Cerebrospinal Fluid Research

Oral presentation

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# Implantation failures and suboptimal positions of gravitational valves - with massive impact on shunt dysfunction

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*from* 53rd Annual Meeting of the Society for Research into Hydrocephalus and Spina Bifida
Belfast, UK. 24-27 June 2009

Published: 27 November 2009

*Cerebrospinal Fluid Research* 2009, **6**(Suppl 2):S20 doi:10.1186/1743-8454-6-S2-S20

This abstract is available from: http://www.cerebrospinalfluidresearch.com/content/6/S2/S20



## Background

The function of gravitational (g)-valves is strictly dependent on the angle of verticalization. For even minor axis-deviations have a significant impact on the functional pressure, a strict orientation parallel to the longitudinal body axis is important. Despite the decisive role only 1/166 g-valve-papers (incl. running studies) investigated systematically g-valve-deviations (= failure angles) to the body axis. Furthermore, the more frequent implantation site on the lateral head yet has not been compared to the thoracal site.

## Materials and methods

Each 50 consecutive g-valve patients with retroauricular and thoracal implanted gravitational devices were randomly extracted from our medical records of about 650 g-valve-implanted patients. On scout-scans/x-rays the deviations to the body axis were measured. The impact on g-valve-function and additionally the effect of a head elevation of 30 degrees were calculated.

## Results

Only 22% of retroauricular vs. 28% of thoracal implantated devices were correctly placed (<10 degree). Valves placed on the head showed anteversion in 84% and retroversion in 16%. The mean deviation was 21 degrees implying a valve-offset of 72 (126) mm $H_2O$ in a 200 (350) mm $H_2O$-g-valve, the maximum was 43 degrees (valve-offset: 136 (239) mm $H_2O$). A nocturnal head elevation of 30 degrees may result in a mean valve-offset of 156 (272) mm $H_2O$ calculated with the mean deviation angle and 191 (335) mm $H_2O$ in the worst case. In the thoracal position the mean counted 10 degrees in lateral and 16 degrees in anteroposterior direction, implying a valve-offset of 55 (96) mm $H_2O$ in 200 (350) mm $H_2O$-valve. Maximal deviation was 52 degrees resulting in valve-offset of 158 (276) mm $H_2O$.

## Conclusion

Position failures are common in our series and may declare malfunction of g-valves. The thoracal implantation site is clearly superior to the head position and should therefore be preferred in adults.