



# Post-lumbar puncture headache: an adverse effect in multiple sclerosis work-up

Domizia Vecchio<sup>1</sup> · Paola Naldi<sup>1</sup> · Veronica Ferro<sup>1</sup> · Cristoforo Comi<sup>1</sup> · Maurizio Angelo Leone<sup>2</sup> · Roberto Cantello<sup>1</sup>

Received: 9 November 2018 / Accepted: 14 January 2019 / Published online: 21 January 2019  
© Fondazione Società Italiana di Neurologia 2019

## Abstract

**Background** Lumbar puncture (LP) is a safe procedure commonly performed in the diagnostic work-up of multiple sclerosis (MS), and its main adverse event is post-LP headache (PLPH). Predictors for PLPH in MS are not established.

**Aims** To describe the occurrence of, and, factors related to PLPH in patients with suspected MS, studied on a daily-basis admission.

**Patients and methods** One hundred patients (70 females) were admitted for a diagnostic LP (standardized with a traumatic 19-G needle), observed for 6 h, and evaluated for adverse events 2 and 7 days later. Descriptive statistics and a multivariate analysis (for PLPH) were performed.

**Results** Fifty-seven (57%) patients had PLPH at 48 h, which persisted 1 week in 31, and only two presented beyond the first 2 days. Other adverse events were tinnitus and neck stiffness. None required investigations or was hospitalized. Age was the only predictor for PLPH at day 2, whereas the onset of headache within 48 h and female gender were predictors for PLPH at day 7.

**Conclusion** PLPH is a frequent complication of LP performed on daily-basis admission in MS work-up. The maximum onset is within the first 48 h. Age and gender seem the only predictors for the appearance and persistence of PLPH.

**Keywords** Diagnostic work up · Headache · Lumbar puncture · Multiple sclerosis

## Introduction

Post-lumbar puncture headache (PLPH) is a common adverse event occurring within 7 days after a spinal tap, and usually resolving in 14 days. By definition, PLPH “worsens within 15 minutes of standing and disappears within 30 minutes of the lying position” [1]. The drainage of 10% of the total cerebrospinal fluid (CSF) volume could cause an orthostatic bilateral headache in about one third of patients [2]. Pain is generally located to the

frontal and occipital regions and is worsened by maneuvers increasing the intracranial pressure (i.e., coughing, sneezing). Other adverse events occurring after a spinal tap are lumbar pain, nausea, vomiting, dizziness, and tinnitus, which may associate with headache [3]. PLPH is a clinical diagnosis, and several predictors, mostly related to the procedure itself, have been proposed. The use of atraumatic, compared to traumatic, needles, and independently from their sizes, have been related to a lower risk of PLPH [4], whereas no differences in the occurrence of back pain, severe PLPH, or other types of headache have been described between the two needles [4]. Anyway, most studies were performed in different clinical settings, and included heterogeneous groups of participants undergoing dural taps not only for diagnosis, but also for anesthesia or myelography [5]. Of note, bed rest after the tap was not associated with PLPH prevention [5]. On the other hand, looking at patients’ features, data on predictors for PLPH are less established. PLPH was reported to be more frequent in females, in patients at a younger age, and with a low body mass index [6]. Our first aim was to describe the incidence and features of PLPH in the

**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s10072-019-3724-z>) contains supplementary material, which is available to authorized users.

✉ Domizia Vecchio  
domizia.vecchio@gmail.com

<sup>1</sup> Neurology Unit, Department of Translational Medicine, AOU Maggiore della Carità and University of Piemonte Orientale, Novara, Italy

<sup>2</sup> Neurology Unit, Department of Medical Sciences, IRCCS, Casa Sollievo della Sofferenza, San Giovanni Rotondo, Italy

diagnostic work-up of multiple sclerosis (MS) performing LP during 1-day admission. Secondly, we looked at prognostic factors for PLPH including features both related to the patients and to the procedure itself.

## Patients and methods

We recruited consecutive patients from September 2013 to June 2016, admitted in our day-unit for a planned LP in the clinical suspicion of MS. We followed them for at least 7 days after the LP, and included only those who completed the study (4 patients did not fill all the requested questionnaires, and were excluded). The LP procedure was standardized as follows: information was provided by doctors or nurses; a 19G traumatic needle was used; patients were in the sitting position during LP; the prone position was recommended for 2 h after the tap. Patients were discharged 6 h after the procedure. We collected patient-related features at admission and instructed patients to fulfill two questionnaires, one at 48 h and 7 days later. Both questionnaires were self-compliant, similarly including multiple-choice questions, to detect any symptoms occurring after the tap ([Supplemental materials](#)). The study was approved by the local Ethics Committee and all participants gave written informed consent. Descriptive statistics (Chi square, Mann-Whitney tests) and a multivariate logistic analysis were performed using the SPSS program.

## Results

We included 100 patients (70 females) with a median age of 36 years (range 16–63). Sixty-two patients had a history of headache with a median age of onset at 17 years (range 8–50). Fifty-two percent of them had a diffuse (versus localized) pain, mostly (44%) pulsating (versus pressing or stabbing), sometimes associated with nausea or vomiting (46%) and photophobia (47%). Most of the patients (61%) had a maximum of four attacks monthly (higher frequencies in the remaining). Thirty-three patients had an affected first or second-degree relative, who was the mother in 64% (family history is not limited to migraine but included any type of headache). Nineteen patients had already performed a LP (16 for anesthetic procedures, 1 for infection, 1 for myelography, and 1 for a suspected demyelinating disorder). The procedure was generally performed with no severe adverse events (8 patients had presyncope, and 3 nausea), and none required to extend the planned 6-hour observation. The first attempt was successful in 65 patients. More than two attempts were necessary in 16 cases.

PLPH was observed in 57 patients (57%) at 48 h, and in 33 patients (33%) at 7 days, 31 of whom presented already with headache at day 2. None required investigations or

hospitalization for PLPH. Other adverse events occurring 2 and 7 days after the spinal tap were tinnitus (13 patients at day 2/11 at day 7), neck stiffness (35/15), back pain (31/16), dizziness (7/0), nausea, and vomiting (7/0). PLPH related significantly to tinnitus (at day 2,  $p < 0.01$ ; at day 7, 0.02), and neck stiffness (at day 2,  $p < 0.01$ ; at day 7, 0.02). Of note, both symptoms occurred mostly within 24 h after the spinal tap, and in the orthostatic position. Eighty-nine (89%) patients were diagnosed as MS, among them 49 (55%) presented PLPH in 48 h, and 30 (34%) in 7 days. MS diagnosis did not relate to PLPH (at day 2,  $p = 0.3$ ; at day 7,  $p = 0.7$ ).

We searched for predictors for PLPH (Table 1). Patients who presented headache at day 2 were significantly younger (median age at PL was 35 years in those who had PLPH versus 43 years in those who had not,  $p = 0.01$ ; not significant differences at day 7: 36 versus 39 years,  $p = 0.1$ ) Females outnumbered males, particularly among those who had PLPH at day 7. Personal history of headache was associated to the presence of PLPH both at 2 and 7 days ( $p < 0.05$ ), whereas the family history was not. Patients referring a prior spinal tap or who needed more than two attempts did not present higher percentages of PLPH.

In a multivariate model with PLPH as a dependent variable, we included the following parameters as independent variables: age at spinal tap (categorized as: less or equal to 30, 30–45, more than 45 years), gender, personal or family history of headache, number of attempts for the spinal tap, and the presence of PLPH at day 2 (only for the outcome at day 7). Only age was retained in the model as a statistically significant predictor for PLPH at day 2 ( $p = 0.03$ ): patients who had 30 years or less at the time of the spinal tap were more keen to have PLPH 48 h later ( $p = 0.04$ ). The presence of headache at day 2 ( $p < 0.001$ ) and female gender ( $p = 0.03$ ) were predictors for headache at 7 days ( $p < 0.001$ ).

## Discussion

Our study confirmed that headache is a common adverse event after a spinal tap, mostly occurring within 48 h, which could persist even a week. The presence of auditory symptoms and neck stiffness were more frequently associated with the occurrence of PLPH; furthermore, other adverse events occurring after the maneuver were back pain, dizziness, nausea, and vomiting. Overall, no PLPH case required hospitalization or investigations because of LP complications.

As needle type has been suggested as a predictive factor of PLPH [4], we standardized the maneuver using a 19-G traumatic needle (mostly available in our Day Unit since the beginning of the study). One or two attempts were needed in most cases, and we could speculate if the use of the 19-G needle reduced the number of unsuccessful attempts [7]. On the other hand, larger needle sizes have not been associated to

**Table 1** Prognostic variables for PLPH 2 and 7 days after the spinal tap ( $N=100$ )

Clinical variables ( $N=100$ )	PLPH day 2, $N$ (%)			PLPH day 7, $N$ (%)		
	Yes ( $N=57$ )	No ( $N=43$ )	$p$	Yes ( $N=33$ )	No ( $N=67$ )	$p$
Age at onset: years						
≤ 30	17 (71%)	7 (29%)	0.056	9 (36%)	15 (63%)	0.3
30–45	27 (61%)	17 (39%)		17 (39%)	27 (61%)	
> 45	13 (14%)	19 (59%)		7 (22%)	25 (78%)	
Gender:						
Females	43 (61%)	27 (39%)	0.2	29 (41%)	41 (59%)	0.004
Males	14 (46%)	14 (54%)		4 (13%)	26 (87%)	
Previous spinal tap:						
Yes	14 (74%)	5 (26%)	0.9	7 (37%)	12 (63%)	0.7
No	43 (53%)	38 (47%)		26 (32%)	55 (68%)	
Family history headache: ( $N=100$ )						
Yes	22 (67%)	11 (33%)	0.1	8 (27%)	25 (73%)	0.6
No	35(53%)	32(47%)		24(35%)	45 (65%)	
Personal history headache:						
Yes	41 (66%)	21 (34%)	0.02	25 (40%)	37 (60%)	0.04
No	16 (42%)	22 (68%)		8 (22%)	30 (78%)	
$N$ . attempts:						
1	42 (65%)	23 (35%)	0.1	25 (38%)	40 (62%)	0.06
2	7 (37%)	12 (64%)		3 (16%)	16 (84%)	
> 2	8 (50%)	8 (50%)		5 (31%)	11 (69%)	
PLPH at day 2:						
Yes	–	–	< 0.001	31 (54%)	26 (46%)	
No				2 (5%)	41 (95%)	

a higher risk of PLPH [4], and our frequency of 57% is minimally higher than other groups who used smaller traumatic needles [8]. Our study pointed out the safety of diagnostic spinal tap performed in a Day Unit. Indeed, only 8% of patients had acute complications and none required any clinical evaluation within the first week.

We identified few patient characteristics as possible predictors of PLPH (age at LP, personal history of headache, and gender), but none related to the procedure itself. In our cohort, PLPH at day 2 was more frequent in youngest people, which fits previous reports of highest incidences of this adverse event from 20 to 40 years [9]. Patients older than 45 had less frequently PLPH in our cohort, which is similar to data from memory clinics (PLPH in 17.5% of cases) [10]. We could hypothesized that young patients have less cerebral atrophy that could compensate more difficultly to positional traction on intracranial structures and intracranial and meningeal vasodilation [11].

Moreover, we first confirmed that the PLPH incidence is greater among females [8]. In our cohort, women also showed a more persistent headache lasting till 1 week more frequently than men. Secondly, we evidenced that patients with a personal history of headache presented more frequently with PLPH, as already described [8]. Family history and previous LP were not relevant, differently from other authors [12]. Notably, a final diagnosis of MS was not associated with a higher risk of PLPH.

In conclusion, a diagnostic spinal tap performed on a daily admission in MS work-up is confirmed to be a safe procedure. The first 48 h after the maneuver are at higher risk of PLPH, which occurred in more than half of the patients. Headache may persist up to a week. Only few patient-related features (younger age and female gender) predicted the onset of PLPH, whereas a final diagnosis of MS did not.

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## References

1. Headache Classification Committee of the International Headache Society (IHS) (2014) The international classification of headache disorders. *Cephalalgia* 33:629–808
2. Kunkle EC, Rey BS, Wolff HG (1943) Experimental studies on headaches: analysis of the headaches associated with changes in intracranial pressure. *Arch Neurol Psychiatry* 49:323–358
3. Turnbull DK, Shepherd DB (2003) Post dural puncture headache: pathogenesis, prevention and treatment. *Br J Anesth* 91:718–729
4. Arevalo-Rodriguez I, Muñoz L, Godoy-Casasbuenas N, Ciapponi A, Arevalo JJ, Boogaard S et al (2017) Needle gauge and tip designs for preventing post-dural puncture headache (PDPH). *Cochrane Database Syst Rev* 7(4):CD010807
5. Arevalo-Rodriguez I, Ciapponi A, Roqué i Figuls M, Muñoz L, Bonfill Cosp X (2016) Posture and fluids for preventing post-dural puncture headache. *Cochrane Database Syst Rev* 7(3):CD009199

6. Vilming ST, Schrader H, Monstad I (1989) The significance of age, sex and cerebrospinal fluid pressure in post-lumbar puncture headache. *Cephalalgia* 2:99–106
7. Thomas SR, Jamieson DRS, Muir KW (2000) Randomised controlled trial of atraumatic versus standard needles for diagnostic lumbar puncture. *BMJ* 321:986–990
8. Evans RW, Armon C, Frohman EM, Goodin DS (2000) Assessment: prevention of post-lumbar puncture headaches: report of the therapeutics and technology assessment subcommittee of the american academy of neurology. *Neurology* 55:909–914
9. Bezov D, Lipton RB, Ashina S (2010) Post-dural puncture headache: part I diagnosis, epidemiology, etiology, and pathophysiology. *Headache* 50:1144–1152
10. Monserrate AE, Ryman DC, Ma S, Xiong C, Noble JM, Ringman JM, Morris JC, Danek A, Müller-Sarnowski F, Clifford DB, McDade EM, Brooks WS, Darby DG, Masters CL, Weston PSJ, Farlow MR, Graff-Radford NR, Salloway SP, Fagan AM, Oliver A, Bateman RJ (2015) Dominantly inherited Alzheimer network. Factors associated with the onset and persistence of post-lumbar puncture headache. *JAMA Neurol* 72(3):325–332
11. Mokri B, Atkinson JL, Piepgras DG (2000) Absent headache despite CSF volume depletion (intracranial hypotension). *Neurology* 55:1722–1724
12. Amorim JA, Valença MM (2008) Postdural puncture headache is a risk factor for new postdural puncture headache. *Cephalalgia* 28:5–8