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Diagnostic yield of lumbar puncture in adult patients with purpura fulminans

Damien Contou[1,2*], Romain Sonneville[3], Armand Mekontso Dessap[2,4], Nicolas de Prost[2,4] and For the HOPEFUL study group

Dear Editor,

Purpura fulminans (PF) is a rare infection mainly affecting young and otherwise healthy patients [1, 2]. It carries high mortality [1, 2] and morbidity rates [3]. Microbiological documentation is obtained in more than 90% of cases [1], with *Neisseria meningitidis* and *Streptococcus pneumoniae* found to be the main responsible bacteria [1]. It remains to be established whether lumbar puncture (LP) should be performed in adult patients with PF. LP may be useful for optimizing bacteriological documentation or for adjusting the dose of β-lactam antibiotics in cases of associated meningitis. However, most of these patients have no consciousness disorders [1], and other less invasive sampling methods such as blood cultures or skin biopsy [1, 4] may be sufficient to isolate the causative bacterium. Moreover, LP may be contra-indicated due to the presence of severe thrombocytopenia [1] and coagulation disorders [1], which are almost constant findings in patients with PF. Our aim was to evaluate the diagnostic yield of LP in adult patients with PF.

We performed an ancillary analysis of a 17-year multicenter retrospective cohort study that included adult patients admitted to the ICU for infectious PF. The methods and patients have been previously described elsewhere [1] (online supplement). LP was performed at the discretion of the intensivist. LP was considered contributive when it showed meningitis (defined as ten or more white blood cells/mm^3 of cerebrospinal fluid, CSF) and/or when a CSF bacterial culture was positive and/or when a PCR in CSF was positive for *N. meningitidis* or *S. pneumoniae*. All patients had blood cultures upon ICU admission, but skin biopsy was not routinely performed.

Among the 306 patients admitted for PF (median Glasgow Coma Scale score 15 [1st–3rd quartiles 13–15]), 171 (56%) had an LP upon ICU admission. A comparison between the patients submitted to and those not submitted to LP is available in eTable 1. Cerebral CT scan was performed before LP in 21/171 (12%) patients. CSF analysis revealed meningitis in 61/149 (41%) patients (CSF count was missing in the other 22 patients), while bacterial culture was positive in 85/171 (50%). Notably, 37/88 (42%) patients without cytological meningitis, and 41/121 (34%) patients with negative CSF Gram stain eventually had a positive CSF culture. Among the 73 patients with no cytological meningitis and a negative CSF Gram stain, 23 (32%) had a positive CSF culture. A comparison between patients with and those without contributive LP is provided in eTable 2. Factors independently associated with contributive LP were identified by uni- and multivariable logistic regression, and were as follows: age < 30 years (adjusted odds ratio (aOR) = 3.45 [1.67–7.12]; $p = 0.001$) and a Glasgow Coma Scale score ≤ 13 (aOR = 7.56 [2.71–12.10]; $p < 0.0001$) (eTable 3). A sensitivity analysis in which contributive LP was defined as five [5] or more white blood cells/mm^3 of CSF did not alter these findings (eTable 4). The rate of microbiological documentation did not differ between patients who underwent an LP and those who did not ($n = 161/171$ (94%) vs. $n = 127/135$ (94%); $p > 0.99$) (Fig. 1, eTable 1). Antibiotic therapy administered before ICU admission did not alter the global rate of microbiological documentation ($n = 218/230$ (95%) vs. $n = 70/76$ (92%), $p = 0.403$) or the rate of positive CSF cultures ($n = 71/136$ (52%) vs.

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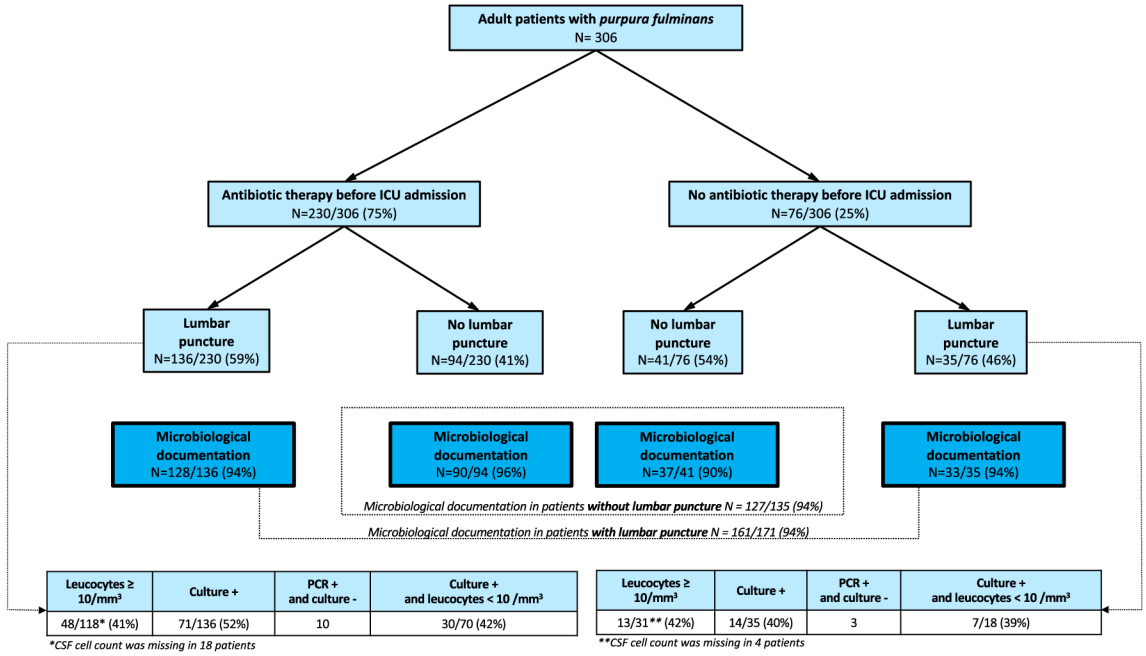

Fig. 1 Global microbiological documentation (including skin biopsies, blood and CSF cultures, and PCR for *N. meningitidis* or *S. pneumoniae*) and results of lumbar puncture in adult patients with *purpura fulminans* ($n = 306$) who received ($n = 230$) or did not receive ($n = 76$) antibiotic therapy before ICU admission

$n = 14/35$ (40%), $p = 0.256$) (Fig. 1). CSF bacterial culture was the only positive microbiological test in 41/306 (13%) patients (eFigure 1). Four brain deaths related to cerebral herniation and one post-LP headache were reported in patients submitted to LP. No paraplegia related to epidural hematoma or bleeding at the site of LP was reported.

Performing an LP did not significantly increase the rate of microbiological documentation in adult patients with PF, whether or not the patient had received antibiotic therapy before ICU admission. The bacteriological yield of LP appears to be limited a fortiori in a context where skin biopsy might be extensively performed [4]. In the absence of contra-indications (i.e., severe thrombocytopenia, coagulation disorders, and profound consciousness disorders/focal motor deficit, unless a CT scan has been performed and shows no major intracranial abnormality), recourse to LP may be considered for diagnosing associated meningitis/neuro-meningeal bacterial seeding, and adjusting the dose of β-lactam antibiotics, particularly in patients younger than 30 years old or presenting consciousness disorders. In view of the retrospective design of the present study, the fact that the decision to perform an LP was left to the discretion of the intensivist, and the absence of systematic skin biopsy and PCR results, our data have to be interpreted with caution and a general recommendation cannot be given.

Electronic supplementary material

The online version of this article (https://doi.org/10.1007/s00134-019-05676-0) contains supplementary material, which is available to authorized users.

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Compliance with ethical standards

Conflicts of interest

The authors have not disclosed any potential conflict of interest.

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