

Kadhim Hasan Zamil

M.B.Ch .B.,F.I.C.M.S^a.

Ventriculoperitonealshunt, Programmable or non-programmable

Raad Sachit Sapheeh

M.B.Ch .B.,F.I.C.M.S^b

ARTICLE INFORMATION

ABSTRACT

Authors addresses:

^{a-b} Baghdad Neurosurgical Hospital

E-mail address:
drKadhimalkuzaee@yahoo.com

Article history:

Received: 12th Jul, 2013.
Revised form: 15th Nov, 2013.
Accepted: 3th Jan, 2014.

Keywords:

Hydrocephalus, ventriculoperitoneal shunt, programmable.

Background: Hydrocephalus is dilatation of the ventricular system due to excessive production and/ or obstruction of cerebrospinal fluid (CSF) pathways. Different surgical procedure are used to treat this disease. Ventriculo peritoneal shunt is by far the most popular technique for CSF diversion..

Objective; To compare the programmable and non-programmable valves regarding the complications of both types

Methods: This study was conducted in the Neurosurgical hospital of Baghdad/Iraq over a period of 3 years from July 2008 to August 2011. A special inclusion criteria has been tabulated for the selection of patients..

Results: Fifty cases with hydrocephalus admitted and diagnosed by CT scan and treated by ventriculoperitoneal shunts (Codman type). There were 11 cases with programmable valves that demanded revision and 6 patients with fixed pressure valves required revision.

Conclusions: The programmable shunt had lower complication rate in adults and it should be used cautiously in infants because of the higher complication rates.

Introduction:

Hydrocephalus is dilatation of the ventricular system due to excessive production and/ or obstruction of CSF pathways. It was first described and named by Hippocrates(466-377 BC). Andreas Vesalius (1514-1564) presented the concept of hydrocephalus accumulation of water inside the ventricle⁽¹⁾. In the mid-1980s, the development of magnetic resonance imaging (MRI) allowed neurosurgeons not only to diagnose hydrocephalus but also to determine the actual site of obstruction to the flow of CSF that cause it⁽²⁾. There are different surgical procedure used to treat this disease & by the early 1970s three different shunt system were commonly used: ventriculoatrial, ventriculoperitoneal, and lumboperitoneal⁽³⁾. Ventriculoperitoneal shunt is by far the most popular technique for CSF diversion. It is relatively simple and suitable for patients of all ages with hydrocephalus from any cause⁽⁴⁾. Codman ventriculoperitoneal shunts are used regularly in Baghdad neurosurgical hospital. Two types of these shunts were used to treat hydrocephalus, the precision fixed pressure valves (nonprogrammable) & programmable valves.

Methods:

The study was conducted in Neurosurgical hospital of Baghdad/Iraq over a period of 3 years from July 2008 to August 2011. Inclusion criteria were new cases of hydrocephalus with no prior shunt implantation or cranial surgery and any cases. The patients were admitted and diagnosed by CT scan and treated by ventriculo peritoneal shunts (Codman

type). The programmable shunts are programmed by the HAKIM valve programmer (Medos), figure 1.



Figure 1 .HAKIM valve programmer (Medos)

The standard occipital bur hole used more frequently than parietal one and unless the left lateral ventricle is markedly more dilated than the right or there was a tumor on the right side in the pathway of the ventricular catheter, the right side of the head is chosen for placement of the valve. X-ray film used to assess the pressure in the valve in the follow up period if we didn't know the pressure of the non-programmable valve (figure 2). The patients were followed for 6 months.

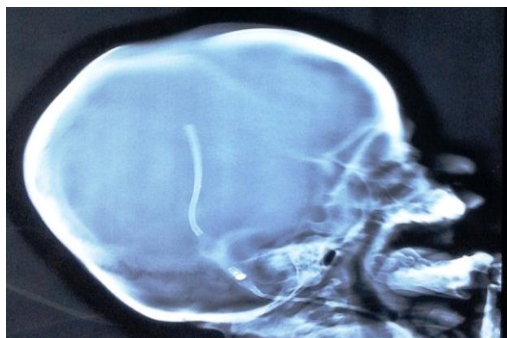


Figure 2 x-ray film used to assess the pressure of the valve

Results:

During the period of the study, fifty cases with hydrocephalus admitted and diagnosed by CT scan and were treated by ventriculoperitoneal shunts, 25 cases with programmable and 25 cases with non-programmable shunts (Codman type). The gender distribution was 30 females and 20 males (table 1).

Table 1 Gender distribution of the patients

Gender	Fixed pressure valve	programmable valve
Male	10	10
Female	15	15
total	25	25

The cause of the hydrocephalus was congenital in 16 patients (aqueduct stenosis, encephalocele, benign intracranial cyst), postmeningitic in 10, posterior fossa tumor in 8, Dandy Walker malformation in 5, thalamic tumor in 2 and Choroid plexus papilloma in 1 (table 2).

Table 2 Causes of hydrocephalus and the type of the shunt implanted

Causes	Fixed pressure valve	programmable valve
Congenital	7	9
Post meningitis	6	5
Posterior fossa tumor	5	3

Dandy walker cyst	2	3
Thalamic tumor	1	1
Choroid plexus papilloma	1	0
other	3	4
total	25	25

Regarding the age of the patients, the average age of patients was (5y), range (1month- 55years), there were 32 patients under the age of 10 years and 2 cases above 50 years old (table 3).

Table 3 Age of the patients

Age	Fixed pressure valve	programmable valve
1-9	18	14
10-19	3	5
20-29	0	2
30-39	2	2
40-49	1	1
50-59	1	1

The complications during the follow up were infection in 5 cases, obstruction in 7 cases, 2 seizure, ascites 1, hardware erosion through the skin 5, subdural hematoma 1, and over drainage syndrome in 1 (table 4).

Table 4 Complication

Complication	Fixed pressure valve	programmable valve	total
Infection	2	3	5
obstruction	Proximal	1	3
	Distal	2	4
Seizure	1	1	2
ascites	1	0	1

Hardware erosion through the skin	1	4	5
Subdural hematoma	1	1	2
The over drainage syndrome	0	1	1
total	10	13	23

Shunt revision was done in 17cases, 11 programmable and 6 fixed pressure (table 5).

Table 5shunt revision

operation	programmable	Fixed pressure	total
Shunt revision	11(44%)	6(24%)	17(34%)

Discussion

The programmable valve with the ability to adjust the opening pressure non-invasively has made it easier to find exactly the right opening pressure for each child and reduce the risk of over-or under-drainage⁽⁵⁾. The Codman Hakim programmable valve (Codman /Johnson & Johnson, Raynham, Massachusetts) permits regulation of the opening pressure between 30 and 200mmH₂O⁽⁶⁾. We arrange the opening pressure 30 to 140 mmH₂O, and there was no need for additional adjustments.

There appears greater consensus that programmable valves play a valuable role in treating adults with hydrocephalus⁽⁷⁾, in this series 6patients were adults and one of them show shunt over drainage symptoms (complain of postural headache and nausea) that need reprogramming to 140mmH₂O opening pressure.

The exposure of the first generation externally programmable shunt (EPS) valves to 3 Tessa MRI results in frequent changes in shunt settings that necessitate re-evaluation soon after MRI to avoid complication⁽⁸⁾. In our institution 1.5 Tessa MRI was used; still there was one case where changes in shunt setting happened necessitate re programming of the valve to the pre MRI setting.

In this study 5 cases show hardware erosion through the skin, all of them were infant and four of them the programmable valve were used. This may be due to the thin infant skin and the additional dissection needed for programmable valve insertion and when we choose the occipital area, flexion-extension movement may cause breakage of the skin overlying the valve.

Nearly every prospective pediatric population shunt study has reported an infection rate of approximately 8%, less information is available about infection rates for adults⁽⁹⁾. In other studies reported rates ranging from 1.5% to as high as 38 %^(10, 11). Infection occurred in 5cases (10%), two of them respond to antibiotics alone (ceftriaxone 1g bd+ ampiclox 500mg qd) & other three cases required shunt revision.

The two patients who complained of seizure treated successfully by antiepileptic

(sodium valproate syrup or tablets) and there was no associated shunt malfunction .In contrast to the Timothy et al study⁽¹²⁾, there is significant difference existing between two valve systems for reason of revision. For the programmable valve 11(44%) while fixed pressure valve 6(24%) .This may be due to the majority of the patient(32) were below the age of 10 years and only one type of shunt used(Codman).

Non programmable valve patients survives longer than programmable valves in children⁽¹³⁾. The result of this study goes with this evidence where there were 11 cases of programmable valve that required revision. Hydrocephalus is almost always a result of an interruption of CSF flow and is rarely because of increased CSF production⁽¹⁴⁾. In this study there was only one case of choroid plexus papilloma.

Conclusions:

Although larger series required to provide statistically significant data, we may conclude that the programmable shunt had lower complication rate in adults and it should be used cautiously in infants because of the higher incidence of complications.

Reference:

- 1 - T. Trojanowski. Hydrocephalus in adults. (Including Normal pressure Hydrocephalus Syndrome). Practical Handbook of Neurosurgery, 2009. 429-439
- 2 -Harold L.Rekate. Hydrocephalus in children. Youmans Neurological surgery 2004 .(215) 3387-3404
- 3 - Elisabeth M. Post, Shunt system. Wilkins Neurosurgery, 1996. (367) 3645-3653
- 4 -Joseph H .Piatt, Jr. Hydrocephalus treatment, Wilkins Neurosurgery 1996. 366:3633-3643.
- 5 -Amel K , Ericsson E, Olsen L. The programmable adult Codman Hakim valve is useful even in very small children with hydrocephalus. A7-year retrospective study with special focus on cost analyses. Eur J Pediatr Surg. 2006 Feb; 16(1):1-7.
- 6 -S.S, Lollisa, A.C .Mamourian, T.J. Vaccarob, A.-C .Duhaimea. Programmable CSF shunt valves: Radiological identification and interpretation, American journal of neuroradiology 2010 31: 1343-1346.
- 7 -Jeffrey P. Blount. Ventricular Shunting Procedures. Youmans Neurological surgery 2011, 190:2009-2020.
- 8 -Zabramski JIM, Preul MC, Debbin J, McCusker DJ. 3T magnetic resonance imaging testing of externally programmable shunt valves. Surg Neurol Int 2012;3:81.
- 9 -Marvin Bergsneider , Eric Stiner .Management of adult Hydrocephalus .Youmans Neurological surgery 2011 35 -515-524.
- 10 -Ammirati M, Raimondi AJ: Cerebrospinal fluid infections in children: A study on the relationship between the etiology of hydrocephalus ,age at the time of shunt placement ,and infection rate . Childs Nerv Syst 3:106-109, 1987
- 11 -Caldarelli M, DiRocco C, LaMarca F: Shunt complications in the first postoperative year in children with meningomyelocele. Childs Nerv Syst 12:748-754, 1996.
- 12 -Timothy Hallen1, David Shurtleff1, Richard Ellenbogen2, Anthony Avellino2 and Sharon Duguay1.

Efficacy of conventional valves compared to programmable valves in managing children & adolescence with hydrocephalus: a450 valve retrospective study. Cerebrospinal fluid research 2009, 6(suppl2):S9 doi: 10.1186/1743-8454-S2-S9.

valve malfunctions in pediatric hydrocephalus. JofNeurosurgery. 2005 Dec; 103(6 suppl.): 501-7.
14 - Paul P Wang and Anthony M Avellino .Hydrocephalus in children .Principles of neurosurgery 2nd edition, 2005 (8), 117-135

13 -Mangano FT, Menendez JA, Habrock T, Narayan P, Leonard JR, Park TS, Smyth MD. Early programmable