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Cerebrospinal Fluid Biomarkers

Consensus guidelines for lumbar puncture in patients with neurological diseases

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Abstract

Introduction: Cerebrospinal fluid collection by lumbar puncture (LP) is performed in the diagnostic workup of several neurological brain diseases. Reluctance to perform the procedure is among others due to a lack of standards and guidelines to minimize the risk of complications, such as post-LP headache or back pain.

Methods: We provide consensus guidelines for the LP procedure to minimize the risk of complications. The recommendations are based on (1) data from a large multicenter LP feasibility study (evidence level II-2), (2) systematic literature review on LP needle characteristics and post-LP complications (evidence level II-2), (3) discussion of best practice within the Joint Programme Neurodegenerative Disease Research Biomarkers for Alzheimer's disease and Parkinson's Disease and Biomarkers for Multiple Sclerosis consortia (evidence level III).

Results: Our consensus guidelines address contraindications, as well as patient-related and procedure-related risk factors that can influence the development of post-LP complications.

Discussion: When an LP is performed correctly, the procedure is well tolerated and accepted with a low complication rate.

Keywords: Lumbar puncture; Cerebrospinal fluid; Post-LP complications; Headache; Back pain; Consensus guidelines; Evidence-based guidelines

1. Introduction

Lumbar puncture (LP) is a technique to sample cerebrospinal fluid (CSF) as a window into brain pathology (Supplemental Data). The procedure involves introducing a needle into the subarachnoid space of the lumbar sac, at a level safely below the spinal cord [1]. Despite modern neuroimaging techniques, LP remains an important diagnostic tool as CSF analysis provides important diagnostic information for many neurological conditions. For example, no procedure can replace the CSF analysis in differential diagnosis of infectious disorders of the central nervous system (e.g., bacterial or viral meningitis, neuroborreliosis). Moreover, CSF analysis is now at the core of the diagnostic criteria for the diagnosis of Alzheimer's disease [2–4]. In addition, an LP is the easiest procedure to perform a CSF pressure measurement. Given the use of CSF analysis for diagnosis, LPs are currently often performed to perform research to discover novel diagnostic biomarkers and understand brain pathology.

A recent large international, multicenter study on LP feasibility that included 3868 patients in a memory clinic setting showed that LPs can be safely performed [5]. The acceptance rate of an LP was high, especially taking into consideration that there was no acute medical indication.

The most common complications of LP consist of post-LP back pain and post-LP headache (PLPH) [6]. PLPH typically begins within three days after the procedure in most patients [7]. If a patient develops typical PLPH, bed rest, adequate hydration, and simple analgesics should be started [8]. Further review of possible treatments will be given in later sections of this study.

Very rare (prevalence of $<0.01\%$) but potential serious complications consist of post-LP infections, spinal and subdural cerebral hematoma, and cerebral venous thrombosis [1]. In the multicenter LP feasibility study, a substantial proportion (31%) of patients reported post-LP complaints; however, these were mostly mild in nature, and severe complications were very rare [5]. Back pain, headache, and typical PLPH were reported by 17%, 19%, and 9%, respectively [5]. Only 0.3% of the patients needed a blood patch, and in 0.7%, a hospitalization was required [5]. The most important risk factors for post-LP complaints were related to patient characteristics: history of headache and fear of complications.