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Different Therapeutic Approach to Idiopathic Normal Pressure Hydrocephalus: Lumboperitoneal Shunts Versus Ventriculoperitoneal Shunts

İdiyopatik Normal Basınçlı Hidrosefalide Farklı Tedavi Yaklaşımları: Lumboperitoneal Şantlar ya da Ventrikülöperitoneal Şantlar?

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Abstract

Objective: Idiopathic normal pressure hydrocehalus (iNPH) or Adam-Hakims syndrome is an uncommon but important cause of dementia, gait disturbance and bladder incontinence. Our aim was to compare the efficacy and complication rates of ventriculoperitoneal and lumboperitoneal shunts in the treatment of iNPH.

Method: This is a retrospective study conducted in 25 patients who were treated with either ventriculoperitoneal or lumboperitoneal shunts for iNPH between 2003 and 2012. Age, gender, clinical presentation, methods of treatment, and complication rates were recorded.

Results: Two of the twelve patients in lumboperitoneal shunt (LPS) group were revised; 1 distal catheter infection was replaced by a ventriculoperitoneal shunt (VPS). In addition, there was one revision for wound detachment (due to scratching by the patient). In VPS group (13 patients), one of the patients was complicated with subdural haemorrhage 3 months after the operation and extraction of shunt was carried out immediately. Moreover one dysfunctioning VPS was revised with a LPS after 3 years.

Conclusion: Our results indicate that when the patients are properly selected for shunt insertion, both LPSs and VPSs, are effective in controlling all the clinical manifestations of iNPH with positive results.

Keywords: Amnesia, imbalance, lumboperitoneal shunt, normal pressure hydrocephalus, urinary incontinence, ventriculoperitoneal shunts

Öz

Amaç: İdiyopatik normal basınçlı hidrosefali (iNPH) ya da Adam-Hakims sendromu demans, yürüme bozukluğu ve idrar inkontinansın önemli ve az bilinen bir nedenidir. Çalışmamızda iNPH tedavisinde kullanılan ventrikülöperitoneal ve lumboperitoneal şantların etkinliğini ve komplikasyon oranlarını karşılaştırdık.

Yöntem: Kliniğimizde 2003-2012 yılları arasında iNPH tanısıyla ventrikülöperitoneal veya lumboperitoneal şantla tedavi edilen 25 hasta geriye dönük olarak incelendi. Yaş, cinsiyet, klinik prezentasyon, tedavi yöntemi ve komplikasyon oranları kaydedildi.

Bulgular: Lumboperitoneal şant (LPS) grubunda iki revizyon yapıldı; 1 distal kateter enfeksiyonu ventrikülöperitoneal şantla (VPS) değiştirildi. Bir hasta yara yeri kaşıntısı sonucu yara yeri açıldı ve peritoneal uç revize edildi. VPS (13 hasta) grubunda, 1 hasta subdural hematom nedeniyle 3 ay sonra kanama boşaltıldıktan sonra revize edildi. Çalışmayan bir VPS de 3 yıl sonra LPS ile değiştirildi.

Sonuç: Şant, yerleştirilmesi için uygun hastalar seçilecek olursa, tipi ister VPS olsun ister LPS olsun iNPH nedeniyle oluşan klinik bulguları kontrol etmede etkin bir yöntemdir.

Anahtar kelimeler: Amnezi, dengesizlik, lumboperitoneal şant, normal basınçlı hidrosefali, üriner inkontinans, ventrikülöperitoneal şant

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Introduction

Normal pressure hydrocephalus (NPH) which has three main symptoms as gait disturbance, dementia and urinary incontinence, is a disorder of cerebrospinal fluid (CSF) absorption first described by Hakim and Adams in 1965 (1,2). The classical triad of NPH which can be primary, is named as idiopathic or it can be secondary caused by subarachnoid hemorrhage, trauma, meningitis, posterior fossa surgery, tumors causing meningitis carcinomatosa, Alzheimer patients, stenosis of aquaductus, insufficiency in arachnoid granulations (3). The incidence of idiopathic NPH (iNPH) is 5.5 per 100.000 and prevalence is 21.9 per 100.000 (4). Improved diagnostic and therapeutic methods have raised clinical success rates to a range of 70-90% and risk-benefit analysis have shown that surgery is superior to conservative treatment and natural course (5). Magnetic resonance imaging (MRI) provides important information for NPH by demonstrating a pulsatile flow void across the aquaduct and a hyperdynamic CSF flow on T2-weighted images (6). CSF drainage by lumbar puncture or extended lumbar drainage, CSF pressure dynamic measurements are confirmatory tests (7-9). The standard treatment of NPH is ventriculoperitoneal shunting (VPS) that has significant morbidity (30%) and re-operation rates due to subdural hematoma or hygroma, infection, obstruction, etc. (10,11). Lumboperitoneal shunt (LPS) is an alternative method to VPS for CSF diversion in these patients.

We have retrospectively analyzed our patients with iNPH for effectiveness and outcome of LPS versus VPS.

Material and Methods

We retrospectively analyzed the medical records of patients undergoing LPS and VPS placement for idiopathic NPH by the same author (E.Ç) from 2003 to 2012. Secondary NPH cases were excluded. Ethical committee approval and written consent from the patients were obtained.

The diagnosis were confirmed by clinical findings (Table 1), CSF dynamic flow MRI demonstrating increased flow at the aquaduct, and positive CSF tap test. Positive CSF tap test was meant that gait, balance, incontinence and cognitive symptoms get better after daily lumbar puncture (30-45 mL CSF drainage in every puncture) for three days.

In our clinic the standard surgical technique was placement of VPS (Medtronic-CSF Flow-Control Valve, Integra Orbis Sigma Valve, Medtronic Delta valve) from Kocher point or Keen points until 2011, and LPS (Miethke LPS) after 2011 due to availability of the shunt system in our hospital.

There were 34 patients with NPH, but 9 of them were excluded because they were secondary NPH (sNPH) due to subarachnoid hemorrhage, trauma, tumor, or infection. The rest of the 25 patients were diagnosed as iNPH. The 25 patients were divided into two groups according to the type of CSF shunt used for their treatment (VPS group and LPS group).

Statistical Analysis

IBM SPSS statistics 22.0 software was used for statistical evaluation of the data collected in the study. While comparing data with normal range between groups, Student's t-test was used, and comparing data without normal range, Mann-Whitney U test was used. Qualitative data was compared by Fisher's exact test or chi-square test according to the subject number. P values <0.05 were accepted as significant.

Results

Of the 25 iNPH patients, 10 were female and 15 were male. The mean age was 71.52+8.48 years (range 56-83 years). There were 13 patients in VPS group, and 12 patients in LPS group.

The age, gender, symptom duration, rate of presence of concomitant systemic diseases and complication rates were not significantly different between two groups (p>0.05).

In 13 patients treated with VPS, 2 patients had complications. In one patient, there was with subdural hematoma three months after surgery. The VPS was removed and the hematoma was evacuated surgically. On follow-up of this patient, hydrocephalus progressed again and a new VPS was inserted. In another patient, a LPS was placed due to VPS dysfunction 2 years later. On long-term follow-up (mean 3.2 years with range 1-5 years) in VPS group, 2 patients died because of unrelated causes. The rest of the patients had improvement in gait disturbance

Table 1: The demographic data and outcome of the two groups

	VPS	LPS	p
Age	69.6±8.3	75.5±8.5	0.271
Gender (M/F)	9/4	6/6	0.428
Symptom duration (year)	1.2±0.7	2.1±2.9	0.852
Concomitant disease (n of patients)	10	9	1
Ex	2	2	1
Revision	2	2	1
Complication	2	2	1

M: Male, F: Female, VPS: Ventriculoperitoneal shunt, LPS: Lumboperitoneal shunt

and memory deficits, and there was a complaint about urinary incontinence only in one patient.

Two of twelve patients treated with LP shunts has complications (16.6%). In one patient, the LPS was replaced with a VPS for wound infection 7 days after first shunt operation. This patient died because of aspiration pneumonia 7 months later. In another patient with LPS, shunt revision was performed because of opening of the abdominal wound, and the peritoneal catheter was placed with another abdominal incision. In this group, 2 patients died owing to unrelated causes. In 10 patients, only two patients had residual symptoms at long-term follow-up (2.8 years, range 1 to 5 years). In one patient, she still had difficulty while steady gait possibly due to lumbar degenerative spondylosis, and in another patient, there was still complaint on memory function (Table 1).

Discussion

The diagnosis of iNPH is made according to clinical triad of gait disturbance, cognitive impairment and urinary incontinence with ventricular enlargement in the absence of apparent cortical atrophy. The treatment of iNPH is preferably surgical. Natural history of iNPH is unclear, still there is a concensus that outcome is worse without surgery (12,13). The main shunt procedures are VPS and LPS for iNPH. VPS are usually chosen according to the surgeon's experience. However, as an advantage, LPS does not need to access to ventricular cavity within the brain tissue, which has risk of brain and cortical venous injury, and hemorrhage. Besides, LPS is associated with lower infection rates than VPS (14,15).

In the early surgical series of shunt insertion, the clinical improvement and efficacy of the procedure were reported to be low because of high complication rates (11,12). Current studies have stated that VPS insertion in iNPH have good outcome in 71% and has low mortality (1%), and low revision and complication rates (16% and 10.4% respectively) (16). Moreover, with the improvement of surgical technique and shunt technology, the stated subdural hemorrhage (SDH), intracerebral hemorrhage, and seizure rates have also declined (16).

Pujari et al. (17) have studied the long term results of shunt patients with a mean follow up of 5.9+2.5 years. Gait improved 83% at 3 years and 87% in 7 years, cognition improved %84 and 86% and urinary incontinence improved 84% and 80% respectively. However 53% required shunt revisions and 74% of them improved after revision surgery. In our series, which included 25 patients, 13 patients had VPS and 12 patients had LPS. In VPS group, gait, cognition and urinary incontinence improvement rate was 100%, 100% and 92% respectively on last follow-up. In LPS group, gait, cognition and urinary incontinence improvement rate was 90%, 90% and 100% respectively. In a meta-analysis of 44 articles by Hebb et al. (11) it was reported that the pooled mean rate of shunt complication (including death, infection, seizures, shunt malfunction, SDH or effusion) was 38%. In our series, there was no mortality, and complication rate was 16% (2 patients from VPS group and 2 patients from LPS group), and revision rate was 16% (2 patients from VPS group and 2 patients from LPS group). We did not find a difference between groups for mortality, complication or revision rates.

McGirt et al. (18) demonstrated that gait disturbance as the primary symptom and short duration of symptoms are indicators for good outcome. In our series, there were residual complaints in three patients (urinary incontinence in one, memory function in one, and gait disturbance in one). Other patients had a very good improvement for all three symptoms.

Conclusion

In conclusion, we state that the two CSF diversion methods, both VP and LP shunts, are safe and effective for treatment of iNPH. Our study is limited due to the small number of patients and variability in shunt devices. Controlled randomized prospective trials in larger groups are required to maintain high rank evidence of shunt effectiveness in iNPH management.

Ethics

Ethics Committee Approval: Retrospective study.

Informed Consent: Retrospective study.

Peer-review: External and internal peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.C., A.Ç., Concept: A.Ç., Design: A.Ç., Data Collection or Processing: M.İ., A.Ç., Analysis or Interpretation: A.Ç., Literature Search: A.Ç.,Writing: M.İ., A.Ç.

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