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Research Article

Comparison of central vein pressure between distal, medial, and proximal lumens with water manometer method

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ABSTRACT

Catheter Vein Pressure in ward-cared patients is rarely measured and considered invalid. The two catheter vein pressure postulates contradict, making confusion among health workers. Dr Russo said the distal-medial-proximal Catheter Vein Pressure has no difference but were denied by Susan S. Scott. Proof of postulate is needed as a solution to inward care. Therefore, this study aimed to compare the central vein pressure between distal, medial, and proximal lumens with the water manometer method. Forty-nine samples retrospective study were taken from the distal - medial - proximal Catheter Vein Pressure of the "zero" until fifth days. The differences are analyzed with Statistical Paired t Test with p-Value < 0.05 from SPSS ver. 26 to prove the right postulate. 49 samples were concluded to represent of population. Catheter Vein Pressure from day "zero" becomes zero difference, the fifth day 91.8% are no difference while the rest have difference of 0.2 - 1.0 cm H2O and the conclusion are no significant difference with 95% CI. The correlation scale of 0.998 and 0.999 proves that the three lumens tend to produce no differences. In conclusion, the distal - medial - proximal Catheter Vein Pressure values in this study have no significant differences and consistent from "zero" until fifth days. This is formulated as P distal = P medial = P proximal (cm H2O).

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INTRODUCTION

Central Vein Catheter in the collaborative and intensive care space (Sanjiv J.Shah and Carolyn S. Calfee, 1998; Chen et al., 2000; Wolf Scott W., 2006) measurements are still useful in confined spaces (Magder, 2005; Miryam M Reems, DVM, and Marcel Aumann, Dr. Med Vet., DACVECC, 2012; Stephen M.Rupp, 2012), although this has only recently begun to doubt (Magder, 2012). In practice, Dr. Russo in his postulate said Central Vein Catheter pressure on the distal - medial - proximal lumen would be the same value based on the laws of physics, while according to Susan S Scott higher values in each lumen and buying every equalization (Susan S Scott et al., 1998).

This problem has an impact when working in the ward treatment room and the need for a road based on evidence from measurement practices that are then discussed in scientific form. From the explanation, it can be seen that the problem flow that must be proven is really needed for the equalization in the central vein catheter lumen.

The focus of attention from this research was the smooth operation of these three lumens from the time they were installed until the next five days, and that requires routine and thorough maintenance techniques (Stephen M.Rupp, 2012; Wolf et al., 2015; Anne Rose et al., 2017). When the lumen is not smooth, the measurement considered invalid also has a bias that determines clinical decisions (Magder, 2005, 2006, 2012). Therefore, this study aimed to seek a proof of the accuracy, difference and deviation of catheter vein pressure distal - medial - proximal lumens from patients with central vein catheter with the water manometer method.

METHODS

This study was cross-sectional in a descriptive retrospective observational design. This study aimed to compare the accuracy, difference, and deviation of catheter vein pressure distal - medial - proximal lumens from patients with central vein catheters. Measurements were taken when newly installed and compared with 5x24 hours afterward for the approved and independent variables.

The study population was patients with demographic characteristics of 17-80 years old samples, central vein catheter with three French 7 size lumens, catheter vein pressure measurements on Day-0, Day-3, and Day-5. Patients had to complete administration and had been evaluated by radiological studies after insertion as indicated. The central vein catheter was not pulled out or replaced before Day-5. According to statistics, the large samples were a minimum of 31 patients to take samples in the medical records room Dr. Soetomo Hospital Surabaya. This study has been ethically approved by the ethical committee of Dr. Soetomo Hospital Surabaya (certificate number: 1995 / KEPK / V / 2020)

The data was processed to obtain the difference and accuracy by comparing the distal catheter lumens. The data has been analyzed using a paired t-conformity test (statistical paired t-Test with p-Value < 0.05 from SPSS ver. 26).

RESULTS

Demographic characteristics data in this study diverged in normally distributed. Demographic data descriptions summarized are listed in the following table.

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Table 1. Demographic and Clinical Characteristic of Patients Sample

Variable	Means ± SD or Frequency (%)	Range
Age (yr)	50 ± 15,542	17 – 80
Gender		
Male (♂)	25 (51%)	
Female (♀)	24 (49%)	
Height (cm)	158,898 ± 7,570	143 – 170
Weight (kg)	60,082 ± 13,441	35 – 100
Body Mass Index (kg/m^2)	23,751 ± 4,835	16,647 - 40,058
Body Surface Area (m^2)	1,408 ± 0,152	0,919 - 1,623

* SD = Standard Deviation

Table 2. Difference Comparison of Catheter Vein Pressure (ΔP) Distal – Medial.

Difference Pressure (ΔP)	Interval Class frequency(F)	Percentage (%)
1.00	1	2.0
0.70	1	2.0
0.50	2	4.1
0.00	45	91.8
Population (N)	**49**	**100.0**

*N = Population; F = Interval Class frequency; ΔP = Difference Pressure.

Table 3. Difference Comparison of Catheter Vein Pressure (ΔP) Distal – Proximal.

Difference Pressure (ΔP)	Interval Class frequency (F)	Percentage (%)
2.00	1	2.0
1.40	1	2.0
1.20	1	2.0
0.90	1	2.0
0.00	45	91.8
Population (N)	**49**	**100.0**

*N = Population; F = Interval Class frequency; ΔP = Difference Pressure.

Table 4. Difference Comparison of Catheter Vein Pressure (ΔP) Medial - Proximal

Difference Pressure (ΔP)	Interval Class frequency (F)	Percentage (%)
1.00	1	2.0
0.90	1	2.0
0.70	1	2.0
0.20	1	2.0
0.00	45	91.8
Population (N)	**49**	**100.0**

*N = Population; F = Interval Class frequency; ΔP = Difference Pressure.

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Table 5. Difference Comparison Distal, Medial, Proximal Catheter Vein Pressure.

Paired Samples Test 95% CI		Mean ± SD	t	df	p Value**
Pair 1	Distal Medial	-0,055 ± 0,196	-1.969	48	0,055
Pair 2	Distal Proximal	-0,112 ± 0,398	-1.976	48	0,054
Pair 3	Medial Proximal	-0,057 ± 0,213	-1,877	48	0,067

*CI = Confidence Interval; df = *Degree of freedom*, t = Pair Test; SD = Standard Deviation
** Student t Paired Test with p Value < 0.05

The catheter vein pressure value of the first measurement day does not produce a difference. The paired t-test cannot be done, and the value is considered to be the baseline value of the central vein catheter test before it is marketed. The fifth-day measurement for the catheter vein pressure value difference values are obtained and shown in the following tables.

There was 91.8% distal and medial catheter vein pressure difference in is zero, while the rest is 0.5-1, and it is concluded that there is no significant difference.

From this data, 91.8% Distal and proximal catheter vein pressure differences in is zero, while the rest is 0.9 - 2.0 cm H2O and it is concluded that there is no significant difference.

Also, from this data, 91.8% Distal and proximal catheter vein pressure difference is zero, while the rest is 0.2 - 1.0 cm H2O, and it is concluded that there is no significant difference.

The difference in pressure from the three lumens does not significantly differ with a 95% confidence interval. It concludes the first measurement until the fifth-day catheter vein pressure values remain not disputed.

DISCUSSION

The study took data on several patients who had completed intensive care or resuscitation treatment with a central vein catheter device that was inserted to measure catheter vein pressure. Care for smooth lumen should be carried out if the lumen is used for total parenteral nutrition administration (Magder, 2005, 2006, 2012), or suspected to have formed fibrin fibers due to never being used (John Santilli, 2002; Miert, Hill and Jones, 2012; Wolf et al., 2015)

Many medical practitioners have assumed that if the lumen is used for total parenteral nutrition, catheter vein pressure measurements cannot be carried out (Blot and Laplanche, 2000; Magder, 2005; Barke et al., 2008; Malinoski et al., 2013). The Catheter Vein Pressures that are performed other than distal lumens produce invalid values and need to be synchronized (Susan S Scott et al., 1998).

On the first measurement day, the distal-medial-proximal lumen catheter vein pressure was proven to be no different using a water manometer, as well as proving the quality of production according to standards manufacturer (Arrow International, 2001; Marsha Halfman, RN and Sandra Reiner, RN, BSN, 2002; Davidovits, 2008; Ishikawa, 2010). This is in accordance with Dr. Russo's postulate in 1991 which was not published (Susan S Scott et al., 1998). In vitro similar studies not living

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things but resembling a human body have been conducted and prove the same result (Jonuarti, 2013).

All the data collected analyzed for its distribution and variance first. Levene's and Shapiro-Wilk tests proved that the study data within normal limit distribution and normal variance to represent all the statistical characteristics of the demographics of age, sex, height, weight, body mass index, and body surface area. This study's sample got different data of measurement from its previous study of Susan S Scott, which is 8 patients experiencing significant catheter vein pressure differences in the three distal-medial-proximal lumens (Susan S Scott et al., 1998). For both measurement techniques, Susan S Scott measures once using a modern transducer and is only done in the ICU room (Susan S Scott et al., 1998) but this study measured three times using a water manometer as a primary gauge and only once compared in a modern transducer for the first time and carried out in various ward treatments.

On the fifth day, as much as 91.8% of the catheter vein pressure value resulted in a zero difference, and the rest produced differences ranging from 0.2 to 1.0 cm H2O. From the t-test comparison between the differences in the three lumens, it was concluded that there was no significant difference between the distal-medial-proximal lumen catheter vein pressure from the day "zero" to fifth. The correlation scale results prove the distal-medial-proximal lumens catheter vein pressure tends to be the same value without a difference. This research also proved that there was no difference in distal - medial - proximal lumens catheter vein pressure both days from "zero" to fifth. The equation can be written as P distal = P medial = P proximal.

This study also found a technique to keep the distal-medial-proximal lumen so that it remained smooth to exchange the infusion lumen every 12-24 hours on each central vein catheter lumen. Although in some compendium the use of alteplase is included as a drug to prevent or destroy blood clots in the central vein catheter lumens (Barke et al., 2008; Miert, Hill and Jones, 2012; Miryam M. Reems, DVM and Marcel Aumann, Dr. Med. Vet. , DACVECC, 2012; Wolf et al., 2015; Anne Rose et al., 2017), but this technique is the safest, simplest and most economical way to be used during the care of patients in the care ward.

The researchers also found that if the pressure difference still occurs on the fifth day even though the lumens maintenance has been carried out. It must be wary of the surface's quality in the distal-medial-proximal central vein catheter lumens are not good and do not have the resistance according to standards production.

CONCLUSION

The distal - medial - proximal lumens catheter vein pressure of the first until the fifth day has proven to be consistent based on measurements and statistical tests. The important practical conclusion from this result is that catheter vein pressure can be measured from any of its lumens. Infusion fluid that flow through central vein catheter lumens every 12-24 hours maintains lumen patent. There is no limitation for the measurement from clinical patient's condition, it can be done for all patients with central vein catheters.

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