

## Frontal VP & VA Shunts Versus post parietal VP & VA Shunts

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### Summary:

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**Background:** Hydrocephalus is an imbalance of cerebro-spinal fluid (CSF) formation & absorption of sufficient magnitude to produce a net accumulation of fluid within to cerebral ventricles.

**Aim of study:** the main objective of this study is to compare frontal with post parietal shunt regarding the surgery complications, end results & then to compare it with other studies abroad.

**Patient & Methods:** this study included 920 patients admitted to the Neurosurgical department in the Hospital of surgical specialty, Medical city. The patients had full radiological study including MRI and CT. All patients were surgically managed & followed up for at least one year.

**Results:** results were compared regarding the type of surgery we did (VP&VA)shunt, frontal or parietal with other studies.

**Conclusion:** frontal shunts can be as successful as post parietal shunts, & it carries less complications & lower mortality although more difficult procedure & needs more experience

### Introduction

Hydrocephalus is an imbalance of cerebro-spinal fluid (CSF) formation & absorption of sufficient magnitude to produce a net accumulation of fluid within the cerebral ventricles. (1)

#### Types:

1. **Infantile Hydrocephalus:** occurs at birth or in the 1st year of life. The head is usually enormously enlarged & the body appears small. The scalp is thin & glistening, the veins of the scalp are distended, there may be also suture diastasis with sun set sign due to weakness of upward gaze.

Transillumination of the head is usually positive. (2)  
(3)

2. **Adult Hydrocephalus:** four distinct clinical types of Hydrocephalus are present:

**A-acute hydrocephalus:** due to sudden obstruction of the CSF pathways, symptoms can occur in few hours usually start as nausea, vomiting & headache. Transient or sustained blindness can occur, paranoid's syndrome in adults or setting sun sign in infant & young children & if not treated urgently the condition can deteriorate rapidly.

**B-chronic hydrocephalus:** this is due to long standing obstruction. The patients usually present as frontal generalized headache, vomiting, papilledema, or optic atrophy, failing mental function, behaviour disturbances & memory loss, with unilateral or bilateral 6th nerve palsy, weakness of upward gaze (paranoid's syndrome). Long standing disease can cause spastic paraparesis with mild spastic weakness of the upper extremities.

**C- Normal pressure hydrocephalus:** This is a state of chronic hydrocephalus in which prevailing CSF pressure has returned to a physiological range but in which a slight pressure gradient persists between the ventricles & the brain. Adult patient usually presents with the classic triad of dementia, incontinence & disturbance of gait. (1) Infant usually presents with enlarged head, mental subnormality & spastic paraparesis.

**D- Arrested hydrocephalus:** This is a state of chronic hydrocephalus in which the CSF pressure has returned to normal & pressure gradients between the ventricles and brain parenchyma have been dissipated.

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this is almost asymptomatic .(1) The diagnosis is confirmed by: CT Scan & MRI of the brain which can diagnose hydrocephalus & show the type & cause of it (4) Treatment: the surgical treatment of hydrocephalus is ventriculo peritoneal shunt or ventriculo atrial shunt. Surgical procedure :a curve line incision is made above & behind the right ear or curve line incision is made in the parasagittal area in front of the coronal – suture.,aburrhole is made in the size which differ according to the type of the shunt used,dura coagulated & ventricular catheter introduced & CSF ,drain from occipital or frontal horn of the lateral ventricular depending on type of incision , the shunt is connected & passed sub cutaneously to the abdominal area ,where a Rt.small paramedian incision is made & peritoneal cavity is opened, the lower valve catheter is introduced to the peritoneal cavity with extra 20cm ,& closure is done of both wounds in layers.(1) 3rd ventriculostomy is now used for treatment of hydrocephalus in infancy mainly after doing burr hole & introducing the endoscope & release the aqueduct of Sylvius.

**Complications of shunt procedures:**

1. Infection.
2. Obstruction (upper&/or lower).
3. Craniostenosis.
4. Disconnection or Migration.
5. Subdural collection.
6. Abdominal complications (peritonitis).
7. Pulmonery embolism.
8. Technical error.(1)

**Patients & Method:**

A total of 920 patients with hydrocephalus were collected since the establishment of the neuro-surgical department in The Hospital of Surgical Specialty, Medical City- Teaching Hospital. All patients were followed for at least one year after surgery. We excluded the patients who refuse surgery, or those who had surgery & could not be followed up. Surgery was done to all patients using VPor VA shunt technique either frontal or post parietal.

**Results:**

**Table (1)Age & Gender**

Male			Female ♀	
Age	No.	%	No.	%
0-12m.	112	12.1%	158	17.2%
1-10y	187	20.3%	73	7.9%
11-20y	80	8.7%	52	5.6%
21-30y	48	5.2%	28	3%
31-40y	52	5.6%	60	6.5%
41-50y	9	0.97%	20	2.3%
51-60y	18	1.95%	-	0%
Above60	13	1.4%	9	0.97
Total	519	56.22	401	43.47

**Table (2) Causes of Hydrocephalus**

Cause or Type	No. of Cases	%
Congenital	282	30.6%
Due to Tumor	468	50.8%
Post Meningitic	118	12.8%
Other	52	5.6%
Total	920	100%

**Table(3) Diagnostic Radiological Investigation**

Diagnostic Radiological Investigation	No. of patients	%
CTScan	583	63.3%
MRI	102	11.1%
CT&MRI	210	22.8%
U/S	25	2.7%
Total	920	100%

**Table (4) Type of Scalp incision**

	Post Parietal	Frontal	Total
No	685	235	920
%	74.4	25.5	100%

**Table(5) Type of Shunt**

Type of Shunt	Frontal		Parietal	
	No.	%	No.	%
Pudenz high pressure	-	-	12	1.3%
Pudenz med pressure	159	17.2	368	40%
Pudenz low pressure	30	3.2%	92	10%
Cordis med pressure	-	-	60	6.5%
Flat bottom med pressure.	18	1.9	56	6.1%
Flat bottom med pressure	10	1.1	85	9.2%
Other	8	0.8	12	1.3%
Total	225	24.4	685	74.4

**Table(6) Type of Shunt VPor VA**

	Frontal		Parietal	
VP	223	24.2	665	72.2
VA	2	0.2	20	2.17
Total	225	24.45	685	74.45

**Table (7) Surgical Tehnique Diffiulty**

Difficulty	Frontal		Parietal	
	No.	%	No.	%
Introducing of upper (finding the ventricle)	8	3.5%	8	1.1%
Introducing of lower end (opening the peritoneum in right way)	2	0.9%	6	0.9%
Tunneling	2	0.9%	4	0.6%

N.B.: The percentage is not from the total number but from the type ie. frontal or parietal

Table(8) CSF Analysis

CSF finding	Frontal		Parietal	
	No.	%	No.	%
Clear& under pressure	194	21%	587	63.8%
Clear not under pressure	19	2%	20	2.2%
Turbid under pressure	22	2.4%	42	4.6%
Xanthochromic under pressure	-	-	36	3.9%
Total	235	25.4%	685	74.5%

Table (9)1st. week complication according to type of incision

	Frontal		Parietal	
	No.	%	No.	%
Uneventfull	228	97%	652	95%
Obstruction of the upper end requiring revision	2	0.685%	8	1.2%
Obstruction of the lower end requiring revision	-	-	2	0.29%
EDH (Epidural Haemat.)	-	-	3	0.44%
SDH (Subdural Haemat)	-	-	6	0.87%
Severe brain oedema	1	0.42%	-	-
Chest infection	2	0.85%	8	1.2%
Deep Vein Thrombosis	1	0.42%	3	0.44%
Death	1	0.42%	3	0.44%
Total	235	100%	685	100%

N.B: The percentage to the type of incision the type of Shunt

Table (10) 1st 3months of follow up.

Event.	Frontal		Parietal	
	No.	%	No.	%
Uneventful	202	86.3%	561	82.8%
Upper end obstruction require revision	4	1.7%	48	7%
Lower end obstruction require revision	12	5.1%	22	3.2%
Infection require removal	6	2.5%	31	4.5%
Collection of CSF subcutaneously	5	2.1%	12	1.75%
DVT	2	0.85%	-	-
Death	3	1.3%	8	1.2%
Total	234	100%	682	100%

N.B: The percentage is of the type (Frontal or Parietal) excluding post operative mortality.

Tables (11) Long Term follow up12years.

N.B.: percentage of type of shunt excluding previous mortality

Event	Frontal		Post parietal	
	No.	%	No.	%
Uneventful	208	90%	611	90.8%
Upper end obstruction requiring revision	8	3.4%	28	4.1%
Lower end obstruction or problem requiring revision	12	5.2%	4	0.6%
Infection requiring removal (including exposed shunt)	3	1.3%	8	1.2%
Meningitis	-	-	4	0.6%
Require another shunt	-	-	8	1.2%
Epilepsy	-	-	6	0.9%
Died	-	-	4	0.6%
Total	231	100%	673	100%

Table (12) Final. Outcome

Out come	Frontal		Post parietal	
	No.	%	No.	%
Good prognosis	215	91.5%	626	91.4%
Alive with mild disability	10	4.25%	32	4.7%
Alive with severe disability	6	2.6%	12	1.8%
Death	4	1.7%	15	2.2%
Total	235	100%	685	100%

**Discussion:**

Hydrocephalus, wether congenital or aquired at any age is still a common problem. The data collected from the Neurosurgical unit of The Hospital of Surgical Specialty, Medical city former name Al-Shaheed Adnan hospital.

It's a retrospective study since the establishment of the unit above .This retrospective study include 920 patients of different age groups .

Any patient who could not be followed for at least 1year was excluded from the study.

Patients with hydrocephalus secondary to a tumor in the post.fossa or other tumor ,& died in the post.operative period of the surgery due to the tumour was also excluded from this study as the death was not obvious whether due to the tumour surgery or shunt surgery .

In table 1 which show the Age & Gender hydrocephalus occurred more in ♂ than ♀, 56.2 & 43.7 respectively.

In the ♂ 12% occurred in the 1st year of life and 20.3% occurred in between 1-10 years of age. While in ♀ 17.2% occurred in the 1st year of age between 1-10.

The commonest cause of hydrocephalus, in our study was tumour 50.8% whether post.fossa or other tumour while congenital was 30.6% & post Meningitic was 12.8% as in table (2).

Diagnosis was made by Radiological investigations 22.8% of patients had CT&MRI, 63.3% CT alone, 11.1% by MRI alone while 2.7% of cases of congenital hydrocephalus were diagnosed by ultra sound alone, when CT&MRI were out of order as in table (3).

As in table (4) the type of scalp incision 235 (25.5%) were frontal, while 685 (74.5%) were post parietal, the decision depends mainly on surgeon experience rarely on circumstances that prevent other type e.g. scalp infection preventing a particular type of incision in a patient who cannot be delayed.

As in table (5) patients were divided to 2 categories, frontal & parietal, the aim of the further tables is to compare between these two types.

The type used was different according to the available type whether pudenz or cordis or flat bottom or others (limited samples) but the pressure depends on the selection of the surgeon 40% of the patients we used for them pudenz medium pressure post. parietal while 17.2% we used for them the same type but frontal. 10% we used for them low pressure pudenz post parietal. & 3.2% we used for them frontal same type of shunt. 6.5% we used for them cordis medium pressure post.parietal but this type of shunt was not used for frontal incisions. 9.2% of patient we used for them flat bottom shunt post .parietal, & 1.1% same shunt frontal as in table (5).

The whole number of VA shunt was 22 (2.4%), 20 of them post.parietal & 2 frontal as in table (6).

Surgical technique difficulty were slightly more in the frontal type especially in introducing the upper end 3.5%, (one patient needed two steps surgery) while it was only 1.1% in the post. parietal type & it seems that this difficulty can be made easier with more experience of this type of shunt.

Other difficulties as tunneling & introducing of the lower end were in very low numbers below 1% (0.9%) as in table (7).

In table (8) any patient operated upon a sample of the CSF was taken and analyzed either preoperatively or intra operatively 85% CSF was clear & under pressure, while 4.2% it was clear & not under pressure, 7% it was turbid & under pressure but the culture was negative (pre-operatively evaluated) 3.9% it was xanthochromic & under-pressure, noticing that if it was a baby with hydrocephalus then

CSF study was done also before the surgery & another sample during surgery, & no surgery was done in cases with positive culture.

Regarding the complications of surgery, we divided the time to three periods, post-operative period (time of admission 1st. week, & then the 1st. 3 months of follow up, & then the long follow up at least one year as in table (9).

As in tables (9-10-11) Upper end obstruction requiring revision in frontal type percentage of 0.85, 1.7% & 3.4%, while in post partial type it was 1.2%, 7%, 4.1%.

Although upper end introduction is more difficult in the frontal type but it is less liable for upper end obstruction than parietal type.

Lower end obstruction requiring revision in the frontal type was seen in the percentage of 0%, 5.1%, 5.2%, while in post partial type it was 0.29%, 3.2%, & 0.6% although the no. of lower end obstruction in the frontal is little higher, any how it is obvious that obstruction of the lower end does not have any relation to the type of scalp incision.

Irvings et al 1971 the rate of revisions was around 10% (5). While sugar et al 1974 the revision rate. is around 14% (6).

So in comparison both our results were within acceptable ranges. With slight priority to the frontal type which shows lower percentage of upper end obstruction.

Infection of the shunt that requires removal of the shunt happened in 2.5% of frontal type & 4.5% of the post parietal type, the complication can be in the long run attributed to the type of the shunt.

In our study the infection rate was 2.5% in frontal type 4.5% parietal type while George colleagues in 1979, 25 year study infection rate 11.4% (7), in 1982 Haines Goodman infection rate of 9.5% (8) & Walterr's et al 1984 it was 15% (9).

So our results even in the post parietal type the rate of infection is still very low and it occurred more in the parietal type.

Extradural hematoma occurred in 3 patients (0.44%) of post parietal shunts only, one patient died from it. Subdural hematoma developed in 6 patients (0.88%) also in the post parietal type only as in table (9).

In table (10) CSF subataneous collection was seen in the frontal type 2.1% & 1.75% in the post parietal type, but with no further complications. Meningitis was seen in 0.6% of the post parietal type & not seen the frontal type.

1.2% of patients with post parietal shunts required another shunt on the other side, although the shunt is functioning, this was not required for any patient of frontal type as in table (11).

In table (11) Epilepsy developed in 9 patients (0.9%) of post-partial type, one of them was status & fatal, in patients not known to be epileptic before. Patients with frontal shunt did not develop epilepsy & this is

against Riamond et al 1997 who illustrated that frontal shunts carries higher possibility of post surgical epilepsy. (10)

DVT. developed in 0.42% post partial, 0.85% in 1st 3 months following surgery in frontal type & less in parietal type only 0.44 post operative period & not in other period of course this is related to the patient rather than type of operation as in table (10).

In table (12) the final outcome of our patients show that good prognosis 91.5% of frontal type & 91.4% in the parietal type, good prognosis means that if the patient is a baby he has normal head circumference, able to thrive, good general health, normal cry, normal milestone.

While in the the adult good prognosis means mainly normal intra-cranial pressure, normal size of the ventricle by CTScan or MRI, & a normal neurological exam.

N.B. this is the final outcome no matter what the complications the patient developed during his post-operative period & long run of the disease.

Patient survive with minimal disability 4.25%, the infrontal type, & 4.7% ,the post-partial type .

Patient with sever disability 2.6% ,the frontal type & 1.8% in the post-partial type.

In table (12) mortality was 1.7 % in the frontal type & 2.2 in the parietal type, but still mortality is not a very good parameter for evaluation of the procedure as hydrocephalus is not the main or only cause of death, and the cause of death can be the tumour that caused the hydrocephalus (post foss tumour or others) .Anyhow Rimonde etal 1997 the mortality rate was 2%.(10)

### Conclusion :

Frontal shunts can be as successful as post parietal shunts, and it carries less complications & lower mortality although more difficult procedure & needs more experience.

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