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CLINICAL OUTCOMES OF LUMBO-PERITONEAL SHUNT IN THE MANAGEMENT OF BENIGN INTRACRANIAL HYPERTENSION: A RETROSPECTIVE ANALYSIS OF THREE YEARS

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ABSTRACT

BACKGROUND: First line of management of benign intracranial hypertension is through conservative approach by medications and weight loss program and is reported to have successful effects, however failure to or no response to conservative treatment leads to surgical intervention consisting of optic nerve sheath fenestration, endoscopic decompression of optic nerve, venous sinus stenting and CSF diversion techniques (Ventriculoperitoneal or lumbar-peritoneal shunt).

OBJECTIVE: To evaluate the clinical outcomes of lumbo-peritoneal shunt in terms of resolution of headaches and visual symptoms especially papilledema along with the possible complications.

METHODOLOGY: A retrospective observational study was conducted from the records of three years (2019 to 2022 with 1.5 years follow up). Clinical records were analyzed for including the patients with non-probability convenience sampling. Patients were operated on through lumbo-peritoneal shunt. Subjective improvement in headache and resolution of papilledema through fundoscopic pictures along with visual acuity assessed through Snellen chart were the main outcomes assessed at follow up. SPSS version 26 was used to analyze the data.

RESULTS: A total of 157 cases were operated for benign intracranial hypertension out of which 71 (45%) patients underwent lumbo-peritoneal shunt. Majority of the patients were females 58(82%) while 13(18%) were males.The most common clinical feature reported by majority of the participants was headache 63(89%) while all the patients suffered from papilledema 71(100%). Among these, 61(86%) demonstrated subjective improvements in headaches while 65(91%) patients had resolution to fundoscopic picture.

CONCLUSION: This study concluded that Lumbo-peritoneal shunt is an effective and safe surgical procedure in improving symptoms associated with benign intracranial hypertension such as headache and papilledema, however the procedure is also associated with complications such as infection and revision surgeries.

KEY WORDS: Benign intracranial hypertension, lumbo-peritoneal shunt, lumbar peritoneal shunt, papilledema, pseudotumor cerebri, idiopathic intracranial hypertension.

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INTRODUCTION:

Benign intracranial hypertension which is also known as idiopathic intracranial hypertension and pseudotumor cerebri is attributed to the condition characterized by having visual symptoms along with headaches and increased intracranial pressure with no evidence of any identifiable etiology evident on radiological or other technical findings.(1, 2) Patients presents typically with symptoms of raised intracranial pressure along with tinnitus, visual field defects, defects in visual acuity and changes in cognition. The condition can take a severe course leading to blindness if left untreated.(3-5) The most common visual symptom associated with the benign intracranial hypertension is papilledema, which if not treated in a timely manner can lead to visual loss which may be permanent.(6, 7)

The incidence reported in general population of the United states is estimated to be 0.9 per 100000 individuals with the female affected to a greater extent than males as evident by female to male ratio which is 8:1.(8) Although the etiology and pathophysiology of the condition is skill unknown and controversial, and pathophysiology of the condition is skill unknown and controversial, certain factors are associated with increased prevalence of the disease such as obesity, female gender, increased levels of vitamin A and endocrine disturbances.(1, 2, 9, 10).First line of management of benign intracranial hypertension is through conservative approach by medications and weight loss program and is reported to have successful effects, however failure to or no response to conservative treatment leads to surgical intervention consisting of optic nerve sheath fenestration, endoscopic decompression of optic nerve, venous sinus stenting and CSF diversion techniques (Ventriculoperitoneal or lumbar-peritoneal shunt).(11)Traditionally, the lumbar peritoneal shunts are preferred in the management of BIH owing to the decreased size of ventricles, however literature have reported several case series studies illustrating same outcomes and even less rates of

revisions in ventriculoperitoneal shunts.(12)

The aim of this three years retrospective analysis was to evaluate the clinical outcomes of lumbo-peritoneal shunt in terms of resolution of headaches and visual symptoms, especially papilledema along with the possible complications.

METHODOLOGY:

A retrospective observational study of three years was carried out on the records at Rizwan Medical Center, Peshawar from 2019 to 2022 with one and a half year follow up period. Ethical approval was granted from the institutional research committees. Records were evaluated through purposive sampling. A total of 157 cases were operated for Benign Intracranial hypertension with different surgical techniques among which 71 cases were operated through lumbo-peritoneal shunt and included in our study. All other cases incorporating other surgical techniques or having any specific etiology identified causing the symptoms of raised intracranial pressure were excluded. Demographic and patient characteristics prior to surgery were reported on a proforma such as age, gender and presenting symptoms. Two trials of conservative treatment were carried out including medications and lifestyle modification. The patients not responding to two trials of conservative treatment were then opted for lumbo-peritoneal shunting procedure.

Before undergoing the surgical procedure, each patient's preoperative documentation was done including findings from CT scan and MRI along with pressure measurement. In all patients the standard procedure of lumbar-peritoneal shunt was carried out and outcomes were assessed at different follow up periods ranging to one and half year.

SPPS version 26 was used to analyze the results. All the categorical data was analyzed using frequency and percentages while mean and standard deviations were reported for numerical data.

RESULTS

Patients' characteristics and demographics:

A total of 157 cases were operated for benign intracranial hypertension out of which 71 (45%) patients underwent lumbo-peritoneal shunt. Majority of the patients were female 58(82%) while 13(18%) were males. The mean age of participants was 33 years (range 25-60). The mean BMI reported was 28. Among the female population 53(92%) were married while only 5(8%) were unmarried. (Table 1)

Table 1: Patient characteristics and demographics:

Variables		Frequency/Percentages and Mean
Gender	Male	13 (18%)
	Female	58 (82%)
Age	Mean Age and range	33(25-60)
BMI	Mean	28
Marital Status of females	Married	53 (92%)
	Unmarried	5 (8%)

Clinical symptoms at the time of presentation:

The most common clinical feature reported by majority of the participants was headache 63(89%) while all the patients suffered from papilledema 71(100%). Visual deficits were present in 60(84%) of the patients including decreased visual acuity and visual field and diplopia. Vomiting was also reported by 21(30%) of the patients. 32(45%) patients also had tinnitus. (Figure 1)While 4 patients were presented to emergency department with severe visual deterioration leading to emergency VP shunt insertion after confirmation of the findings from MRI i.e., increased intracranial pressure without any identifiable etiology or mass lesion. MRI, CT scan and spinal tap was non-conclusive for tumor or hydrocephalus in 71(100%) of the patients.

Mean Evans ratio reported for the patients was less than 0.23. Spinal tap was performed CSF manometry, the mean value of which was 75.

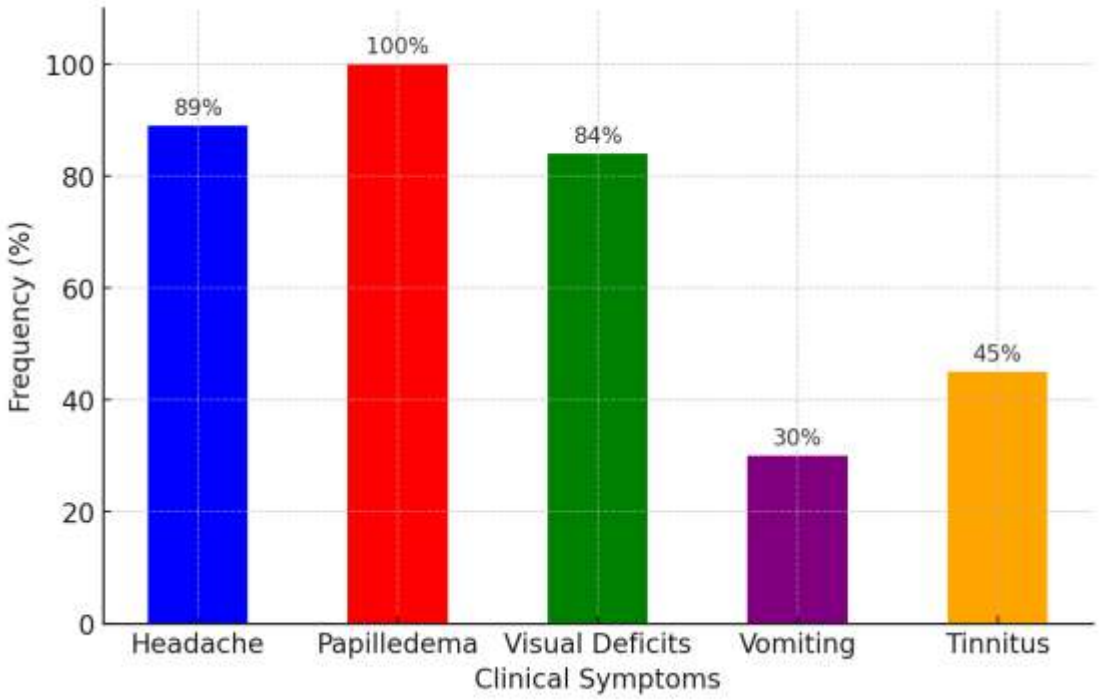

Figure 1: Frequency and percentages of clinical presentation

Symptomatic outcomes of LP Shunt in terms of headache and papilledema:

Improvement in papilledema and visual acuity was evaluated objectively by the neurosurgeon while all other improvements were self-reported subjectively by the patient. A total of 61(86%) demonstrated subjective improvements in headaches while 65(91%) patients had resolution to fundoscopic picture while 3(4%) patient was having atrophic changes after papilledema resolution. While in 6(8%) of the patients, the papilledema persisted while 3(4%) patients were reported to have complete optic atrophy despite the LP shunt. (Table 2)

Table 2: Symptomatic outcomes in terms of headache and papilledema:

Symptomatic outcomes	Frequency/Percentages
Improvement in Headache	61 (86%)
Resolution of Papilledema	65 (91%)
Atrophic changes after Papilledema	3 (4%)
No improvement in papilledema	6(8%)
Complete optic atrophy	3(4%)

Improvements in visual acuity and visual field:

By analyzing the available data of 62 patients for whom visual acuity was assessed on Snellen chart, the difference and improvement of three lines were categorized as having improvement in visual acuity. Thirty-seven patients (60%) demonstrated improved visual acuity while 25(40%) remained stable with no further improvement or deterioration in comparison to pre-operative values.

Table 3: Visual Acuity Outcomes and Complications Following the Procedure

Parameter	Frequency (Percentages)
Visual Acuity Outcomes	
Improved Visual Acuity	37 (60%)
Stable Visual Acuity (No Change)	25 (40%)

Complications of the procedure:

Three (4%) cases of shunt infection necessitated shunt extraction and antibiotic therapy, while 9(12%) cases of shunt obstruction required shunt revision due to shunt complications.

Table 4: Complications of the Procedure

Complications of the Procedure	Frequency (Percentages)
Shunt Infection	3 (4%)
Shunt Obstruction	9 (12%)

DISCUSSION

Attributed to the diverse and unknown pathophysiology and etiology of the Benign intracranial hypertension, the management of the condition is a challenging one. The theory most supported in literature in terms of pathophysiology suggests that CSF builds up and manifests increased pressure due to hypersecretion or malabsorption of the CSF from the choroid plexus.(13) While the first line of management is conservative through trials of medications and life style modifications including weight loss and many patients have shown promising results. However, certain cases are refractory and progressive and needs surgical intervention.(14) This study evaluated the clinical outcomes of one of the most commonly performed CSF diversion technique i.e. lumbar peritoneal shunt and results demonstrated satisfactory and excellent results in terms of resolution of presenting symptoms.

The results of a study conducted on Indian population demonstrated that out of the total 33 sample size, there were 31 females(94%) indicating higher prevalence of BIH in females.(15) Another study reported prevalence of 85% in females.(16) The results of our study are also in accordance with the literature as there were 20(82%) females. The exact cause of increased prevalence in females is still unknown, however different hormonal abnormalities and disturbances such as those caused by the hormonal contraception usage and certain pathological conditions resulting in hormonal imbalances such as PCOS (Polycystic ovary syndrome) are thought to contribute to the increased prevalence of BIH in females. Studies have also shown a strong association of BIH with the body mass index (BMI).(17)

Results of a systematic review illustrated that since 2014. the number of surgical procedures carried out for the management of BIH has tripled. However, no study has incorporated randomization or any high-quality study design to form consensus on a particular preferable and effective surgical technique. Literature has highlighted the most commonly used surgical interventions for BIH which are sub temporal decompressive craniectomy, ONSF (optic nerve sheath fenestration),lumbo-peritoneal and ventriculoperitoneal shunting (CSF diversion techniques), venous sinus stenting and bariatric surgery.(18-20) Owing to the expertise and increased skillfulness of the operating Neurosurgeons in Lumbo-peritoneal shunting procedures, the LP shunt was opted in those patients. Endoscopic optic nerve decompression can also be used as a surgical intervention, but the literature reported is scarce therefore leading to decreased evidence about the effectiveness and possible adverse effects.

A 2021 review regarded the venous sinus stenting as the most effective surgical procedure for BIH in relieving visual related sign and symptoms and ONSF(optic nerve sheath fenestration) for visual field.(21-23) One other study conducted in UK to evaluate the effectiveness of VP shunt demonstrated that Ventriculoperitoneal shunt is also an effective CSF diversion technique used in the management of BIH, the results of which demonstrated that ventriculo-peritoneal shunt when used for the management of benign intracranial hypertension, is a safe and effective surgical procedure. The study elaborated that on follow up visit all the patients (100%) had complete resolution of papilledema while the percentage of patients who showed improvements in headache and visual acuity were 84% and 93%

respectively.(12) While the results of our study showed variable rates of improvements after lumbo-peritoneal shunt. 61(86%) demonstrated subjective improvements in headaches and 65(91%) patients had complete resolution to fundoscopic picture and 37(60%) patients were categorized as having improved visual acuity when measured on Snellen chart by the minimum improvement and difference in three lines.

One case series study was conducted to compare the two CSF diversion techniques (VP and LP shunt) in the management of BIH,the results of which concluded that both the procedures were effective in reducing the symptoms and overall clinical picture. However, ventriculoperitoneal shunts was associated with increased rate of failure (14%) as compared to LP shunts while Lumbo- peritoneal shunts had greater rate of revision surgeries (60%) than ventriculoperitoneal shunts (30%). (11%). The results of our study also reported some complications associated with the procedure including Three (4%) cases of shunt infection which necessitated shunt extraction and antibiotic therapy, while 9 (12%) cases of shunt obstruction required shunt revision due to shunt complications. The choice of surgery depends on different factors including patient condition, surgeons' preference, expertise, and experience. All these procedures are associated with some complications, and each have their reported failure and recurrence rates (9.4% for ONSF, 12.3% for venous sinus stenting, 14% for VP shunt and 11% for LP shunts).(18)

The single series of patients undergoing lumbo-peritoneal shunt for Benign intracranial hypertension were included in the study with no control group for comparison, which is the limitation of the study. Also, the smaller sample size makes the generalizability of the results on the whole population difficult. Future multi-center studies of higher study designs with increased sample size incorporating randomized samples from two techniques and comparing the outcomes are needed to further enhance our knowledge of the subject.

CONCLUSION

Different surgical techniques can be used in the management of Benign Intracranial hypertension, the choice of which depends on different patient related factors and surgeon expertise and preference. This study concluded that Lumbo-peritoneal shunt is an effective and safe surgical procedure in improving symptoms associated with benign intracranial hypertension such as headache and papilledema, however the procedure is also associated with complications such as infection and revision surgeries.

Conflict of Interest Statement

The authors declare no conflict of interest related to this publication.

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A.Conception, Planning of the Research
B.Initial Review of Data Collection, Research Proposal of Article
C.Writing of manuscript of Article
D.Critical Review of Article