What’s new in Hydrocephalus? March to July 2012!

For this letter we conducted a PubMed literature search on “hydrocephalus” and noted that the total number of publications was 25,001. The number for the period of March to July 2012 was approximately 225. As stated before we have no ambition to be comprehensive or to make a critical review of what is published, the goal is to illustrate that there are significant research contributions in the hydrocephalus field by acknowledging a few of these articles. We also encourage you as members to make us aware of the articles you publish.

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Normal Pressure Hydrocephalus

A new iNPH scale was designed and presented (Hellström et al., 2012). The scale covers the domains of gait, balance, neuropsychology and continence and they found that it discriminates well between levels of severity and was reliable and valid. The authors recommend that the scale should be used in future studies on iNPH. The scale was also used in the presentation of the one-year outcome in the European multicenter study on iNPH (Klinge et al., 2012). The results with 84% improving from shunting support shunt surgery in patients presenting with symptoms and signs and MRI findings suggestive of iNPH.

Solana et al in Barcelona studied cognitive disturbances and neuropsychological changes in a sample of 185 iNPH patients. Analysis showed that cognitive impairment occurs in practically all patients and that the most affected domains are memory, executive functions, attention, and psychomotor speed. Shunting improved especially psychomotor speed, verbal memory, and general cognition. The study also stressed the importance of treating patients in the early stages of the disease (Solana et al., 2012).

A paper from Seoul presented positive results from an evaluation of the efficacy of Solifenacin in the treatment of overactive bladder symptoms in iNPH patients (Chung et al., 2012).

Using a SenseWear armband a group in Linköping made actigraphic recordings and evaluated physical activity in iNPH patients before and after shunt surgery. Although the patients improved in the gait tests the actigraphy parameters indicated that they did not use their improved capacity in their daily life. (Lundin et al., 2012)

Two published papers have investigated the change in ventricular volume with respect to TAP-test or external lumbar drainage test (Lenfeldt et al., 2012; Singer et al., 2012). Both found a small but significant decrease in ventricular volume. Other findings was a spatially distributed increase in the global brain volume following CSF removal (Singer et al., 2012) and that improvement neither correlated with ventricular reduction or CSF removal volume (Lenfeldt et al., 2012).
A pituitary endocrine evaluation of 16 NPH patients revealed pituitary dysfunction in five patients and that two improved in testosterone levels from NPH surgical correction. The authors recommend that pituitary screening should be considered in all NPH patients. (Moin et al., 2012)

In the search of a prognostic CSF biomarker for iNPH, a group from Tokyo has identified that soluble amyloid precursor protein α (sAPPα) had a sensitivity of 67% and a specificity of 83% for MMSE > 25 after surgery and concluded that sAPPα can be a suitable biomarker for the diagnosis and prognosis of iNPH (Miyajima et al., 2012).

**Idiopathic intracranial hypertension**

In a MRI study on twenty-seven astronauts it was found that exposure to microgravity can result in a spectrum of intraorbital and intracranial findings similar to those in idiopathic intracranial hypertension.(Kramer et al., 2012)

**Pediatric and Obstructive Hydrocephalus.**

In a paper from Malaga presenting a series of 58 ETV procedures the authors investigated the relationship between the ETVSuccess Score and the postsurgical success rate. They concluded that the success of ETV could have been predicted by ETVSS and that the predictability could help establish stricter surgical selection criteria (García et al., 2012). On the same topic; in certain cases when standard ETV might not be technically possible an alternative through the lamina terminalis by a transventricular, transfornaminal approach with flexible neuroendoscopy has been presented (Rangel-Castilla et al., 2012). The authors showed that the procedure was feasible with a low incidence of complications.

A study with focus on ETV in infants younger than 1 year old concluded that the effectiveness of ETV is not actually age-related, but etiology-related, with high success rate for aqueductal stenosis the (90 %) and lower for the treatment of Chiari II-related hydrocephalus (Costa Val et al., 2012). In a study on African infants with congenital aqueductal stenosis, long-term outcome for endoscopic third ventriculostomy alone or in combination with choroid plexus cauterization was investigated. It was concluded that the combined approach was significantly superior to ETV alone for infants younger than 1 year of age. (Warf et al., 2012)

In a phase-contrast MRI study comparing CSF flow after ETV and endoscopic aqueductoplasty (EAP) in patients presenting with aqueductal stenosis it was found that CSF flow through ventriculostomies is significantly higher than aqueductal CSF flow after EAP. The authors concluded that this could be one factor to explain why the reclosure rate of aqueducts after EAP is higher than the reclosure rate of the ventriculostoma. (Schroeder et al., 2012)

From Denmark there is a contribution with an impressive investigation of familial aggregation of primary congenital hydrocephalus in an unselected nationwide population (Munch et al., 2012). This study, that was based on 1928683 live-born children out of which 2194 had the diagnosis, found strong evidence of familial aggregation, supporting the existence of a genetic component to the etiology.
**Experimental Hydrocephalus**

Del Bigio et al investigated hypoxic and oxidative damage in the brains of rats with kaolin induced hydrocephalus and found evidence of hypoxia in periventricular capillaries. They concluded that hypoxia contributes to brain changes in young rodents with hydrocephalus (Del Bigio et al., 2012). A paper from Xiamen investigated reactive gliosis and neuroinflammation of hydrocephalic rats of different severity at both cellular and molecular levels. Results indicate that gliosis and inflammation continue to rise dramatically in experimental hydrocephalus and can be regarded as the main factors of hydrocephalus (Xu et al., 2012). In another study intracranial biomechanics of hydrocephalus in rats was investigated by force-controlled indentations. It was found that very small forces applied exogenously or endogenously cause progressive intracranial deformation (Shulyakov et al., 2012). The authors link this to that a small increase in CSF pulsatility can readily explain enlargement of the cerebral ventricles in hydrocephalus. Abnormal osmotic gradients as a potential component of hydrocephalus motivated an investigation of relationship between manipulated CSF osmolarity and ventricle volume in the normal rat brain. The results showed that hyperosmolar CSF was sufficient to produce a proportional degree of hydrocephalus.(Krishnamurthy et al., 2012)

In a study from Copenhagen the translational aspects from hydrocephalic rat to hydrocephalic human brain was investigated by direct comparison of AQP4 expression between those species. The study emphasizes the relevance and use of models in hydrocephalus research but also state that caution should be taken when interpreting data from experimental studies and underscores the importance of translational studies (Skjolding et al., 2012).

A fine review over the current knowledge on the pathophysiology of congenital and neonatal hydrocephalus was recently presented. (McAllister, 2012)

**Shunts**

The Certas shunt was introduced last year and we now presented an in-vitro evaluation (Eklund et al., 2012). The most interesting feature of the new shunt was the “Virtual Off” setting with an opening pressure nearly 500 mmH2O that may reduce the need for surgery in the treatment of subdural hygromas and hematomas. Related to overdrainage, a positive study on the effectiveness of a gravitational valve in the treatment of symptomatic overdrainage in children was recently presented.(Weinzierl et al., 2012) Another alternative could be to use lumboperitoneal shunts with horizontal–vertical valves. It was shown to be safe and effective alternative to ventriculoperitoneal shunting for iNPH, resulting in significant symptomatic improvement with a low risk of overdrainage (Bloch and McDermott, 2012).

Bayston and colleagues investigated in vitro the ability of linezolid or vancomycin against biofilms of bacteria in ventriculoperitoneal shunts. The results suggest that both linezolid and vancomycin might be effective against staphylococcal shunt infections without shunt removal.(Bayston et al., 2012) A retrospective study that evaluated CSF reinfection after using ETV during removal of infected CSF shunts found that ETV can be considered a potent alternative or at least an adjunct to ventriculoperitoneal shunts reinsertion (Shimizu et al., 2012).
**CSF Dynamics and Measurement techniques**

Santamarta and colleagues proposed a method based on central tendency measure (CTM) to quantify and characterize the changes in the ICP waveform. CTM was evaluated using NPH infusion studies and was showed to be closely correlated with pulsatility and to be a suitable approach (Santamarta et al., 2012).

In an attempt to measure ICP non-invasively a group in Kaunas have developed a technique based on simultaneous Doppler ultrasound of the flow in intracranial and extracranial segments of ophthalmic artery while controlling the external pressure on the tissues surrounding the eyeball. The method was evaluated against invasive lumbar measurements and they concluded that the method was precise and accurate (Ragauskas et al., 2012).

Another method for non-invasive measurement of ICP has also been presented and evaluated with promising results (Kashif et al., 2012). It uses routinely obtainable time-synchronized measurements of peripheral arterial blood pressure and blood flow velocity in the middle cerebral artery. Data are analyzed with a dynamic model and an estimation algorithm.

The pressure pulsatility is potentially an importance component of the pathophysiology of NPH. In a study from Umeå we investigated the agreement between intracranial pressure amplitude and lumbar pressure amplitude. We found that the lumbar amplitudes were slightly attenuated but that lumbar measurements is an alternative to ICP recording (Behrens et al., 2012).

**References**


McAllister JP. Pathophysiology of congenital and neonatal hydrocephalus. Semin Fetal Neonatal Med 2012


Shulyakov AV, Buist RJ, Del Bigio MR. Intracranial Biomechanics of Acute Experimental Hydrocephalus in Live Rats. Neurosurgery 2012


