarez-Villalobos, N. A., ... & Elizondo-Omaña, R. E. (2021). Trendelenburg position for internaljugular vein catheterization: A systematic review and meta-analysis. *The Journal of Vascular Access*,11297298211031339.

[5]. Gutiérrez,D.G.,Sánchez,J.B.,&Patiño,R.R.(2019).Supraclavicularapproachforsubclavianveincatheterization in pediatric anesthesia: The reborn of an ancient technique with the ultrasound'sassistance.*RevistaEspañoladeAnestesiologíayReanimación(EnglishEdition)*,*66*(5),267-276.

[6]. Kang, H.,& Ma, H. (2021). Opportunistic Insertion of Implantable Venous Access Port Through PersistentLeft Superior Vena Cava: A Report of 2 Cases and Literature Review. *Ame J Surg Clin Case Rep*, *3*(9), 1-4.Kim, D. W., Chung, S., Kang, W. S., & Kim, J. (2022). Diagnostic Accuracy of UltrasonographicRespiratory Variation in the Inferior Vena Cava, Subclavian Vein, Internal Jugular Vein, and Femoral VeinDiametertoPredictFluidResponsiveness:ASystematicReviewandMeta-Analysis.*Diagnostics*,*12*(1),49.

[7]. Kochuba,M.,Rozycki,G.F.,&Feliciano,D.(2021).Outcomeafterligationofmajorveinsfortrauma.*JournalofTraumaand AcuteCareSurgery*,*90*(2), e40-e49.

[8]. Kolikof, J., Peterson, K., & Baker, A. M. (2020). Central Venous Catheter. *StatPearls [Internet]*.Leibowitz, A., Oren-Grinberg, A., & Matyal, R. (2020). Ultrasound guidance for central venous access:currentevidenceandclinicalrecommendations.*JournalofIntensiveCareMedicine*,*35*(3),303-321.

[9]. Lockwood, J., & Desai, N. (2019). Central venous access. *British Journal of Hospital Medicine*, *80*(8),C114-C119.

[10]. Meng, X. H., Liu, Y. C., Xie, L. S., Huang, C. P., Xie, X. P., & Fang, X. (2022). Intravascular fasciitisinvolving the external jugular vein and subclavian vein: A case report. *World Journal of ClinicalCases*, *10*(3), 985.

[11]. Millington, S. J., Lalu, M. M., Boivin, M., & Koenig, S. (2019). Better with ultrasound: subclavian centralvenous catheter insertion.*Chest*, *155*(5), 1041-1048.

[12]. Patel,A.R.,Patel,A.R.,Singh,S.,Singh,S.,&Khawaja,I.(2019).Centrallinecatheters andassociatedcomplications:areview.*Cureus*, *11*(5).

[13]. SafetyCommitteeofJapaneseSocietyofAnesthesiologistsanzen@anesth.or.jp.(2019).Practicalguideforsafecentralvenouscatheterizationandmanagement2017.*JournalofAnesthesia*,*34*(2),167-186.

[14]. Tjiang, M. M., & Prayoga, D. A. (2021). Incidence And Characteristics Of Double Lumen Induced CentralVenous Catheter-RelatedThromboembolismInHemodialyticPatients.*Medicinus*,*8*(3),111-116.

[15]. Zhou, Y., Lan, Y., Zhang, Q., Song, J., He, J., Peng, N., ... & Yang, X. (2022). Totally implantable venousaccess ports: A systematic review and meta-analysis comparing subclavian and internal jugular veinpunctures.*Phlebology*, 02683555211069772.

Dr.Khaled Mohamed, et. al. "Femoral Vein versus Jagular and Sub-clavian Vein Catheterization in ICU." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 21(10), 2022, pp. 24-28.