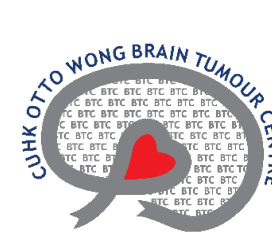
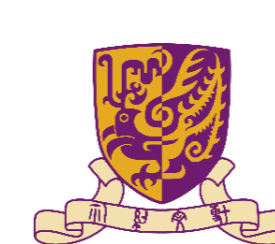


FAVOURABLE CANDIDATES FOR NORMAL PRESSURE HYDROCEPHALUS PATIENTS A CORRELATIVE ANALYSIS WITH SALINE INFUSION TEST

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INTRODUCTION

The diagnosis of idiopathic normal pressure hydrocephalus (NPH) encompasses clinical, radiological and invasive testing such as the lumbar infusion test. Our study would like to further investigate on the clinical and post shunt parameters that might better predict outcomes in NPH patients.

METHODOLOGY

This was a retrospective study of neurosurgical patients with normal pressure hydrocephalus investigated through the lumbar infusion at Prince of Wales Hospital during the period 2017-2023. Pre and post operative parameters and efficacy of improvements were analysed. Outcomes for evaluation including the cerebrospinal fluid resistance rate, operation rate, shunt settings and types, complications rates. Radiological outcomes including pre and post op ventricular size would be evaluated.

RESULTS

- In total there were 25 patients performed lumbar infusion test during the study period.
- The average age was 70.48 (47 -85) years old. There were 15 females.
- The most common symptoms of the surgical candidates were ataxia (100%), cognitive decline (100%) and urinary incontinence (75%).**
- 7 patients have SAH, SDH or IVH while 3 have brain tumours as co-morbidities.
- 8 (32%) patients were operated, 6 (24%) were pending operation and 11 (41%) were not operated.

- There is no significant difference in age and sex regarding their operative state
- The is no significant difference in CSF resistance ($p = 0.65$) between those operated [15.6 (7-24) mL/min] and those not [13.6 (6-22)].**
 - There is no significant difference in CSF resistance rate between those shunted candidates [15.6 (7-24) mL/min] and those not shunted with negative post tap test [16.4 (15-22) mL/min]. ($p = 0.72$)
- The no significant difference in Evans index ($p = 0.42$) between those operated [0.395 (0.376 - 0.443)] and those not [0.385 (0.3 - 0.504)].
- 100% of operated patients have subjective / objective improvement in tap test, compared to only 36% non-operated patients. Those are non fit for surgery due to other co-morbidities.

	shunted	Not shunted	P-value
Age	71.6 (50-85)	61 (41-79)	0.35
Male%	37.5%	36%	0.96
CSF resistance rate	15.6 (7-24)	13.6 (6-22)	0.42
Evans Index	0.395 (0.376 - 0.443)	0.385 (0.3 - 0.504)	0.65
Post tap test symptoms improvement	100%	36.3%	0.002

Table 1. Demographics and clinical parameters of surgical and non surgical candidates.

	Sensitivity	Positive Predictive Value
Infusion test (CSF resistance rate cut-off at 13)	71.4%	83%
Tap test	100%	87.5%

Table 2. Sensitivity and Positive Predictive Values of Saline Infusion Test and Tap Test (with True Positive as shunted patients with symptoms improvement)

- 6 of the surgical candidates has undergone shunting with the Medtronic Strata II shunt and 2 with Colman Certas Plus.
- None of those with Strata II shunt experienced overshunt symptoms or signs. Both with Certas Plus experienced overshunting.**
- 7 surgical candidates (87.5%) showed partial symptoms improvement in at least one of the most common symptoms.
- Tap test with symptom improvement has a higher sensitivity and positive predictive value than infusion test for diagnosing those with symptom improvement post operation.**
- There was no mortality, post op infection, or new neurological deficits.
- All of those non-operated had persistent or worsening symptoms.

CONCLUSION

- The most common symptoms of the surgical candidates were ataxia (100%), cognitive decline (100%) and urinary incontinence (75%).
- CSF resistance rate with saline Infusion test and Evans index CANNOT be solely used to predict surgical candidates.
- Tap test with symptom improvement has a higher sensitivity and positive predictive value than infusion test for diagnosing those with symptom improvement post operation.
- A prospective research with clear protocol and data collection would be helpful for future research

REFERENCE

- Ghosh, S., & Lipka, C. (2014). Diagnosis and prognosis in idiopathic normal pressure hydrocephalus. *American journal of Alzheimer's disease and other dementias*, 29(7), 583-589. <https://doi.org/10.1177/1533317514523485>
- Bortz, C., Dinizo, M., Kummer, N., Brown, A., Alas, H., Pierce, K. E., Janjua, M. B., Park, P., Wang, C., Jankowski, B., Hockley, A., Soroceanu, A., De la Garza Ramos, R., Sciubba, D. M., Frempong-Boadu, A., Vasquez-Montes, D., Diebo, B. G., Gerling, M. C., & Passias, P. G. (2021). Same day surgical intervention dramatically minimizes complication occurrence and optimizes perioperative outcomes for central cord syndrome. *Clinical Spine Surgery*, 34(8), 308-311. <https://doi.org/10.1097/BSD.0000000000001234>
- Ryding, E., Kahlon, B., & Reinstrup, P. (2018). Improved lumbar infusion test analysis for normal pressure hydrocephalus diagnosis. *Brain and behavior*, 8(11), e01125. <https://doi.org/10.1002/brb3.1125>
- da Rocha, S.F.B., Kowacs, P.A., de Souza, P.K.M. et al. Serial Tap Test of patients with idiopathic normal pressure hydrocephalus: impact on cognitive function and its meaning. *Fluids Barriers CNS* 18, 22 (2021). <https://doi.org/10.1186/s12987-021-00254-3>
- Beck, J., Fung, C., Ulrich, C., Fiechter, G., Fiechter, J., Mattle, H. P., Monz, M. L., Meier, N., Jordanasi, P., Z'Graggen, W. J., Gralla, J., & Raabe, A. (2017). Cerebrospinal fluid outflow resistance as a diagnostic marker for idiopathic normal pressure hydrocephalus. *Journal of neurosurgery: Spine*, 27(2), 227-234. <https://doi.org/10.3171/2017.1.SP.16548>