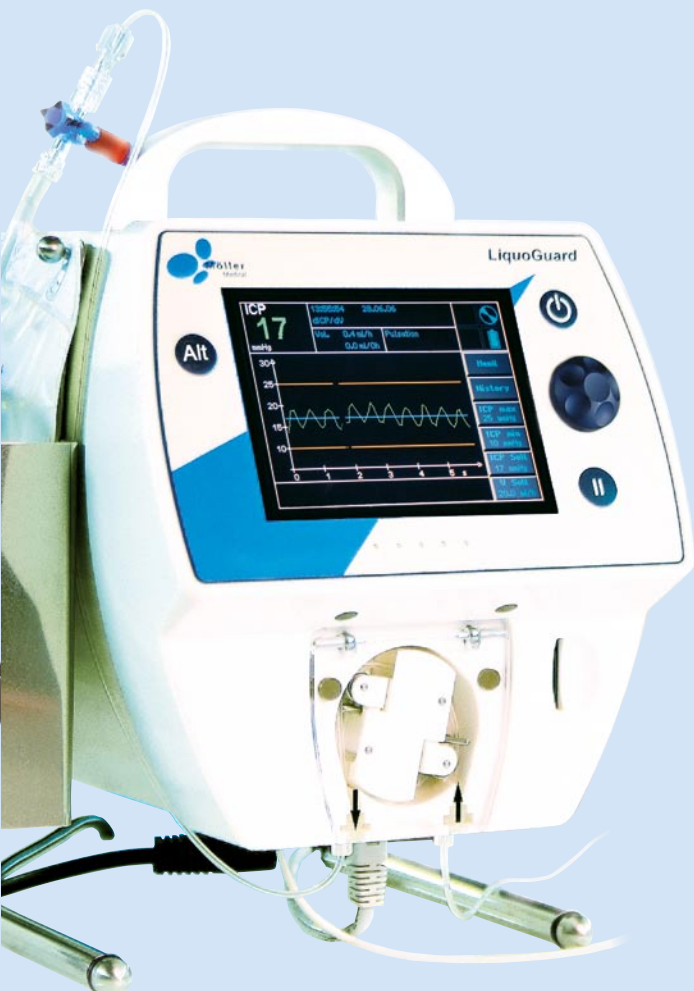


# NEUROSURGERY

## *LiquoGuard*<sup>®</sup>



## ■ INTRODUCTION TO *LiquoGuard*<sup>®</sup> CSF MANAGEMENT

*LiquoGuard*<sup>®</sup> (Liquor = German for CSF) represents a revolutionary step in CSF drainage, maximizing patient safety, reducing costs and enhancing mobility while offering a versatile medical tool.

**SAFETY:** Common problems of conventional external CSF drainage systems are incorrect adjustment of the dripping chamber (e.g. during mobilisation, CT, angiography, OR) and unrecognized pressure sensor malfunction (sensor drift). *LiquoGuard*'s dual pressure sensor technology (DPST), redundant micro-controllers, and sophisticated alarm concept reduce patient risks significantly. E.g., *LiquoGuard*<sup>®</sup> constantly monitors the normal CSF pressure pulsation and thus helps detect catheter occlusions. *LiquoGuard*'s closed system operates without air filter, minimizing infection risks.

**COST REDUCTION:** *LiquoGuard*<sup>®</sup> by design does not require any height adjustments of dripping chambers, thus saves cost and allows staff to concentrate on their essential tasks.

**MOBILITY:** Thanks for powerful rechargeable batteries, the system is independent of external power supply and allows pressure control unaffected by any movement of the patient. Even an earlier transfer from ICU/high care stations may be considered\*.

**VERSATILITY:** The *LiquoGuard*<sup>®</sup> system can be easily connected by Luer-Lock connector to most commercially available lumbar and ventricular drainage catheters. CSF pressure and flow is permanently recorded and displayed bedside. For further analysis, data may be transferred (by storage card) to a PC.

## ■ LUMBAR APPLICATION

**SAFETY:** Conventionally, discontinuous and uncontrolled lumbar CSF drainage may lead to catheter occlusions, intracranial hypotension, collapsed ventricle or subdural haematoma. *LiquoGuard*<sup>®</sup> supports detection of catheter leakage and helps avoid catheter occlusions by a continuous CSF flow.\*

**COST REDUCTION:** The electronically controlled *LiquoGuard*<sup>®</sup> CSF management eliminates the need for time consuming manual adjustments of exact CSF drainage flow.

**MOBILITY:** The *LiquoGuard*<sup>®</sup> sensor unit is easily taped and adjusted to the lumbar catheter level using a specially designed fixation device for maximal patient comfort and mobility.

**VERSATILITY:** *LiquoGuard*<sup>®</sup> is the worldwide first CSF management system permitting a continuous pressure-controlled CSF flow.



dimension of  
CSF management

# LiquoGuard®

Designed and manufactured by Möller Medical

## ■ VENTRICULAR APPLICATION

**SAFETY:** CSF flow is controlled by the desired intracranial pressure (ICP in mmHg) and limited by the pre-selected max. flow rate (ml/h). Pressures below zero are never generated (no "suction").

**COST REDUCTION:** There is no dripping chamber and thus no need for time consuming manual height adjustments.

**MOBILITY:** Pressure measurement and control is continuously provided even during transportation of the patient.\*

**VERSATILITY:** Continuous documentation of ICP and CSF volume helps in decision making for permanent CSF shunting, analyzing effects of medications on CSF flow and calculating ventricular compliance.



\* Depending on the indication for lumbar or ventricular CSF drainage. Assuming a correct adjustment of the **LiquoGuard®** sensor unit. The **LiquoGuard®** alarm concept requires that alarms are always noticed by responsible staff.

dimension of  
CSF management

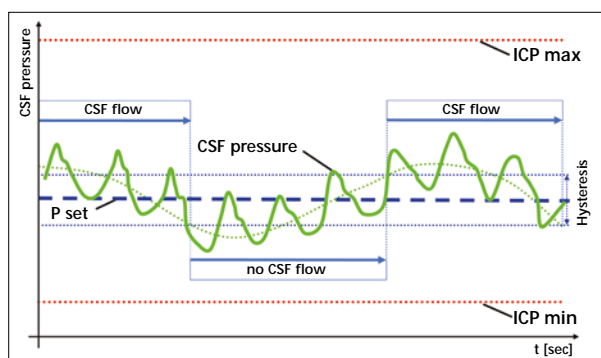
# LiquoGuard®

Designed and manufactured by Möller Medical

■ REVOLUTIONARY APPROACH TO V

■ How *LiquoGuard*® works

*LiquoGuard*® is the first CSF management system that simultaneously measures pressure and drains CSF. For ICP measurement, the *LiquoGuard*® sensor is fixed permanently at the level of the Foramen of Monro. After pre-selection of the desired averaged ICP ( $P_{set}$ , mmHg), CSF flow is automatically controlled to keep the ICP within a corridor around  $P_{set}$ .

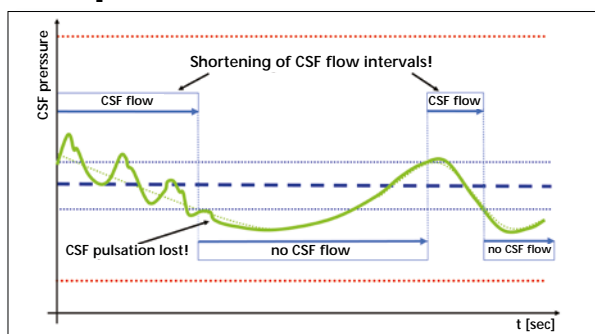


# VENTRICULAR CSF MANAGEMENT

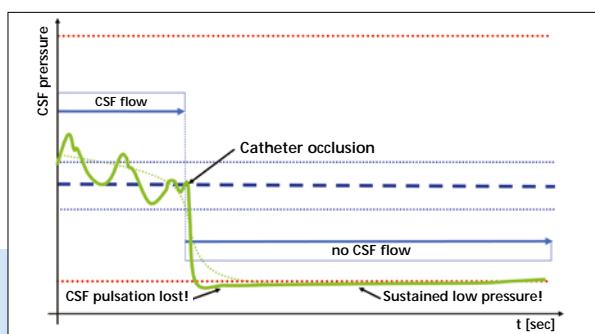
## ■ How *LiquoGuard*<sup>®</sup> enhances patient safety

In conventional ventricular CSF drainage, collapsed ventricles and catheter occlusions are the most frequent reasons for problems. *LiquoGuard*<sup>®</sup> supports early identification of both: During a condition of collapsed ventricles, pulsation is usually lost and CSF flow periods are shortened. During catheter occlusion, measured pressure drops below  $P_{set}$ , CSF flow stops and pulsation is also lost. Both conditions (see pictures) lead to alarms of *LiquoGuard*<sup>®</sup>.

### Collapsed ventricles!



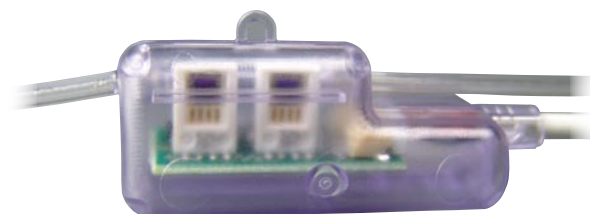
### Catheter occlusion!



## ■ *LiquoGuard*<sup>®</sup> dual pressure sensor technology (DPST)

The throughout dual and redundant concept from sensing through processing of the CSF pressure includes 2 pressure transducers, 2 analog-to-digital converters, 2 microcontrollers, 2 piezo sounders and LEDs for alarms. The two detection chains are supervising each other; any inconsistencies in the measured values, sensor malfunctions and drifts lead to alarms.

A sophisticated alarm concept including monitoring of CSF pressure pulsation supports the user in detecting catheter occlusions and other pathological situations (e.g. collapsed ventricle).\*



## ■ THE COMPANY MÖLLER MEDICAL

Möller Medical was founded in 1949 and is active mainly within the demanding OEM business; the company is developing components, systems and finished devices for human medicine, in vitro diagnostics (IVD) and precision engineering. Customers include many renowned medical devices/IVD companies. All

products are manufactured in-house. Like the *LiquoGuard*<sup>®</sup>, which has been developed and is manufactured completely by Möller Medical. Möller Medical is certified according to DIN EN ISO 13485 and manufactures the products shown here with CE mark according to EU-directive 93/42/EWG.

