

The Effect of Lamina Terminalis Fenestration during Aneurysmal Clipping on the Incidence of Post Aneurysmal Subarachnoid Hemorrhage Hydrocephalus: A Retrospective Study

WALID E. ELHALABY, M.D.*; AHMED KOHEIL, M.D.** and OMAR ABDELALEEM RAGAB, M.D.**

The Department of Neurosurgery, Faculty of Medicine, Cairo University* and Department of Neurosurgery, Faculty of Medicine, Beni Suef University**

Abstract

Background: Hydrocephalus is a common and devastating complication following subarachnoid hemorrhage from a ruptured cerebral aneurysm whether acute or chronic hydrocephalus which may cause neurological deficits and shunt dependency. The lamina terminalis is a sheet of grey matter and pia which when fenestrated acts as a ventriculostomy functioning as form of CSF diversion.

Aim of Study: The aim of the study is to establish the value of Lamina terminalis fenestration during surgical clipping of a ruptured aneurysm on post subarachnoid hemorrhage caused hydrocephalus.

Patients and Methods: This is a retrospective study done on 60 cases presented to the Neurosurgery Department of Kasr Al-Ainy Hospital from Nov. 2012 to May 2022 with spontaneous subarachnoid hemorrhage from an anterior circulation aneurysm that were operated upon through a pterional approach with fenestration of lamina terminalis done to all the patients even if there was no signs of Hydrocephalus, Evaluation of the cases was clinical using Hunt and Hess classification subarachnoid hemorrhage was evaluated by a CT scan of the brain using fisher grading and the aneurysm was diagnosed and located using a CT angiography, digital subtraction or both. Hunt and Hess grade 5 and post circulation aneurysms were excluded from our study.

Results: Study was done on 60 patients with the age range from 30 to 70 years, 38 of our patients were male 22 were female (F/M 1:1.7), with 36 known diabetic patients 40 hypertensive patients and 45 known smokers. Using the clinical Hunt and Hess grading 30 patients were grade 1 (50%), 14 were grade 2 (23%), 10 were grade 3 (16.6%), grade 4 were 6 patients (10%). From our 60 patients 20 developed ventriculomegaly; only 6 patients needed CSF diversion, 4 were immediately postoperative, 2 was 3 weeks after surgery.

Correspondence to: Dr. Walid E. Elhalaby, The Department of Neurosurgery, Faculty of Medicine, Cairo University

Conclusion: So in regards to our study lamina terminalis fenestration decreased the incidence of post-operative hydrocephalus.

Key Words: Aneurysm – Hydrocephalus – Lamina Terminalis.

Introduction

ANEURYSMAL subarachnoid hemorrhage is a major medical emergency that has fatality of almost 50% before reaching the hospital. Those patients who survive the initial attack are still considered high risk due to risk of further neurological injury from rebreeding, hyponatremia from cerebral salt wasting syndrome, vasospasm and hydrocephalus. The risk of those complications remains even after securing the aneurysm by surgical clipping or endovascular coiling especially vasospasm and hydrocephalus [1,2].

Clinical grading of aneurysmal subarachnoid hemorrhage is assed using the hunt and Hess clinical grading system [3], and radiological classification of subarachnoid hemorrhage using fisher grading system [4].

Table (1): Hunt and Hess classification (1968).

Grade	Description
1	- Asymptomatic or mild headache and slight neck rigidity
2	- Cranial nerve palsy with amore severe headache and neck rigidity
3	- Mild neurological deficit and confusion
4	- Stupor with moderate to severe neurological deficit
5	- Deep coma decerebrate rigidity

Table (2): Fisher grading system (1988).

Grade	Description
1	- No SAH detected
2	- Diffuse or vertical layer less than 1mm
3	- Localised clot or layer more than 1mm
4	- Intracerebral or intraventricular haemorrhage with diffuse or no SAH

Hydrocephalus is a common complication following SAH, whether acute or chronic and patient can become shunt dependent [5] acute hydrocephalus is usually obstructive hydrocephalus whether from interventricular hemorrhage or intracerebral hemorrhage blocking CSF drainage, Chronic hydrocephalus can be of the communicating type usually due to adhesions and blockage at the arachnoid space and granulation with the inflammation causing proliferation of macrophages, fibroblasts and arachnoid cells [6].

Surgical clipping of anterior circulation aneurysms can usually be done through the Front-temporo-sphenoidal approach also known as the pterional approach which gives access to the Sylvian fissure, the basal cisterns and the Lamina terminalis [1,7].

The Lamina Terminalis is a thin sheet of grey matter and pia extending from the rostrum of the corpus callosum and the optic chiasm fenestration of the Lamina gives access to the ventricular system relieving the tension and the subsequent ventriculostomy act as a method of CSF diversion which decrease the incidence of shunt dependency [8-10].

Patients and Methods

This is a retrospective study done on 60 cases presented to the Neurosurgery Department of Kasr Al-Ainy Hospital from Nov. 2012 to May 2022 with spontaneous subarachnoid hemorrhage from an anterior circulation aneurysm. The study was to assess the surgical outcome after surgical clipping through a pterional approach with lamina terminalis fenestration on whether those patients required further CSF diversion with a ventriculoperitoneal shunt or not. Cases were selected on a diagnosis obtained by either CT angiography, Digital subtraction angiography or both. Hunt and Hess grade V patients were excluded. A full neurological evaluation of the selected patients was done including: Presenting symptoms, Glasgow coma scale (GCS), Hunt and Hess grade, Fisher grade, Associated hypertension, diabetes, and smoking, Glasgow out-

come scale, and radiological evaluation was done using: CT brain, CT angiography, Digital subtraction angiography.

All patients were approached with the same surgical plan which was a pterional approach for surgical clipping and whether there were signs of hydrocephalus or not Lamina Terminalis fenestration was done.

Results

Study was done on 60 patients with the age range from 30 to 70 years, 38 of our patients were male 22 were female (F/M 1:1.7), with 36 known diabetic patients 40 hypertensive patients and 45 known smokers. Using the clinical Hunt and Hess grading 30 patients were grade 1 (50%), 14 were grade 2 (23%), 10 were grade 3 (16.6%), grade 4 were 6 patients (10%). Using Fisher radiological grading using CT brain scan, 18 patients were grade 1, 20 patients were grade 2, 14 patients were grade 3 and 8 patients were grade 4. Aneurysm location which was diagnosed via a CT angiography or a digital subtraction or both 20 were anterior communicating artery aneurysms, 16 were middle cerebral artery aneurysms, 10 were posterior communicating artery aneurysms, 8 patients were carotid bifurcation aneurysms, and 6 were Carotid-ophthalmic aneurysms. From our 60 patients 20 developed ventriculomegaly; only 6 patients needed CSF diversion, 4 were immediately postoperative, 2 was 3 weeks after surgery.

Table (3): Gender.

Gender	Cases number	Percentage
Males	38	63.3%
Females	22	26.6%

Table (4): Associated diseases.

	Diabetes	Hypertension	Smoker
Number	36	40	45

Table (5): Hunt and Hess Grading.

Hunt and Hess Grade	Number of cases
Grade 1	30
Grade 2	14
Grade 3	10
Grade 4	6

Table (6): Fisher grading.

Fisher Grade	Number of cases
Grade 1	18
Grade 2	20
Grade 3	14
Grade 4	8

Table (7): Aneurysm location.

Site of aneurysm	Number of cases
Anterior communicating artery	20
Middle cerebral artery	16
Posterior communicating artery	10
Carotid bifurcation	8
Carotid-ophthalmic	6

Discussion

One of the most common complications of spontaneous aneurysmal hemorrhage is hydrocephalus which can occur before or after surgery. Hydrocephalus is a more common the older the patient is, other factors associated with hydrocephalus were pre-existing hypertension, interventricular hemorrhage, rebleeding, history of smoking and usage of anticoagulants. Hyponatremia and vasospasm had to be excluded as cause of depressed consciousness [11]. Hydrocephalus post subarachnoid hemorrhage is probably due to multiple factors but it probably boils down to blockage of the CSF drainage whether in the ventricular system at the subarachnoid space or at the arachnoid granulation [12].

Acutely is usually due to a blood clot physically interfering with drainage and causing the proliferation of macrophages, fibroblasts and arachnoid cells. Chronic hydrocephalus occurs in 10 to 20 percent of surviving aneurysmal subarachnoid hemorrhage patients, shunt dependent hydrocephalus is more common in females, older age, higher grade of Hunt and Hess on admission, higher fisher grade on admission, interventricular hemorrhage, rebleeding, vasospasm and cases who were treated via endovascular coiling, location of the aneurysm also is a contributing factor. Chronic hydrocephalus can occur after the procedure to secure the aneurysm by up to one month and can be diagnosed clinically or even by a CT scan [6].

The fronto-temporo-sphenoidal approach known as the pterional approach is probably the most used and most comfortable approach for all

neurosurgeons was first described by Yasargil more than 50 years ago. This approach gives access to the Sylvian fissure, the insula and the subarachnoid cisterns. It also gives access to the vascular tree and the optic chiasm [7].

The Lamina Terminalis is a sheet of grey matter a pia which extends from the interventricular foramen (foramen of Monro) to the optic chiasm at the recess at the base of the optic stalk Fenestration of the lamina terminalis can be considered as ventriculostomy and a form of CSF diversion. The pterional approach gives access to both anterior circulation aneurysms and the lamina terminalis [8-15].

The value of the microsurgical fenestration of the lamina terminalis has been proven in multiple series by Winkler EA and Komotar RJ to decrease the incidence of post subarachnoid hemorrhage hydrocephalus [8,9] and the need of permanent CSF diversion.

Conclusion:

In this study where in 60 patients with anterior circulation aneurysms that were operated upon by surgical clipping via a pterional approach and with the added step of fenestration of the lamina terminalis ten patients developed ventriculomegaly but only 3 needed a ventricular-peritoneal shunt two of them were in the first week post operatively. And the last one was 3 weeks after surgery. So in regards to our study lamina terminalis fenestration decreased the incidence of post operative hydrocephalus.

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تأثير فتح ثغرات الصفيحة الطرفية أثناء قص الأوعية الدموية على حدوث استسقاء الرأس ما بعد نزيف تحت الام العنكبوتية بعد تمدد الأوعية الدموية : دراسة استيعادية

استسقاء الرأس هو أحد المضاعفات الشائعة والمدمرة التي تلي نزيفاً تحت الام العنكبوتية ناتجاً عن تمدد الأوعية الدموية الدماغية الممزق، سواء كان استسقاءً حاداً أو مزمنًا، وقد يُسبب عجزاً عصبيًا واعتماداً على التحويلة. الصفيحة الطرفية هي طبقة من المادة الرمادية والنخاع الشوكي، وعند فتحها تعمل كفتحة بطينية تعمل كشكل من أشكال تحويل السائل الدماغي الشوكي. هذه دراسة استرجاعية أجريت على ٦٠ حالة تم تقديمها إلى قسم جراحة المخ والأعصاب بمستشفى قصر العيني من نوفمبر ٢٠١٢ إلى مايو ٢٠٢٢ مصابة بنزيف تحت العنكبوتية من تمدد الأوعية الدموية الأمامية والتي تم إجراء الجراحة لها مع عمل ثقب في الصفيحة الطرفية لجميع المرضى حتى لو لم تكن هناك علامات على استسقاء الرأس. وبالنسبة لدراستنا، فقد أدى فتح نوافذ الصفيحة الطرفية إلى تقليل حدوث استسقاء الرأس بعد الجراحة.