



NEUROSURGICAL BURDEN OF HYDROCEPHALUS IN A TERTIARY CARE HOSPITAL IN THE DEVELOPING WORLD.

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ABSTRACT... Objectives: To know about the Neurosurgical burden of Hydrocephalus in a tertiary care hospital, in developing world. **Study Design:** Cross sectional study. **Setting:** Department of Neurosurgery, MTI/LRH Peshawar. **Period:** September 2015 to August 2016. **Material & Methods:** The age, gender, indication for surgery, type of surgery and mode of surgery i.e. whether as elective or emergency, was recorded on a proforma. All patients undergoing surgery primarily for hydrocephalus due to any cause were included in the study. Patients undergoing surgery for indications other than hydrocephalus as well as patients primarily explored for other etiologies and intervened for hydrocephalus in the midst of procedure were excluded from the study. **Results:** During the study period a total of 2844 patients were operated and amongst them were 437 (15.34%) cases operated for hydrocephalus. Of them were 242 males and 195 females, and the male to female ratio was 1.24. The age range was one month to 68 years and the mean age was 5 ± 4.8 years. There were 250 new shunts and 69 revisions and 13 removal procedures, 70(2.4%) endoscopic hydrocephalus related procedures, 28 external ventricular drains and 7 lumboperitoneal shunts. 189 cases were done on elective list while 248 as emergency. **Conclusion:** Every 3rd case done on emergency list and every 10th case done on elective list was related to hydrocephalus and accounted for 16% of all the cases done in the neurosurgery.

Key words: Burden, Hydrocephalus, Tertiary Care Neurosurgical.

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INTRODUCTION

Hydrocephalus (HCP) is derived from two Greek words; hydro and kephalus, which mean water and head.¹ Congenital hydrocephalus is the second most common congenital brain malformation after spina bifida and it affects one 1 in every 500 children, and 6,000 children annually develop hydrocephalus during the first 2 years of life.¹

Each year there were 38,200–39,900 admissions and total hospital charges of \$1.4–2.0 billion for pediatric hydrocephalus. Hydrocephalus accounted for 0.6% of all pediatric hospital days and 3.1% of all pediatric hospital charges.² VP shunt is the most common modality used for the treatment of HCP, but it is marred with technical problems and complications like shunt failures, which in the modern era are around 14%-failing in the first month, 40 to 50% of shunts will fail

within the first year, and 45 to 59% of all patients, regardless of age, will require a shunt revision.³ The disease burden of HCP results not only from the primary disorders in the form of congenital hydrocephalus, but also from other causes of Hydrocephalus secondary to tumor, stroke, Subarachnoid Haemorrhage (SAH), trauma, infections and following neurosurgical procedures. In fact, many neurosurgical interventions for brain are later complicated by the HCP.⁴ Despite the advances in the field of medical engineering and biomedical sciences, it still poses a great problem for neurosurgeons. And even the patients who are treated for hydrocephalus are pooled into this category as they may require repeated surgeries for the complications of the VP Shunt, LP shunt and Endoscopic brain surgery for HCP.^{5,6}

As stated above, any neurosurgical department has to deal with a great burden of hydrocephalus

not only from the primary causes, but also resulting from the interventions. We studied the burden of Hydrocephalus on our department for the previous one year, and also to know about the type of procedures we perform for treating the disease.

MATERIALS AND METHODS

This was a cross sectional study conducted in the Department of Neurosurgery, PGMI/LRH Peshawar, we reviewed all patients operated/ admitted between September 2015 to August 2016. The age, gender, indication for surgery, type of surgery and mode of surgery i.e. whether as elective or emergency, was recorded on a proforma. All patients undergoing surgery primarily for hydrocephalus due to any cause were included in the study. Patients undergoing surgery for indications other than hydrocephalus as well as patients primarily explored for other etiologies and intervened for hydrocephalus in the midst of procedure were excluded from the study. All the data was entered and analyzed by SPSS version 16, and was expressed in the form of tables and charts.

RESULTS

During the study period a total of 2844 patients were operated and amongst them were 437 cases operated for hydrocephalus during the study period. Among them were 242 males and 195 females, with a male to female ratio approaching 1.12:1. The age ranged from 1 month to 68 years and the mean age was 5±4.8 years. Patients were further subdivided into seven groups based on the age group at 10 years intervals with group I aged from 1 month to 10 years and so on. Around 53% were in the age group below 10 years and next highest were in the age group from 10 to 20 years, while the rest of the groups having aged population from 20 to 40 years were having the same distribution of patients, as shown in the Figure-1.

Figure-2. Graph showing the total number of shunt placed and their mode of placement as elective or emergency procedure, it also shows type of shunt related procedure i.e. whether a new shunt, a revision or a removal of shunt.

The total procedures done were 2055 procedures on elective list while 789 were done as emergency, and among them were 16% of procedures done for hydrocephalus as shown in Figure-2. For hydrocephalus, shunt accounted for the most procedures i.e. 332 among 437, a further breakup of the shunt procedures performed in figure 3, it was followed by Endoscopic third Ventriculostomy (ETV) which were 70 procedures, and External Ventricular Drain(EVD) for 28 procedures, while Lumboperitoneal (LP) Shunt only for 7 procedures. The main indications were congenital, post infectious and tumor related hydrocephalus.

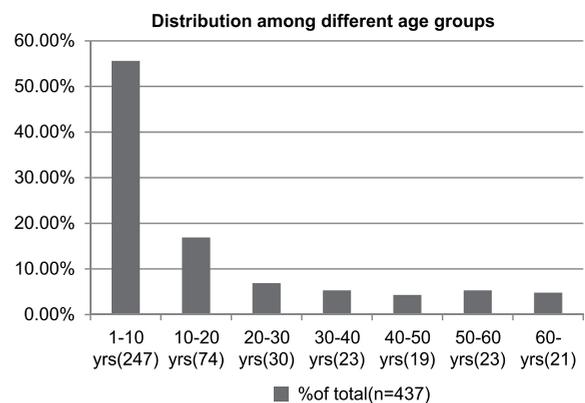


Figure-1. Shows distribution of hydrocephalus among different age groups.

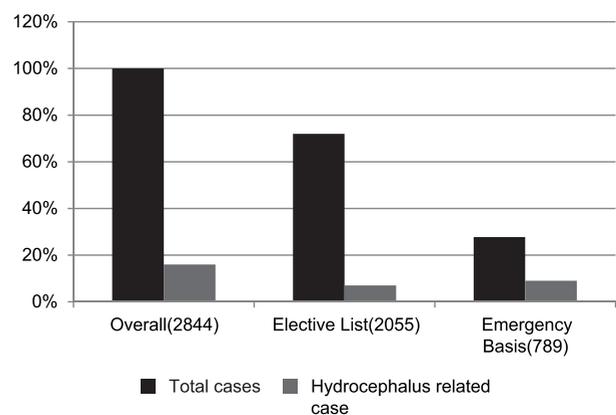


Figure-2. The graph shows number of all cases done on elective and emergency basis and amongst these are shown the percentage of cases done for hydrocephalus.

Figure-3. Graph showing the total number of shunt placed and their mode of placement as elective or emergency procedure, it also shows type of shunt related procedure i.e. whether a

new shunt, a revision or a removal of shunt.

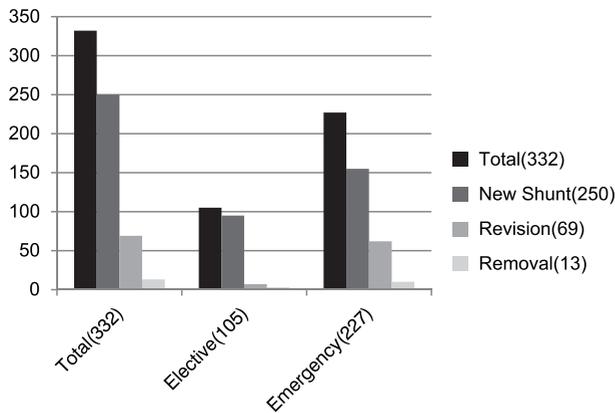


Figure-3

DISCUSSION

Hydrocephalus is a disease known to mankind since time immemorial. It has poised and is still a formidable challenge for the neurosurgeons all over the world.⁷ The disease is due to an imbalance between the CSF absorption and secretion. Moreover, many neurosurgical conditions in itself give rise to hydrocephalus like trauma, brain hemorrhage and tumors. Furthermore, the treatment of hydrocephalus is most of the time a VP shunt, which has established complications of blockage, infection and erosions.^{2,5,6} These all sum up and make the HCP a big burden for the Neurosurgeons, and the neurosurgery department of any institute all around the world. We reviewed our data of neurosurgical unit to understand and know about the Neurosurgical burden of HCP, types of cases we perform and kind of procedures performed for HCP.

In review of our study cases, we sorted out that there were 437 procedures performed for the hydrocephalus during the one year study period. Though this is a large number but still do not represent the actual number of patients and no insight into the prevalence and incidence of the HCP in the region, because there are two public and more than 10 private centers which perform these surgeries on daily basis. Among these were 242 males and 195 females with a male to female ratio approaching 1.12:1. Although HDC has no specific predilection for any gender, many studies had reported that there is always a predominance

of male patients over the female patients, with no known reasons.⁸

In our study, the age ranged from 1 month to 68 years and the mean age was 5 ± 4.8 years. Patients were further subdivided into seven groups based on the age group at 10 years intervals with group I aged from 1 month to 10 years and so on. Around 55% were in the age group below 10 years and next highest were in the age group from 10 to 20 years (16.3%), and the rest of the groups were having almost the same number of patients, i.e. 4.8 to 6.9%. HCP is common in the pediatric age group both in the developed and the developing countries, as the congenital HCP is the most common cause in the developed countries while the post infectious is the most common cause in the developing countries.^{5,6,7,8,9}

The total procedures done were 2055 procedures on elective list while 789 were done as emergency, and among them were 15.36% of procedures were done for hydrocephalus, overall. The department of Neurosurgery has four theatres which runs five days a week and one table is specific for Neurotrauma, which is run seven days a week. Hydrocephalus related procedures account for around 7% of the workload globally¹⁰ and about 32 to 60% in developing world^{11,12}, however this is very large as compared to the developed world, where there is only a portion of the surgical procedure being attributed to the HCP. But in some of these studies there were only cases done by medical team tour organized by charity organizations and include only simple procedures, which is not a true reflection of neurosurgical care.¹³ It also reflected that these procedures required less expertise than more complex procedures like tumor or spinal instrumentation related procedures. The reason behind this great discrepancy is the increased burden of the hydrocephalus on the institutions in the developing world due to increase congenital diseases, infections, trauma and lack of facilities to treat these minor diseases.

Shunt accounted for the most procedures i.e. 332 among 437, a further breakup of the shunt procedures was performed. VP shunt is

still the most common procedure performed for hydrocephalus, as it is simple and cost effective, but nevertheless it is also associated with an increased risk of complications like blockage, infection and exposure, among many others¹⁴, which results in its need for revision or removal accounting for 69 and 13 cases in our series (18.76%), respectively. Hence, there was approximately one case of a revision surgery for every third newly placed shunt, an approximate estimated complication rate of 33%, but it was not known that since how long the patient had a shunt, and it was also not known if the patient was from our cohort, because as a public hospital we accept patients from all over the province. Overall, VP shunt accounted for about 11.67% of the total burden of neurosurgical procedure. Even in the most advanced set up, it accounted for about 17%¹⁵ for CSF diversion procedures, with a further 5.5% for the CSF related complications like infections and leaks, while VP shunt accounted for about 14.4% procedures in tertiary care centers in the East Africa.¹⁷ As noted above, from our estimate it was noted that almost 33% of all shunt procedures were related to the complications in our set up, a study by Nithin A¹⁶ shows that there were 42% shunt complications rate and included infection and blockage, a review over a period of two years. Globally, overall the shunt complications range from 1 to 40%.^{4,5}

VP shunt was followed by Endoscopic third Ventriculostomy (ETV) which were 70 procedures, and External Ventricular Drain (EVD) -28 procedures, while Lumboperitoneal (LP) Shunt were done in 7 patients. ETV is a procedure which can be performed in limited settings where there are expertise, and is performed mostly for the obstructive HCP due to tumors of the posterior fossa and aqueductal stenosis, it accounted for 2.4% of all neurosurgical procedures. ETV has a success rate of around 60 to 80%^{18,19}, for different etiologies of HCP. It does not have all the hardware related complications and is tolerated well. Abebe et al¹⁷ showed that ETV accounted for 7.2% of all neurosurgical procedures and it was even more higher for the pediatric patients.

External ventricular drains (EVD) were placed in

28(6.4%) patients, most of them were in patients having an IVH, or having an infected HCP to divert the CSF, as a shunt or ETV cannot be done in these cases. EVD are not only done to divert CSF, but also to monitor the CSF pressure and to instill medications. We however, used it solely for the purpose of draining CSF and for identifying and treating infections through performing CSF culture and sensitivity.²⁰ Lumboperitoneal (LP) shunt was placed in a small number of patients (0.25%). LP shunt has a very limited role in the treatment of HCP, and is indicated only for a specific and rare disorders like Normal Pressure Hydrocephalus (NPH) and Idiopathic intracranial Hypertension (IIH). Despite its limited use, the LP shunt is having a lot of complications revisions rates upto 85%²¹, which is making it one of the least favored modality for the treatment of HCP, further adding to the disease burden.

HCP also put a substantial burden economically and it is estimated that in Sub-Saharan Africa it would cost about 190 million USD to treat all the incident cases of Hydrocephalus.²² We used cheaper shunts made in the subcontinent, since no difference has been found in the outcome and complications between them and the costly shunt systems.²³ Furthermore, HCP has implications other than just procedures like travel, opportunity and investigations, and in a study from lower middle income country like Pakistan, showed that even 41%²⁴ of patients could not afford basic investigations like Transcranial Ultrasound or CT Brain. Though we did not study the economic burden of the disease and its limitations, but since as a public hospital we can derive the procedural cost only for medications and VP shunt which is about 100 USD, but it ranges from 1000 to 1500 USD in the private set up, apart from travel expenses and days off work for the caretakers.

Hence, not only is HCP per se is a common neurosurgical problem, but also the various treatment modalities used are associated with complications and failure, which makes the disease more prevalent and poses challenges for the neurosurgeons.

CONCLUSION

Hydrocephalus is a common condition dealt within the Neurosurgical units and we encounter every 3rd case done on emergency list and every 10th case done on elective list related to hydrocephalus, and it accounted for 16% of all the cases done in the neurosurgery. Not only does the disease itself present a surgical entity but the treatment modalities also causes complications, further adding to the disease burden.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author(s) Full Name	Contribution to the paper	Author(s) Signature
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2	Muhammad Usman Khan	Did data collection, analysis and literature review.	
3	Aftab Ahmad	Did data collection and literature review.	
4	Usman Haqqani	Did data collection and literature review.	