

Oral Presentation

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## In-vitro-testing of 1318 hydrocephalus valves. An overview of solved and unsolved problems

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### Background

Between 1962 and 1979 only 121 valves have been tested. In 1980 Ekstedt published the first major series of 180 specimens. Now we register >1318 valves tested in vitro by 78 authors. Unfortunately cumulative or meta-analyses of the results are not available.

### Materials and Methods

All papers including technical reports etc. related to valve-tests were evaluated; double publications of the same material were counted once, and papers of companies were excluded.

### Results

96% were investigated in 4 countries: 9.0% in USA and England, 14.6% in Sweden and 63.9% in Germany. The number of specimen per group ranged from 1–643, the tested designs from 1–87. Unfortunately in most early, and also current papers the pretest procedures (de-aeration, pre-perfundation) were not described. In 10 papers, the temperatures in 7 of the test-fluids are missing, the same is true for many methodological details. Most authors measured the resistance-pressure with a given flow, a few the flow dependent of pressure; 4 groups only practiced both methods. The tests of lifelong implants ranged from 10 seconds up to 365 days; 3 labs reported results up to 3 months, one single group only over 1 year. In spite of a massive impact of deformation forces (external pressure, flexion etc.) most labs made no special tests. Data related to influences of waves, magnetic fields, pumping, sterilization, reflux, protein and particles are scattered.

### Conclusions

After the elimination of doubtful papers the results are relatively homogenous: Related to accuracy and drift the

ball-valves are the best followed by diaphragm-designs, while slit- and Orbis-valves showed problems. With respect to a physiological drainage all simple DP including adjustable valves failed. Advantages of antisiphon- and Orbis-like designs are counterbalanced by safety deficits. The gravitational valves, the available optimum were investigated by four authors only.