

# Intracranial Pressure in Different Body Postures Distinguish Healthy from Ill Subjects

MORTEN ANDRESEN, AMER HADI & MARIANNE JUHLER  
CLINIC OF NEUROSURGERY, COPENHAGEN UNIVERSITY HOSPITAL, DENMARK

## Background

Deviations in intracranial pressure (ICP) are used to distinguish between healthy and ill subjects.

Our current understanding of disease entities such as idiopathic intracranial hypertension (IIH) and normal pressure hydrocephalus (NPH) are hampered by insufficient knowledge of appropriate boundaries between “normal” and “abnormal,” as well as the level of expected variations in ICP simply due to changes in body posture.

Our objective in this study was to quantify the effects of postural changes on ICP in normal and ill subjects.

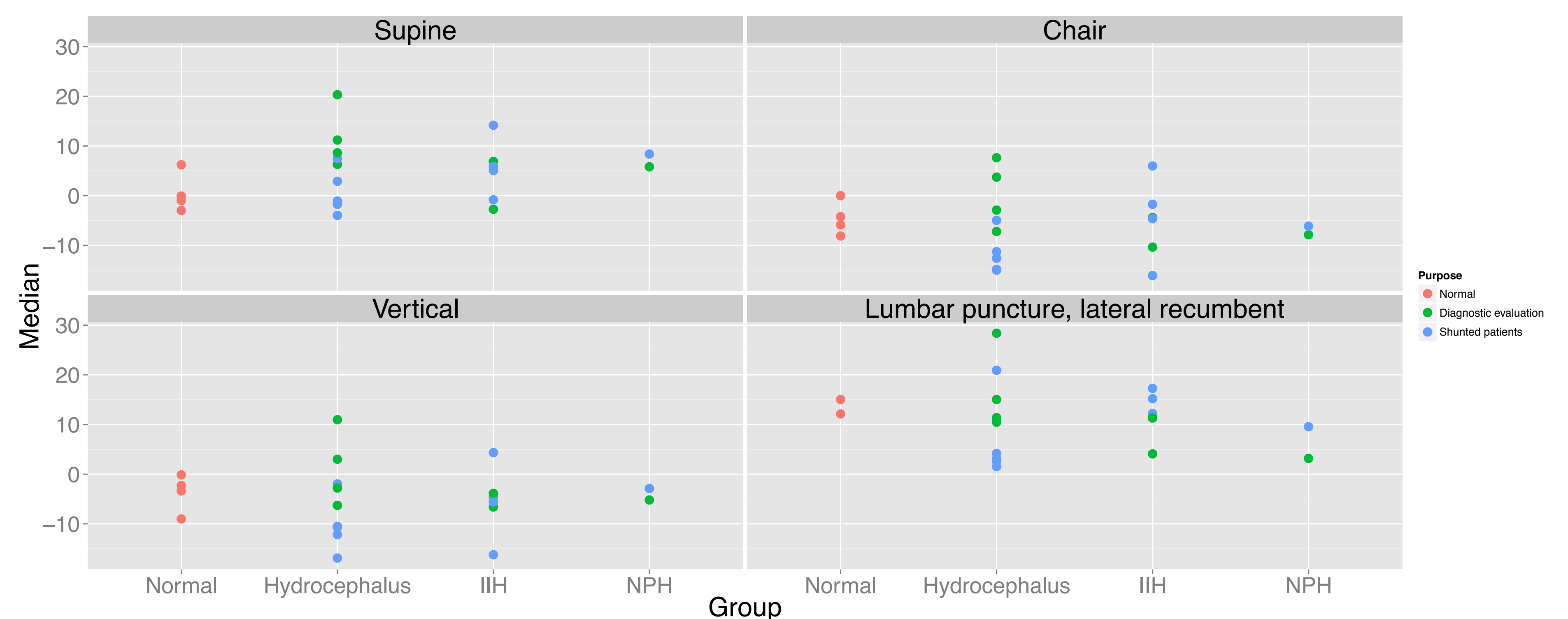


Figure 1. Median ICP based on patient group and purpose of monitoring. The normal group maintained a predominantly negative ICP in all maintained postures—only reaching +10 mmHg in the lateral recumbent lumbar puncture position.

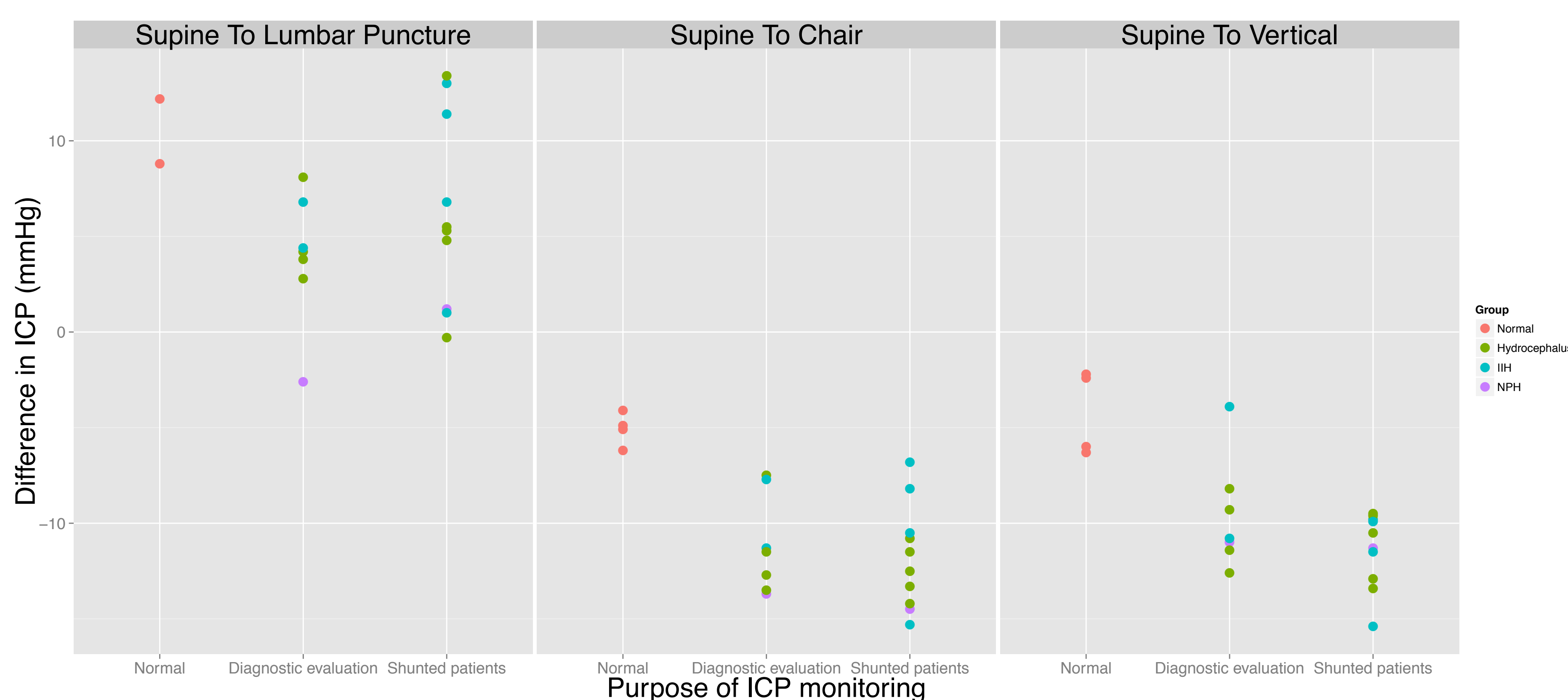


Figure 2. Difference in ICP based on body posture, purpose of monitoring, and patient group. The normal group maintained ICP within the narrowest range of ICP in all body postures. Shunted patients displayed the largest variation when switching from the supine to the vertical position. This indicates a possible need for adjustment in shunt configurations.

## Key results

21 patients were included (4 normal, 2 NPH, 9 hydrocephalus, and 6 IIH). Linear regression of median ICP based on patient posture, group and purpose of monitoring presented a significant model ( $p < 0.001$ ), but could not distinguish between patient groups ( $p = 0.99$ ).

Linear regression of differences in median ICP between body postures and supine ICP as the baseline, presented a highly significant model ( $p < 0.001$ ), and adjusted  $R^2 = 0.88$ .

Both body posture ( $p < 0.001$ ) and patient group ( $p < 0.001$ ) were highly significant factors.

## Material and Methods

The group of normal patients consisted of adult patients scheduled for complete removal of a solitary clearly demarcated small brain tumor.

A telemetric ICP monitoring device was used for long-term postoperative follow-up. All patients requiring invasive ICP monitoring as a part of their diagnostic work-up or monitoring of shunt treatment effect at our department were included prospectively for a session of monitored changes in body posture.

Patients were monitored in the supine and vertical position, as well as while sitting in a chair, and assuming the right lateral lumbar puncture position. Each position was maintained for 10 minutes.

## Conclusions

Differences in ICP between body postures enabled us to distinguish the normal group from NPH, hydrocephalus and IIH patient groups. Normal patients appear able to more tightly regulate ICP when switching body postures.

Further characterization of postural changes in ICP is necessary in order to improve diagnostic accuracy and optimization of shunt treatment.



Copenhagen CSF Study Group  
Morten Andresen, MD  
Clinic of Neurosurgery  
Section NK 2092

Copenhagen University Hospital  
DK-2100 Copenhagen E  
Denmark

Tel: +45 2244 2343  
Mail: [ma@cphcsf.dk](mailto:ma@cphcsf.dk)  
Web: [www.cphcsf.dk](http://www.cphcsf.dk)

