

Sudan University of Science and Technology
College of graduate studies

**Measurements of Normal Lateral
Ventricles in Adult Sudanese Patients
Using Computed Tomography**

قياسات البطينات الجانبية الطبيعية
للمرضى السودانيين البالغين بواسطة
الأشعة المقطعية

*Thesis Submitted for Partial Fulfillment of the Requirements
of M. Sc. Degree in Diagnostic Radio logic Technology*

By:

Amina Abdelbagi Ahmed

Supervisor:

Prof. Bushra Hussein Ahmed

December, 2009

Dedication

To the soul of my father

To my mother

To my dear husband and my children.

To my brothers and sisters.

To my teachers, friends and colleagues

Acknowledgment

Praise and thanks are due to **Allah, the Lord and Creator**.

Special thanks to my supervisor, Professor Bushra Hussein Ahmed, for his valuable and continuous help and guidance.

My thanks are extended to the staff of the radiology department in Khartoum teaching hospital , Alnilien diagnostic center , Elribatt university hospital and Khartoum advanced diagnostic center, which helped me in collecting the information.

My thanks also extended to Dr. Mohamed Elfadil and Dr. Mohamed Ahmed who helped me to analyze the data by computer.

بسم الله الرحمن الرحيم

مستخلص البحث

يمكن قياس البطينات الجانبية باستخدام الأشعة المقطعية حيث يمكن قياس طولها أو عرضها أو حجمها كما يمكن أيضا قياس كثافة السائل النخاعي الشوكي . تمت هذه الدراسة بمستشفى الخرطوم التعليمي بالإضافة إلى بعض المراكز الطبية الخاصة ، امتدت الدراسة من يونيو 2009 إلى ديسمبر 2009م.

كان الهدف الأساسي من الدراسة هو قياس البطينات الجانبية بصورتها الطبيعية في المرضى السودانيين البالغين. شملت الدراسة خمسة وسبعين مريضاً من البالغين (35) من الرجال (46.7%)، (40) من النساء (53.3%) كانت هنالك مجموعات عرقية مختلفة ، 44 من المرضى من شمال ووسط السودان (58.7%)، 3 من المرضى من شرق السودان (4%)، 25 من المرضى من غرب السودان (33.3%) و 3 من المرضى من جنوب السودان (4%). تتراوح أعمارهم بين 20 - 50 سنة وكانوا جميعاً لا يشكون من أي أمراض في المخ من شأنها أن تؤثر على قياس البطينات الجانبية.

تم فحص المرضى بواسطة الأشعة المقطعية بأجهزة سيمنز (ثنائي المقطع ، 16 المقطع) وجهاز شيمادزو ثنائي المقطع وجهاز توشيبا. شملت الدراسة عدة جوانب منها عرض البطينات الجانبية اليمنى واليسرى (الجانب الأعرض للقرن الخلفي)، بالإضافة إلى نصفي المخ (الجانب الأعرض من المخ) ومستوى جسم البطينات الجانبية اليمنى واليسرى، كما تم قياس كثافة السائل النخاعي الشوكي الذي يتم تحديده من خلال الرقم الناتج عن الأشعة المقطعية الخاص به. شملت الدراسة متغيرات أخرى مثل العمر والنوع والقبيلة ووزن الجسم وطول المريض.

أظهر التحليل أن متوسط العرض بالنسبة للبطينات الجانبية اليمنى واليسرى بالإضافة إلى مستوى جسم البطينات الجانبية اليمنى واليسرى و كثافة السائل النخاعي الشوكي كانت على النحو الآتي: 1.1 ± 0.2 ، 1.1 ± 0.3 ، 9.4 ± 2.8 ، 1.1 ± 0.3 ، 1.1 ± 0.3 ، 0.2 ± 0.2 على التوالي.

الارتباط بين طول المريض وعرض البطينات الجانبية اليمنى واليسرى (الجانب المعرض للقرن الخلفي) كان ذا دلالة إحصائية معطياً الأرقام 0.03 ، 0.02 ، على التوالي، إلا أن الارتباط بين الطول ومستوى جسم البطينات الجانبية اليمنى واليسرى وكثافة السائل النخاعي الشوكي لم يكن ذا دلالة إحصائية مهمة معطياً بالأرقام 0.9 ، 0.9 ، 0.1 ، على التوالي.

الارتباط بين العمر وعرض البطينات الجانبية اليمنى واليسرى ومستوى جسم البطينات الجانبية اليمنى واليسرى وكثافة السائل النخاعي الشوكي لم يكن ذا دلالة إحصائية مهمة معطياً الأرقام 0.8 ، 0.8 ، 0.8 ، 0.5 ، 0.2 ، على التوالي.

الارتباط بين القبيلة وعرض البطينات الجانبية اليمنى واليسرى ومستوى جسم البطينات الجانبية اليمنى واليسرى وكثافة السائل النخاعي الشوكي لم يكن ذا دلالة إحصائية مهمة معطياً الأرقام 0.2 ، 0.4 ، 0.3 ، 0.7 ، على التوالي.

الارتباط بين عرض البطينات الجانبية اليمنى و عرض البطينات الجانبية اليسرى كان ذا دلالة إحصائية معطياً الأرقام 0.0 ، 0.0 ، على التوالي.

الارتباط بين مستوى جسم البطينات الجانبية اليمنى و مستوى جسم البطينات الجانبية اليسرى كان ذا دلالة إحصائية معطياً الأرقام 0.0 ، 0.0 ، على التوالي.

الارتباط بين النسبة $\frac{VR}{HR}$ و (العمر، الوزن، الطول، النوع) لم يكن ذا دلالة إحصائية مهمة معطياً الأرقام 0.6 ، 0.5 ، 0.1 ، 0.8 ، على التوالي.

والارتباط بين النسبة $\frac{VL}{HL}$ و (العمر، الوزن، الطول، النوع) لم يكن ذا دلالة إحصائية معطياً الأرقام 0.9 ، 0.9 ، 0.1 ، 0.8 على التوالي.

Abstract

The lateral ventricles can be measured using Computed Tomography, we can measure the length , the width and the density of CSF .This study was

carried out using CT machines in Khartoum teaching hospital and some clinical private centers, from June 2009 to December 2009.

The main objective of the study is to measure the normal lateral ventricles in Sudanese patients.

Seventy five Sudanese adult patients (35males (46.7%), 40 females (53.3%)) with different ethnic groups, 44 patients from Northern and Center of Sudan (58.7%), 3 patients from Eastern of Sudan (4%), 25 patients from Western of Sudan (33.3%), and 3 patients from Southern of Sudan (4%). the age group are ranged between (20-50) years .The patients were free from any brain diseases that affect the measurement of lateral ventricles.

The patients were examined by computerized tomography using CT spiral unit, dual slices, siemens (Somatom Emotion TUO), CT spiral unit, sixteen slices, siemens and CT spiral unit, dual slices, shimadzu with the known CT protocols for brain.

The measured parameters by CT include the width of lateral ventricles (Rt , Lt) at maximum posterior horn, the two hemispheres at maximum brain diameter (MBD), the level of the body of lateral ventricles (Rt, Lt) and the density of CSF which has been determined by the CT number of the fluid. Certain other variables were considered like, age, gender, tribe, body weight and the height.

The analysis shows that the mean of width of right and left lateral ventricles (at maximum posterior horn), Level of the body of right and left lateral ventricles, CT- No. of cerebrospinal fluid were 1.0 ± 0.2 , 1.0 ± 0.2 , 1.1 ± 0.3 , 1.1 ± 0.3 , 9.4 ± 2.8 respectively .

The correlation between the age and all parameters (the width of right and left lateral ventricles (at maximum posterior horn), the level of the body

of right and left lateral ventricles and CT- No. of CSF were insignificant giving the values of 0.8 , 0.8 , 0.8 , 0.5 and 0.2 respectively.

The correlation between weight and all parameters (the width of right and left lateral ventricles (at maximum posterior horn), the level of the body of right and left lateral ventricles and CT- No. of CSF were insignificant giving the values of 0.3 , 0.6 , 0.5 , 0.08 and 0.5 respectively.

The correlation between the height and the width of right and left lateral ventricles (at maximum posterior horn) were significant giving the values of 0.033, 0.022 respectively, but the correlation between the height versus the level of the body of right and left lateral ventricles and CT- No. of CSF were so insignificant giving the values of 0.9, 0.9 and 0.1 respectively.

The correlation between the gender and the width of right and left lateral ventricles (at maximum posterior horn), level of the body of right and left lateral ventricles, CT- No. of CSF were insignificant giving the values of 0.6 ,0.6 ,0.9 , 0.5 and 0.1 respectively.

The correlation between the tribe and the width of right and left lateral ventricles (at maximum posterior horn), level of the body of right and left lateral ventricles, CT- No. of CSF were insignificant giving the values of 0.2 ,0.4 ,0.4 ,0.3 and 0.7 respectively .

The correlation between the width of right lateral ventricles (at maximum posterior horn), and left lateral ventricles (at maximum posterior horn) was significant giving the values of 0.0, 0.0 respectively.

The correlation between the level of the body of right lateral ventricles and the level of the body of left lateral ventricles was significant giving the values of 0.0, 0.0 respectively

The correlation between the ratio V_R/H_R and (age, weight, height ,gender) were insignificant giving the values of 0.6, 0.5, 0.1 and 0.8 respectively.

The correlation between the ratio V_L/H_L and (age, weight, height, gender) were insignificant giving the values of 0.9, 0.9, 0.1 and 0.8 respectively.

List of abbreviation

CT: Computerized Tomography.
MRI: Magnetic Resonance Imaging.
CSF: Cerebrospinal Fluid.
MBD: Maximum Brain Diameter.

Special abbreviation

V_R: Width of right lateral ventricles.
V_L: Width of left lateral ventricles.
B_R: Level of the body right lateral ventricles.
B_L: Level of the body of left lateral ventricles.
H_R: Right hemisphere
H_L: Left hemisphere

List of Contents

Content	Page Number
Title	I
Dedication	II
Acknowledgment	III
Abstract Arabic	IV
Abstract English	VII
List of abbreviation	X
List of Contents	XI
List of tables	XIII
List of Figures	XVII
Chapter (1) Introduction	1
1.1 Introduction	2
1-2 Research objectives	4
1-3 Hypotheses	4
1-4 Methods	5
1-5 Data analysis	5
Chapter (2) Literature review	6
2-1Anatomy	7
2-2 Physiology	20
2-3 Pathology	22
2-4 CT investigation	28
2-5Measurements of lateral ventricles (previous studies)	31
Chapter (3) Materials and Methods	34
3-1 Study design and area	35
3-2 Machines used	35
3-3 Study population	35
3-4Conclusion and exclusion criteria	35
3-5 Study variable	35
3-6 Method of data collection	36
3-7 Method of measurements on CT image	36

3.8 Data collection technique	39
Chapter (4) Data Analysis and Results	40
4-1 Results	41
Chapter(5) Discussion	69
5-1 Discussion	70
Chapter(6) Conclusion and Recommendation	73
6-1 Conclusion	74
6-2 Recommendation	76
References	77
Appendixes	81

List of tables

Tables	Page Number
Table 4.1 Shows the mean of the width of right and left lateral ventricles (at max posterior horn), level of the body of right and left lateral ventricles, CT- No. of CSF.	41
Table 4.25 Shows the result test for differences in mean of the ratio V_R/H_R with respect to gender.	67
Figure	Page Number
Table 4.26 Shows the relationship between the Distribution of Me Age and (age, weight, height, sample).	42 7
Figure 2.1 (A, B) Shows A- Dorsal view of late persomite embryo (approximately 18 days). The amnion has been removed, and the neural plate is clearly visible. B- Dorsal view of the embryo at approximately 20 days. Note the somites, neural groove and neural folds.	42 68
Table 4.27 Shows the result test for differences in mean of the ratio V_L/H_L with respect to gender.	
Table 4.4 Shows relationship between the width of right and left lateral ventricles (at max posterior horn), level of the body of right and left lateral ventricles, CT- No. of CSF and age.	43 10
Figure 2.2 Shows lateral view of the brain vesicles in 8-week embryo.	
Figure 2.3 Shows development of the ventricular system.	10
Table 4.5 Shows the mean of right and left lateral ventricles (at max posterior horn), level of the body of right and left lateral ventricles; CT- No. of CSF in males and females with respect to weight groups.	47 12
Figure 2.4 (A, B) A- Scheme showing relations of the ventricles to the surface of the brain. B- Lateral ventricles right and left lateral ventricles; CT- No. of CSF in males and females with respect to weight groups.	
Table 4.6 Shows relationship between the width of right and left lateral ventricles (at max posterior horn), level of the body of right and left lateral ventricles, CT- No. of CSF and weight.	48 13
Figure 2.6 (A, B) Shows A- Drawing of a cast of the ventricular cavities, viewed from above.	15
Table 4.7 Shows the mean of right and left lateral ventricles (at max posterior horn), level of the body of right and left lateral ventricles, CT- No. of CSF in males and females with respect to height groups.	52
Figure 2.7 Dissection from above to shows the lateral ventricles, ependyma and choroid plexus.	17
Table 4.8 Shows relationship between the width of right and left lateral ventricles (at max posterior horn), level of the body of right and left lateral ventricles, CT- No.	53

Figure 2.8 Shows ventricular system and circulation of cerebrospinal fluid.	21
Figure 2.9 Shows hydrocephalus.	25
Figure 2-10 Shows brain aneurysms and vascular disease	25
Figure 2.11 Shows trauma.	26
Figure 2.12 Shows neoplasm.	26
Figure 2.13 Shows cerebral atrophy.	27
Figure 2.14 Shows schizophrenia.	27
Figure 2.15 Shows multislice CT scanner.	29
Figure 3.1 Shows the method of measurements of (V_R , V_L , MBD, H_R , and HL).	37
Figure 3.2 Shows the method of measurement of (B_R , BL).	38

Figure 4.1 Shows the relationship between the width of the right lateral ventricle (at max posterior horn) and age	44
Figure 4.2 Shows the relationship between the width of left lateral ventricle (at max posterior horn) and age.	44
Figure 4.3 Shows the relationship between the level of the body of right lateral ventricle and Age.	45
Figure 4.4 Shows the relationship between the level of the body of left lateral ventricle, and Age.	45
Figure 4.5 Shows the relationship between CT- No. of CSF, and Age.	46
Figure 4.6 Shows the relationship between the width of right lateral ventricle (at max posterior horn) and weight.	49
Figure 4.7 Shows the relationship between the width of left lateral ventricle (at max posterior horn) and weight	49
Figure 4.8 Shows the relationship between the level of the body of right lateral ventricle and weight.	50
Figure 4.9 Shows the relationship between the level of the body of left lateral ventricle and weight.	50
Figure 4.10 Shows the relationship between CT- No. of CSF, and weight.	51
Figure 4.11 Shows the relationship between the width of right lateral ventricle (at max posterior horn) and height.	54
Figure 4.12 Shows the relationship between the width of left lateral ventricle (at max posterior horn) and height.	54