



CSF SHUNT INFECTION; PEADRIATIC CEREBROSPINAL FLUID SHUNT INFECTION. ANALYSIS OF RISK FACTORS INSTIGATING

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ABSTRACT... Hydrocephalus is the abnormal accumulation of CSF with in the ventricles and subarachnoid spaces. It is often associated with dilatation of ventricular system and increased ICP. Hydrocephalus is almost always a result of an interruption of CSF flow and rarely because of increased CSF production. The definitive treatment of hydrocephalus is surgical treatment which includes shunting and non-shunting procedures. The most common and overwhelming complications that can occur due to the CSF shunts is infection. The risk factors associated with pediatric CSF shunt infection has been analyzed in this study. **Study Design:** Descriptive study. **Setting:** Department of Neurosurgery, Nishtar Hospital Multan & Sheikh Zayed Hospital Rahim Yar Khan. **Period:** Three years 01-07-2013 to 01-07-2016. **Method:** Total 209 eligible patients who were operated for CSF shunt were keenly monitored. Several variables were observed and the responses against these variables were noted down. Post operative follow up of all these cases done for 6 months in order to notice any development of infection (clinical signs of infection & CSF examination) in CSF shunt system. Chi-square method was used applied in order to analyze the association among the variables and shunt infection development. In our population of 209 patients only twenty six patients (12.44%) suffered from shunt infection. In this study four variables were qualified as having significant association with greater risk of shunt infection. 1) Patient age. 2) Inadvertently exposure of surgical instruments to the shunt system. 3) the existence of large number of previous shunt systems. 4) manual handling of shunt system **Conclusions:** Four variables have been reported by this study which can be a great source of shunt infection. it is recommended that changes in clinical practice should be considered in order to avoid these. Few recommendations are as follows. 1) While handling the shunt system great care should be taken. 2) It should be taken care that the manual contact of the Surgeons with the shunt system should be minimum. 3) it is recommended that the alternatives other then the shunt insertion should be considered especially for the children. 4) Great number of previous shunt system is also a great risk factor and these patients must be handled as individuals at high risk.

Key words: Cerebrospinal fluid shunt; Infection; Hydrocephalus; Neurosurgery; Children

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INTRODUCTION

Like other numerous diseases of childhood such as spina bifida, brain tumors, brain hemorrhage, head injury and meningitis Hydrocephalus is also one of the childhood conditions which require insertion of cerebrospinal fluid shunt. But these CSF shunt often associated with different complications. The common complication in these CSF shunts are 3 to 15 % infection rate and more than 40 % of two year failure rate.^{15,17,19,31,35,39,43} These shunt infections mostly occurs after few months of this shunt surgery and is linked up with several risks which include seizure disorder and

decreased drainage.

These shunt infections can be cured by removing the inserted shunt system, time being insertion of an external CSF drain, a proper antibiotic course and finally re-insertion of new shunt system. This whole procedure involves a minimum of two separate surgery operations and two to three weeks hospital stay. Also there is equal chance of long term risk of mortality greater than 30 % which is double in % age as compared to the children without infection.

Several researches and studies have been conducted for the identification of these factors and it has been revealed that no clear identification of these factors has been notified. All the data in previous literature came from retrospective series which does not show any clear agreement for identification of these CSF risk factors. So the need of this study was to identify those risk factors which should be consider for the CSF shunt infection in children and identification of potentially modifiable perioperative practices.

OBJECTIVES

Objective of this study was to analyze prospectively the perioperative risk factors for CSF shunt infections in children.

MATERIAL AND METHODS

The descriptive case study was performed at Nishtar Hospital Multan & SH. Zayed hospital Rahim yar khan in the neurosurgery departments. The total population of this study was comprised of 209 patients. The duration of this study was three years i.e. 01-07-2013 to 01-07-2016.

Inclusion Criteria

The eligible patients for this study were those whose age was between 1 year to below 16 years and if they are going for insertion of shunt or CSF shunt revision.

Exclusion Criteria

Those cases were not considered for the study, in which a history for shunt infection or any other infection in the body system was observed.

Two hundred and nine patients admitted in the departments of neurosurgery indoor and fulfilling the criteria were selected. Prior this study a verbal consent was taken from all those patients after clarifying them the nature and cause of the study. Moreover the procedure of the study was also explained to them. The study was conducted after obtaining the permission from the ethical committees of the hospitals.

A dedicated full time staff nurse was deputed to assist in the study whose duty was to identify the

pending shunt operations for the study from daily operation list. Staff nurse observed the whole procedure of surgery from the time the child entered in the theater till the time wound was closed and record the observations for the study. All the operation was performed by the same neurosurgeon. Patients were observed for CSF shunt infection up to 6 months postoperatively.

Data Analysis

Data was entered in the pre defined Performa. All the data was key punched and analyzed by using software SPSS 20.0. Frequencies were calculated for gender age and mean operation time. The variables to be studied were as follows gender, age, previous shunt system, priority level of operation i.e. ranging from 4 i.e. higher priority emergency cases to 1 i.e. lowest priority, elective cases, operation mean time, manual handling of VP shunt, no. of times shunt system was manipulated by a surgical instrument, nature of surgery either first time or revision surgery and number of person present in the theater. Chi square test was applied and asymptotic significance level as $p < 0.05$ was selected for this study. Mean and standard deviation was also calculated for age and mean operation time.

RESULTS

The total population of this study was 209 patients including both male and female. Among these total count of male patients was 131 and for female patients it was 78. The average patients age at the time of operation was 12.5 ± 4 years (range 02–17). Distribution of gender with respect to age is represented in the below mentioned Table-I.

The mean surgery time was 47.9 ± 22.3 min. Also the mean postoperative follow-up period was 6 months. The mean time to re-operate the patient with infection was 36 days (4–177 days). Out of 209 patients 183 patients were remain infection free after the completion of 6 months follow up period. While infection was observed in rest of 26 patients which are described as follows.

Our analysis revealed that four variables i.e.

manual handling of VP shunt system (p=0.002), manipulation of shunt system due to surgical instrument (p=0.003) the patient age (p=0.002) and greater number of Previous shunt (0.001)

were proved as significant risk factor for these types of surgical operations. These are described as follows.

Age Groups (In Years)	Gender		P-Value
	Male (n=131)	Female (n=78)	
01-05	14	05	0.002
06-10	39	19	
06-15	36	28	
16-20	42	26	
Total	209		

Table-I. Cross-tabulation of age group with respect to gender

Sr. No	Reason	Total cases	Male	Female
1	shunt system was manipulated by surgical instrument	04	3	1
2	Manual handling of VP shuntsystem	04	2	2
3	Greater number of Previous shunt	18	15	3

Table-II. Division of patients who got shunt infection

Manual handling of VP shuntsystem	Gender		P-value
	Male	Female	
Infected	02	02	0.002

Table-III. Cross-tabulation of manual handling of VP shunt system with respect to Gender

Shunt system was manipulated by surgical instrument	Gender		P-value
	Male	Female	
Infected	03	01	0.003

Table-IV. Cross-tabulation of infection with respect to Gender

DISCUSSION

It has been tried to identify those risk factors which cause CSF shunt infection. These have been identified by closely observing the shunt surgeries in children. Our study indicates that four variables which have significant relationship with a great risk of infection are as follows. 1) Patient age 2) inadvertently exposure of surgical instruments to the shunt system 3) the existence of large number of previous shunt systems 4) manual handling of shunt system.

RISK FACTORS

Greater Number of Previous shunt system

There are many reasons which can cause Hydrocephalus and hence ultimately requires the placement of a VP shunt. But apparently the root cause of hydrocephalus does not have

any relationship with the infection risk for shunt. The occurrence of shunt infection lies between 1.6% and 16.7%.^{44,45} It is pertinent to mention that the reason behind such a great percentage of infection incidence is mainly due to are due to patient demographics and varying definitions of infections in VP shunt system. These are also evident through the literature review.

Till date no clear guideline or proper recommendations for the early identification/detection of CSF shunt infection is available. Nevertheless, it is evident from past literature that few authors have proposed recently few standardized approaches in order to handle these infections⁴⁶ Mostly the shunt infection starts after the placement of shunt or revision (e.g. within 1 month); and subsequently is the occurrence of contamination due to microorganisms.^{44,4} Also it

is pertinent to that the chances of increase rate of infection rate are high due to the advance number of shunt revision.⁴⁸ In fact, it is more appropriate to say that rate of occurrence of infection in those patients which have revision of shunt system are more risky as compare to those patients who do not have any shunt revision.

The above mentioned statistics are very important to be noted due to the reason that by a rough estimate more than 50% cases CSF shunt require at least one surgery for revision in later stages.^{45,46}

Bayston and Lari³ observed and declared in a study of sample size of 100 CSF shunt operations, that 58% of patients of hydrocephalus, have the existence of previous shunt system.^{1,36} In our study the presence of previous shunt system can a risk factor is proved. In our study 18 patients has previous shunt system thus causing the infection making the percentage as 8.61%.

Age of the Patient

In previous study few authors reported that the younger patients are more prone to the risk of infection while others reported in negative.^{10,21,29,31-33,37}

But in our study evidences has been found that the patients of younger than 4 year there is a are more prone to risk at the time of shunt surgery as compare to the children older than this. The attributable factors which are the main cause of increase rate of infection are poor skin condition, poor immune system, generally, and high density of skin bacteria.^{7,12} So it is recommended that the alternatives other than the shunt insertion should be considered especially for the children.^{2,20}

Manual handling of Shunt System

In this study the overall frequency of infection due to manual handling the shunt system was 15.38%. These results are quite similar to the other studies in which chances of infection due to manual handling of shunt system have been observed up to 12 to 20%.^{9,13,14,27,30}

Exposure of Shunt System to the surgical

Instruments

It is also evident from our results that due to increase touching of the shunt system can be a source of higher risk of infection. Moreover exposure of shunt system to surgical instrument can also cause infection in children.

All these findings indicate that the role of surgical personnel can be a great source of contamination which in turn causes infection in CSF shunt systems.

In our study, any other variable did not reveal significant results. It is quite a possibility, that this study do not have adequate powers to identify all significant variables.^{24,25,33}

CONCLUSIONS

In this study four factors have acknowledged for the cause of shunt infection, and it is recommended that changes in clinical practice should be considered in order to avoid these. Few recommendations are as follows. 1) While handling the shunt system great care should be taken. 2) It should be taken care that the manual contact of the Surgeons with the shunt system should be minimum. 3) it is recommended that the alternatives other than the shunt insertion should be considered especially for the children. 4) Great number of previous shunt system is also a great risk factor and these patients must be handled as individuals at high risk. These findings can also be used as particle implications for other surgeries.

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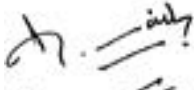

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