http://ejournal.seaninstitute.or.id/index.php/healt
Jurnal Eduhealt, Volume 14, No. 01, 2023
E-ISSN. 2808-4608

Coronary Suture Size Difference Analysis Between Conventional Methods and Morphometric Methods During Ventriculo Peritoneal Shunt Operation

Jefri Henky
Bagian Bedah Saraf dan Spine, Semen Padang Hospital, Fakultas Kedokteran Universitas Baiturrahmah Padang

ARTICLE INFO

Keywords:

Coronary, Conventional Methods, Morphometric Methods, Ventriculo Peritoneal Shunt Operation

ABSTRACT

This action needs attention because the components of the ventricular catheter are considered as the most common cause of mechanical failure in cases of shunt malfunction. The characteristics of the research variables will be presented in the form of concentration values and data variations, while the bivariate data will be analyzed using the t test to analyze the difference in the average coronary suture distance determined using the conventional method and the morphometric method. Significance was determined based on the p-value which was ≤ 0.05 and a confidence interval (CI) of 95%. An observational study was carried out in the operating room of Semen Padang Hospital in hydrocephalus patients who had a VP shunt installed, a sample of 40 patients was collected, then analyzed computerized to present the characteristics of the research subjects. The mean age of patients who underwent VP shunt installation was 46.13 + 125 years. The mean size of the patient's head circumference was 55.60 + 1.297 cm, while the average size of the patient's nasion-POE anatomy was 33.38 + 1.030 cm. The mean thickness of the patient's scalp was 7.73 + 0.679 mm. The average size of the coronary suture anatomy from the patient's orbital rim is 11.81 + 0.443 cm, with a difference in the measurement accuracy of conventional suture identification which is 8.13 +4,43 mm. Meanwhile, the mean difference in size accuracy of morphometric identification of sutures was 6.63 + 6.18 mm. The variable size of the patient's head circumference was normally distributed (p = 0.077), the anatomical size variable of the nasion-POE was normally distributed (p = 0.061), the variable size for scalp thickness was also normally distributed (p = 0.102), the variable size of the coronary suture of the orbital rim was distributed was normal (p = 0.072), the variable difference in the accuracy of the conventional method of identification was normally distributed (p = 0.114) and the difference in the measure of the accuracy of the identification of the morphometric method was also normally distributed (p = 0.084). The difference in mean coronary suture identification size between the conventional method and the morphometric method was 1.475 + 0.107 cm, meaning that there was a significant difference in the mean coronary suture identification size between the conventional method and the morphometric method with a p value <0.001. The mean difference in the difference in the size of the coronary suture identification between the conventional method and the morphometric method was 1.500 + 1.202 mm, meaning that there was a significant difference in the mean difference in the size of the coronary suture identification between the conventional method and the morphometric method with a p value <0.05.

1. INTRODUCTION

Ventriculo peritoneal shunt (VP shunt) is a surgical procedure in the form of placing a ventricular catheter which is useful for permanently or temporarily draining cerebrospinal fluid through a tube implanted under the skin into the peritoneal cavity. Consists of 3 components namely ventricular catheter, valve or pump and distal catheter.[1-4]

Placement of ventricular catheters needs to be considered because the ventricular catheter components are considered to be the most common cause of mechanical failure in shunt malfunction cases, namely around 22.4% are in the intra-brain parenchyma. Epidemiologically, it is estimated that around 25,000 ventricular VP shunt catheters are placed annually in North America and an estimated 2 times of these undergo revision surgery..[5,6]

Ventricular catheter placement is a very common procedure performed by neurosurgeons. But the accuracy of ventricular catheter placement is always a question intraoperatively and postoperatively. It is not uncommon for multiple holes to form in the cerebral cortex and lateral ventricles due to incorrect entry points in the cerebral cortex and incorrect positioning of the ventricular catheter tip in the lateral ventricles.[7-10]

For this action, determining landmarks for the ventricular catheter entry point often slows down the action so that it takes quite a long time, namely 20-45 minutes. This time is quite significant in patients who need surgery as soon as possible or cito as in cases of acute hydrocephalus. The failure of the EVD procedure is quite high, namely 20% in the brain parenchyma.[11-16]

Determination of the coronary sutures is an important and initial step to create a frontal burrhole. Determination of the location of the coronary sutures is classically done by feeling the indentation of the surface of the skull under the soft tissue under the scalp. In general, there are 2 ways to determine coronary sutures, namely the conventional method and the morphometric method.[1,4,5,7-9,12,20-24]

The conventional method is determined based on a line made from a meeting point 1.5 cm in front of the left tragus and a point 1.5 cm in front of the right tragus, the line is made to intersect with the midpupil line on the side to be drilled. The morphometric method of coronary sutures is measured based on the normal anatomical average size of the skull, which is 11 cm from the nasion or orbital rim and intersects with a line formed 3 cm laterally from the midline.[1,4,5,7-9,12,20-24]

Based on the description above, it is considered important to measure the coronary sutures using the conventional method with the morphometric method in VP shunt installation operations as an effort to reduce ventricular catheter placement errors. This will affect the occurrence of shunt malfunction in the VP shunt installation operation.

2. METHOD

This study is an observational study with a cohort design, by observing the measurement of each coronary suture in patients undergoing VP shunt surgery using the conventional method and the morphometric method.

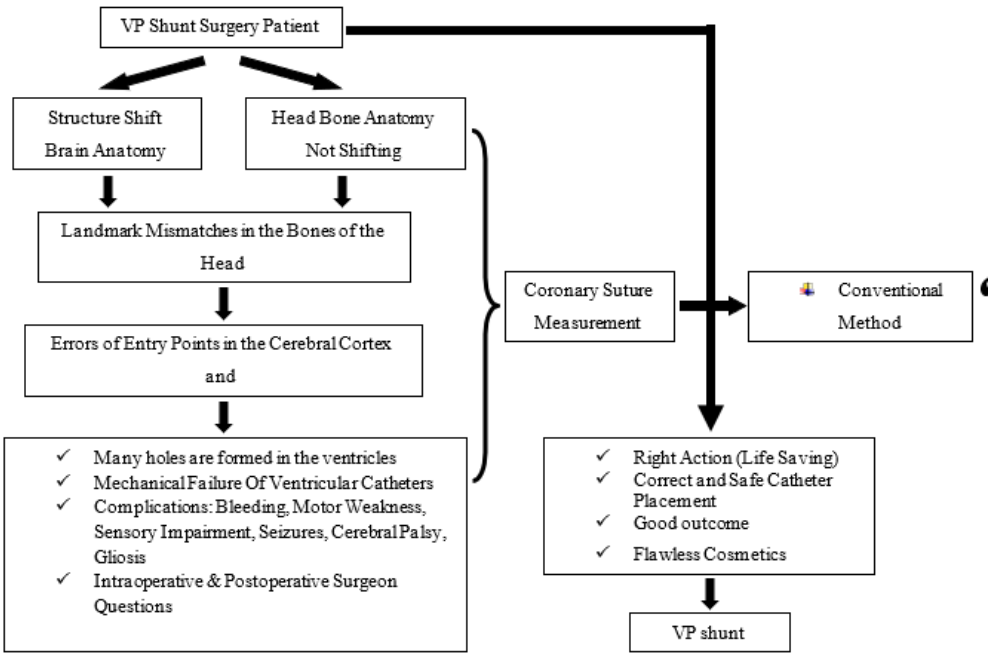

Figure 1. the conventional method and the morphometric method.

The study was conducted in the operating room of Semen Padang Hospital with the subjects of this study being all patients with VP shunt installation who met the inclusion criteria and were not included in the exclusion criteria. The inclusion criteria are:

a. Hydrocephalus patient who will undergo a VP shunt installation operation.
b. Adult (≥18 years old).
c. Obtain approval or permission from the family (informed consent).

While those included in the exclusion criteria are:

a. Patients who have anatomical defects from physical examination.
b. Patients who have an asymmetric head shape.
c. Patients with a history of macrocephaly or microcephaly as a child.
d. Patients who have a history of surgery on the brain and skull.

Determination of the number of samples was calculated based on the suitability test with the Kappa Cohen formula, so a sample of 40 cadaver was obtained, with the following calculations:[27,28]

$$n = Z_\alpha^2 \frac{(1-k)}{d^2}\left[(1-k)(1-2k) + \frac{k(2-k)}{2\pi(1-\pi)}\right]$$

$$n = 1{,}96^2 \frac{(1-0{,}8)}{0{,}2^2}\left[(1-0{,}8)(1-2\times 0{,}8) + \frac{0{,}8(2-0{,}8)}{2\times 0{,}5(1-0{,}5)}\right]$$

n = 36, added 10 % backup (10% from 36 = 4)
n = 40 kadaver

So a minimum total sample is required 40 patient

n : The number of samples needed in the study
α : Errors that are still acceptable, set by researchers at 5%
Z_α : Alpha standard deviation, α = 0.05, so Zα = 1.96

k : The minimum kappa value that is considered adequate is determined by the researcher at 0.8
d : The precision of the kappa value, determined by the researcher, is 0.2
π : The prediction of the actual positive test results was determined by the researcher at 0.5

The research data was calculated and processed using the SPSS for Windows version 12.0 program. The characteristics of the research variables will be presented in the form of central values (mean and median) and data variations (standard deviation and minimum-maximum values). Bivariate data were analyzed using the t test to analyze the difference in mean coronary suture distances determined using conventional methods and morphometric methods. Significance was determined based on the p-value which was ≤ 0.05 and a confidence interval (CI) of 95%.

3. RESULTS AND DISCUSSION

An observational study was carried out in the operating room of Semen Padang Hospital in hydrocephalus patients who had a VP shunt installed. This study observed and compared the size of the coronary sutures between the conventional method and the morphometric method. Data collection was carried out successively on patients who met the inclusion criteria and did not include the exclusion criteria.

Samples were collected as many as 40 patients, then analyzed computerized to present the characteristics of the research subjects. Categorical data variables such as conventional and morphometric suture identification accuracy are presented in the form of frequency distribution tables. Whereas in the numerical data variables the presentation of data in the form of central values (mean and median) and data variations (standard deviations and minimum-maximum values), consists of the variables age, head circumference size, national anatomical size-POE, scalp thickness size, size Coronary suture anatomy from the orbital rim and difference in measurement accuracy of conventional and morphometric suture identification.

The distribution or distribution of the data will be assessed as normal or not normal using the Kolmogorov Smirnov test. Furthermore, the difference in the mean size of the coronary sutures and the difference in the mean difference between the two identification methods were tested using an unpaired t-test.

Table 1. Characteristics of Research Subjects

Characteristics	Statistical Value
Age (years)	46,13 ± 125 (19-68)
Head circumference size (cm)	55,60 ± 1,297 (54 - 58)
National Anatomical Size-POE (cm)	33,38 ± 1,030 (32 - 35)
Size of scalp thickness(mm)	7,73 ± 0,679 (6 - 9)
Coronary suture anatomy size of the orbital rim (cm)	11,81 ± 0,443 (11,00 - 12,60)
The difference in the size of the accuracy of conventional identification of sutures (mm)	8,13 ± 4,43 (0 - 16)
The difference in the accuracy of morphometric identification of sutures (mm)	6,63 ± 6,18 (0 - 20)

In table 1, it can be seen that the average age of the patients who underwent VP shunt surgery was 46.13 + 125 years, with the youngest patient being 19 years old and the oldest patient being 68 years old. The mean size of the patient's head circumference was 55.60 + 1.297 cm, with the smallest patient head circumference of 54 cm and the largest patient head circumference of 58 cm.

Meanwhile, the average length of the national anatomy-POE is 33.38 + 1.030 cm, with a minimum length of 32 cm and a maximum length of 35 cm. In addition, in this study, the average

patient's scalp thickness was 7.73 + 0.679 mm, with a minimum patient scalp thickness of 6 mm and a maximum patient scalp thickness of 9 mm.

In this study, the average size of the coronary suture anatomy of the orbital rim of patients who underwent VP shunt surgery was 11.81 + 0.443 cm, with a minimum size of 11.00 cm and a maximum size of 12.60 cm. From these measurements, there is an average difference in the accuracy of the conventional identification of sutures, which is 8.13 + 4.43 mm, with a minimum accuracy difference of 0 mm and a maximum difference of 16 mm. While the mean difference in the accuracy of the morphometric identification of sutures was 6.63 + 6.18 mm, with a minimum difference of 0 mm and a maximum difference of 20 mm.

The data normality test is carried out on several numerical data variables, this is useful for assessing whether each variable is normally or not normally distributed and for continuing the selection of comparative analysis tests between these variables. Based on the Kolmogorov-Smirnov test the data is normally distributed if the variable has a p value > 0.05.

The variable size of the patient's head circumference was normally distributed (p = 0.077), the anatomical size variable of the nasion-POE was normally distributed (p = 0.061), the variable size for scalp thickness was also normally distributed (p = 0.102), the variable size of the coronary suture of the orbital rim was distributed was normal (p = 0.072), the variable difference in the accuracy of the conventional method of identification was normally distributed (p = 0.114) and the difference in the measure of the accuracy of the identification of the morphometric method was also normally distributed (p = 0.084).

Table 2. Differences in Mean Size of the Two Coronary Suture Identification Methods

Variable	average ± SD (cm)	Average Difference ± SE	p
Conventional Method	12,48 ± 0,679	1,475 ± 0,107	0,000
Morphometric Method	11,00 ± 0,000		

Based on table 2 above, it can be seen that the difference in the mean coronary suture identification size between the conventional method and the morphometric method in 40 patients who underwent VP shunt surgery was 1.475 + 0.107 cm, meaning that there was a significant difference in the mean coronary suture identification size between the conventional and morphometric methods. ie with a p value <0.001.

Table 3. The difference in mean difference between the two Coronary Suture Identification Methods

Variable	Average ± SD (mm)	Average Difference ± SE	p
Conventional Method	8,13 ± 4,427	1,500 ± 1,202	0,016
Morfometrik method	6,63 ± 6,180		

Based on table 3 above, it can be seen that the mean difference in coronary suture identification size between the conventional method and the morphometric method in 40 patients who underwent VP shunt surgery was 1.500 + 1.202 mm, meaning that there was a significant difference in the average difference in coronary suture identification size between the conventional and coronary suture identification methods. morphometric method with a p value <0.05.

If you use one of the coronary suture identification methods above, then in this study it is better to use the morphometric method with an average difference in size accuracy of suture identification of around 6.63 + 6.18 mm from the size of the coronary suture to the orbital rim which is about 11.81 + 0.443cm.

The morphometric way of identifying coronary sutures is based on the anatomical average size of normal skull bones, which is 11 cm from the nasion or orbital rim and intersected by a line formed 3 cm laterally from the midline on the side of the insertion site or the place where the burrhole was made. This method is very simple, fast and easy to do, especially in an emergency. The research data supports that the morphometric method has a greater percentage of accuracy than the conventional method. Besides that, the average size difference in the accuracy of identifying the coronary sutures by the morphometric method is smaller than the conventional method, meaning that the morphometric method is closer to the actual size in determining the coronary sutures. 3,4,20-22

All of the data in this study apply to adult patients with an average age of 46.13 years, who have normal head shape and anatomical size. The distribution of the data in this study was also normal because this study followed the inclusion and exclusion criteria that had been established as a procedure to equate all subjects. As a reference value for this study, the average size of the head circumference of the study subjects is displayed at around 55.60 + 1.297 cm and the average size of the anatomical length of the National-POE is 33.38 + 1.030 cm and the average thickness of the scalp is 7.73 + 0.679 mm . This data is considered to have benefits in determining the reference value of the head anatomy of research subjects if one day there is research on different ethnicities, tribes or nations.

Research conducted by Ji-Hoon L, et al in 2010 stated that about 50% of the ventricular catheter tips were in the frontal horn, 10% were in the brain parenchyma and 40% were in the contralateral lateral ventricles, interhemispheric fissures and cisterns. If related to the literature, the large percentage of inaccurate identification of coronary sutures using two methods in this study, the data of this study indirectly contributed to the incidence of mispositions, malfunctions and revision surgeries for shunt installation so that it needed to be modified or reassessed. 5-7 ,21-29

The mean difference in the size of the coronary suture identification between the conventional method and the morphometric method is statistically 1.475 + 0.107 cm, whereas the conventional method has a larger average size of 12.48 + 0.679 cm compared to the average size of the morphometric method which is 11 cm, statistically the mean difference the two measures of identification are significant with a p value <0.001.

As for the difference in the mean difference in the size of the coronary suture identification between the conventional method and the morphometric method is 1.500 + 1.202 mm. The morphometric method has a smaller average size difference and is considered closer to the normal size of the coronary suture of the orbital rim when compared to the conventional method, statistically the difference in the mean size difference between the two identification methods is also significant with a p value <0.05.

4. CONCLUSION

The morphometric method in identifying coronary sutures has a greater percentage of accuracy and is closer to the actual size of the coronary sutures. The accuracy of identification of coronary sutures using the conventional method is significantly different from the morphometric method in terms of the average size and the mean difference in size with the actual size of the coronary sutures.

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