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***How is a Lumbar Puncture performed in Pediatrics? –
Analysis of the Portuguese reality***

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How is a Lumbar Puncture performed in Pediatrics? – Analysis of the Portuguese reality

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ABSTRACT

Introduction: Lumbar puncture (LP) is a technique that allows access to the lumbar spinal subarachnoid space using a needle to collect cerebrospinal fluid (CSF). It is a procedure that is frequently performed in pediatric emergency departments. Our aim was to analyze how LP is performed in pediatrics in Portugal.

Material and methods: National study was conducted, by applying an anonymous online questionnaire with 20 questions about LP technique, through Pediatric Emergency Society of the Portuguese Society of Pediatrics contacts.

Results: A total of 190 questionnaires were analyzed in which 67.9% (n=129) were specialists and 32.1% (n=61) were pediatric residents. The majority (79%) routinely used analgesia and/or sedation and 53.2% (n=101) do not allow the parents to be present during the procedure.

A large proportion of physicians (43.7%) prefer to place the child in lateral decubitus and 43.2% decide the position to place the child according to age. Most referred to use Quincke needles (60%). Butterfly needle was used in 25.8% (n=49) when referring to newborns. There was a more frequent use of this type of needle in the group of specialists (30.2% vs 16.4%, p=0.071).

Only 24.7% of physicians orient the needle bevel parallel to the longitudinal fibers of the dura, and the group of pediatric residents performed it more frequently than the group of pediatricians (39,7% vs 17,5%, p=0.001).

The majority of doctors recommend rest after the procedure.

Discussion and conclusions: Our study was the first to describe how LP is performed in children in Portugal. It reinforces the need to create a national protocol for this procedure in children. It is also important that medical schools and training hospitals create simulation trainings and courses, to not only teach the correct technique and enhance skills, but also to improve self-confidence.

KEYWORDS

Lumbar puncture, Pediatrics, Quincke, needle, bevel, position, post-lumbar puncture headache, guidelines

RESUMO

Introdução: A punção lombar (PL) é uma técnica que permite o acesso ao espaço subaracnoideo da coluna vertebral lombar utilizando uma agulha para colher líquido cefalorraquidiano (LCR). É um procedimento frequentemente realizado em serviços de emergência pediátrica. O nosso objetivo foi analisar como a PL é realizada em pediatria em Portugal.

Material e métodos: Foi feito um estudo nacional, através da aplicação de um questionário anónimo online com 20 perguntas sobre a técnica de LP, através dos contactos da Sociedade de Emergência Pediátrica da Sociedade Portuguesa de Pediatria.

Resultados: Foram analisados 190 questionários, sendo 67,9% (n = 129) de especialistas e 32,1% (n = 61) de internos de pediatria. A maioria (79%) utilizava rotineiramente analgesia e/ou sedação e 53,2% (n=101) não permitem a presença dos pais durante o procedimento.

Uma grande percentagem de médicos (43,7%) prefere colocar a criança em decúbito lateral e 43,2% decide a posição de colocar a criança de acordo com a idade. A maioria referiu usar agulhas tipo Quincke (60%). Foi descrito que as agulhas do tipo borboleta foram utilizadas em 25,8% (n=49) quando a PL é realizada em recém-nascidos. Os especialistas utilizam esta agulha mais frequentemente (30,2% vs 16,4%, p=0,071).

Apenas 24,7% dos médicos orientam o bisel da agulha paralelamente às fibras longitudinais da dura-máter, e o grupo de internos praticam esta técnica com mais frequência do que o grupo de pediatras (39,7% vs 17,5%, p=0,001).

A maioria dos médicos recomenda descansar após o procedimento.

Discussão e conclusões: O nosso estudo foi o primeiro a descrever como a PL é realizada em crianças em Portugal, o que reforça a necessidade de criar um protocolo nacional para a realização deste procedimento em crianças. Também é importante que as escolas médicas e os hospitais universitários criem treinos e cursos de simulação, não apenas para ensinar a técnica correta e aprimorar as aptidões, mas também para melhorar a autoconfiança.

PALAVRAS-CHAVE

Punção lombar, Pediatria, Quincke, agulha, bisel, posição, cefaleia pós-punção lombar, guidelines

INTRODUCTION

Lumbar puncture (LP) is a technique that allows access to the lumbar spinal subarachnoid space using a needle to collect cerebrospinal fluid (CSF). LP with examination of CSF is an important diagnostic tool for a variety of clinical situations.¹ For most children, the indication for an urgent LP is to obtain CSF for the evaluation of possible central nervous system (CNS) infection (such as meningitis or encephalitis).² Other indications for urgent LP include the diagnosis of subarachnoid hemorrhage and various other neurologic conditions (for example, Guillain-Barré syndrome). Further common indications are instillation of chemotherapy or contrast media for spinal cord imaging and the removal of CSF in cases of idiopathic intracranial hypertension.²

This technique was first described by Quincke in 1891 and it is frequently performed in Pediatrics.^{1,3} However, there are some contraindications, namely raised intracranial pressure with risk of cerebral herniation, severe thrombocytopenia or other bleeding diathesis, including ongoing anticoagulant therapy and suspected spinal epidural abscess.⁴ Other contraindications for LP include the presence of moderate to severe impairment of consciousness; fluctuating Glasgow Coma Scale (total score <13 or fall in score >2); focal neurological signs, hemodynamic instability, coagulation abnormalities and cutaneous infection at the proposed LP site.^{2,5}

LP is a relatively safe procedure and complications are unusual in children, but they can occur even when standard infection control measures and good technique are used. The main adverse event is by far post-lumbar puncture headache (PLPH) occurring in 5 to 15 percent of cases.⁶⁻¹¹ Its precise etiology is unclear, but it is thought to relate to leakage of CSF through the dural hole created by the needle. Various techniques such as using atraumatic needles and placing the bevel of the needle parallel to the long axis of the spine have been shown to prevent or lessen PLPH.^{2,4,12,13} Other complications, such as epidermoid spinal cord tumor, secondary infection, cerebral herniation and spinal hematoma have also been described following this procedure but are much rarer.^{2,6-11}

Our study aims to analyze how LP is performed in pediatrics in Portugal, namely characterizing the technique and assessing whether the current recommendations for this procedure are followed.

MATERIAL AND METHODS

An anonymous survey with 20 questions was applied online. The first 6 questions were open type to collect epidemiological data (such as age and place of work) and professional experience (professional status, years of experience, approximate number of performed LP and the experience of the person that first taught the technique). The other 14 questions were multiple choice, regarding the technique itself (use of sedation/analgesia, patient position, the type of needle, bevel orientation, the intervertebral space for entrance and the reintroduction of the stylet before taking the needle out) and the recommendation for rest after the procedure.

The questionnaire was distributed between February and March of 2020 (2 months) to pediatricians and pediatric residents at national level by electronic mail, through the Pediatric Emergency Society of the Portuguese Society of Pediatrics contacts.

The definition of the correct LP technique was based on recent international recommendations of American and European Neurology Societies and recent literature published about the procedure (**Table I**).^{1-4,14-17} We developed a performance score (0-5 points) in which one point was given for each correct answer, which comprised the following parameters:

- i. needle gauge;
- ii. level of introduction of the needle;
- iii. orientation of the bevel in lateral decubitus and in sitting position;
- iv. reintroduction of the stylet to remove the needle.

This study was approved by the Regional Health Administration of the Central Portugal (ARS-Centro, I.P.) ethics committee.

The statistical analysis was performed using the program Statistical Package for the Social Science®, version 26. Descriptive statistics and cross reference tables were performed. The p values were obtained by applying the Chi-square test or Fisher's exact test. A level of $p < 0.05$ was considered statistically significant.

Table I. Recommendations for performing a lumbar puncture in children¹

Preparation-anxiety control	<p>Non-pharmacological sedation:</p> <ul style="list-style-type: none"> - Calm environment; - Presence of parents;¹⁸ - If the child is old enough to understand, the purpose and technique must be explained. <p>Pharmacological sedation:</p> <ul style="list-style-type: none"> - <u>Collaborating patients (over 4-6 years)</u>: nitrous oxide 50% with inhaled oxygen; - <u>Non-collaborative patients</u>: midazolam (oral, intranasal or intravenous) or ketamine (intramuscular or intravenous).
Pain management	<ul style="list-style-type: none"> - Lidocaine 2.5% associated with prilocaine 2.5%;^{15,19} - Ethyl chloride.
Position	Lateral decubitus ²⁰ or sitting ^{21,22}
Asepsis	<p>An povidone-iodine solution or other appropriate site preparation solution, such as 2% chlorhexidine gluconate 70% isopropyl alcohol² is applied to the lower back, in a circular motion from the center towards the periphery, including both flanks, the beginning of the glutes and both iliac crests.</p> <p>A sterile field must be established.</p>
Needle type	<p>Quincke-type needles (traumatic):</p> <ul style="list-style-type: none"> - The hole is distal with a sharp bevel; preferred choice of pediatricians; <p>Whitacre-type and Sprotte-type needles (atraumatic):</p> <ul style="list-style-type: none"> - The hole is on one side of the needle; - The tip is blunt;
Needle size	The smallest needle should be used to allow the CSF sample to be extracted adequately (22 G). ²
Entry point	The point of entry must be found by identifying the interspinous space below the line connecting the two iliac crests, which would correspond to the L4 vertebral body or the L4-L5 intervertebral space. It should be punctured in the first or second intervertebral space immediately below this line, which would correspond to the L4-L5 or L5-S1 spaces, both inferior to the end of the spinal cord in the child (at approximately L3 level). ^{2,23,24}
Needle insertion	<p>Orientation of the needle bevel with the Quincke-type needles: parallel to the longitudinal fibers of the dura, to avoid the development of PLPH^{2,12,25}:</p> <ul style="list-style-type: none"> - <u>Seated patient</u>: bevel to one side; - <u>Patient in lateral decubitus</u>: bevel up or down. <p>The needle must be inserted with an approximate inclination of 15° towards the umbilicus.</p>
Sample collection	The sample must be collected directly in a sterile tube. Never aspirate.
Needle withdrawal	When finished, the stylet should always be reinserted before removing the needle.

Legend: CSF: Cerebrospinal fluid; G: Gauge; PLPH: Post lumbar puncture headache

RESULTS

The questionnaire was completed by 190 physicians from 30 different hospitals across the country (**Fig. 1**), of which 67.9% (n=129) were specialists in pediatrics and its specific areas, namely neonatology (n=24), pediatric intensive care (n=20), neurology (n=12) and oncology (n=7) and 32.1% (n=61) were pediatric residents.

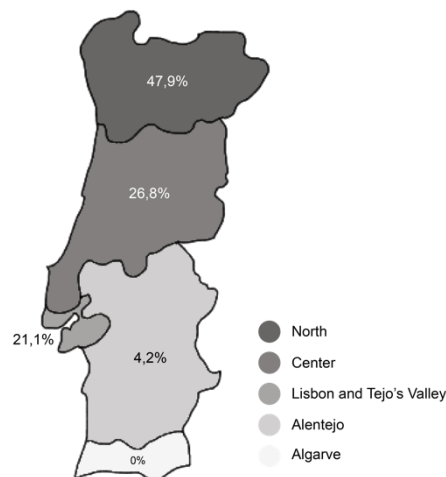


Figure 1. Geographic distribution of the participants (n=190).

The medium age of the participants was 38 years (IQR P_{25} - P_{75} 31-44), with a minimum age of 25 and a maximum of 67 years old.

Regarding the approximate number of performed LPs, 38,4% (n=73) claimed to have performed less than 20, while 27,9% (n=53) have already performed more than 50. The vast majority (96.3%) learned the technique from a specialist, while 2.1% learned from a resident. A minority (1.6%) learned it exclusively from the literature.

With regard to sedation/analgesia during the procedure, only 6.3% (n=12) did not use it at all; 39.5% (n=75) applied local anesthesia (EMLA or ethyl chloride) and 39.5% (n=75) combined local anesthesia with sedation (midazolam, nitrous oxide). There were 23 doctors (12.3%) that claimed to use other strategies, such as, non-nutritive sucking in neonates and small infants, intranasal midazolam and nitrous oxide alone.

Concerning the presence of parents during the procedure, the attitude was not consensual, since 53.2% (n=101) do not allow it.

A large proportion of physicians, 43.7% (n=83), prefer to place the child in lateral decubitus while 13.2% (n=25) selected the sitting position. 43.2% (n=82) decide the position to place the child according to age.

Most doctors (60.0%, n=114) use a Quincke needle, however 33.7% (n=64) are unaware of the type of needle they use. When the LP was performed in newborns, the Quincke needle was used by 41.1% (n=78) and the butterfly needle by 25.8% (n=49).

Concerning the needle gauge, only 38.9% (n=74) use 22G, while 35.8% (n=68) did not know the needle gauge they normally use.

When performing a LP in a child 74.2% (n=141) introduce the needle at the level or one space below the iliac crest line. Only 25,8% (n=49) introduce it above this anatomical reference (**Fig.2**).

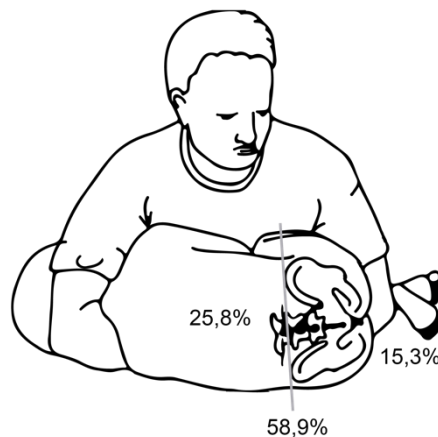


Figure 2. Level of needle introduction when performing a lumbar puncture in children (n=190).²³

In the sitting position only 28.7% (n=51/178) orient the bevel to the sides (left or right) when introducing the needle, while 68% (n=121/178) orient it upwards (towards the head). In lateral decubitus position the majority (66.9%; n=119/178) orient the bevel towards the head and only 29.2% (n=52/178) orient it up or down.

During the procedure, if the CSF does not come out when the stylet is removed, 94.7% (n=180) re-insert the stylet before moving the needle again. And when the CSF is collected, before removing the needle, 91.1% (n=173) also reintroduce the stylet.

Only 3.2% (n=6) do not recommend rest after the procedure, while 35.8% (n=68) recommend less than 4 hours and 54.2% (n=103) recommend 4-12 hours.

As mentioned above, it was created a performance score based in the technique's guidelines showed in **Table I**. The median score obtained was 3 points (IQR P₂₅-P₇₅ 2-3). Only 8,4% (n=16) achieved 5 points.

In **Table II** we compare aspects of the LP technique in two different groups according to professional experience (pediatricians vs residents).

Table II. Summary of comparisons between pediatricians and residents in Portugal (n=190).			
	Pediatricians (n=129)	Residents (n=61)	
Allows presence of parents, n (%)	65 (50.4%)	24 (39.3%)	p=0,154 (Chi-square test)
Type of needle, n (%)			
Quincke	80 (62.0%)	34 (55.7%)	p=0.426 (Fisher's exact test)
Sprotte/Pajunck	7 (5.4%)	2 (3.3%)	
Butterfly	1 (0.8%)	2 (3.3%)	
Do not know	41 (31.8%)	23 (37.7%)	
Type of needle (in newborns), n (%)			
Quincke	54 (41.9%)	24 (39.3%)	p=0.071 (Fisher's exact test)
Sprotte/Pajunck	4 (3.1%)	2 (3.3%)	
Butterfly	39 (30.2%)	10 (16.4%)	
Do not know	32 (24.8%)	25 (41.0%)	
Needle gauge, n (%)			
22G	52 (40,3%)	22 (36,1%)	p=0.872 (Chi-square test)
Orientation of the needle bevel, n (%) (n=178)			
Parallel to the longitudinal fibers of the dura (Sitting: bevel to the sides; Lateral decubitus: bevel up or down)	21/120 (17,5%)	23/58 (39,7%)	p=0.001 (Chi-square test)
Rest after the procedure, n (%)			
<4 hours	53 (41.1%)	15 (24.6%)	p=0.140 (Fisher's exact test)
4-12 hours	64 (49.6%)	39 (63.9%)	
12-24 hours	8 (6.2%)	5 (8.2%)	
No rest	4 (3.1%)	2 (3.3%)	
Performance score (n=178)			
Median (IQR)	2 (2-3)	3 (2-3)	p=0.342 (Mann-Whitney test)

Regarding the type of needle, there was a more frequent use of butterfly needle in newborns in the pediatricians' group (30.2% vs 16.4%), although not statistically significant ($p=0.071$).

Pediatric residents orient the bevel parallel to the longitudinal fibers of the dura more frequently than pediatricians do (39,7% vs 17,5%, $p=0.001$). There were no other significant differences between the two groups. There were also no significant differences when comparing the various regions of Portugal.

DISCUSSION AND CONCLUSION

Lumbar puncture is frequently performed in pediatric emergency departments, however, to our knowledge, this is the first national survey analyzing how this technique is executed in children in Portugal.

LP is a procedure that is recognized to be painful and cause of anxiety, especially in infants.^{26,27} All pediatric societies are unanimous on their recommendations to use analgesia and sedation in pediatric patients requiring a LP. It is recognized that it improves the success rate of the procedure, without significant adverse events.^{15,27-30} Topical analgesia (such as EMLA[®]) or subcutaneous lidocaine are indicated in children, including neonates.^{2,15,19} In our survey, almost all physicians referred to use analgesics, although a minority used only sedatives, like midazolam, that do not provide any analgesia. This could be attributed to the lack of time in emergency departments for the common topical preparations (EMLA[®]) to be effective (60 minutes).² This was also noticed in similar studies in Spain.¹ However, sedation in addition to analgesia, should not be forgotten because younger children may be anxious and unable to tolerate being positioned and restrained during the procedure.²

In order to further reduce anxiety, it is also advised to allow the presence of the parents during the procedure.¹⁸ There is still some controversy regarding this issue but besides being considered beneficial, it doesn't increase the frequency of traumatic or unsuccessful procedures. In our study, unfortunately, only 47% consented the parents to be present.^{28,29} The residents group seemed even more apprehensive towards this recommendation (only 39,3% allow the parents to be present), which is similar to other studies and may be explained by anxiety and fear of failure in the presence of the parents by a less experienced provider.²⁹⁻³⁰

A large proportion of physicians (43.7%) prefer to place the child in lateral decubitus, as previously described in Spain.^{1,20} Infants and small children may tolerate the procedure better when performed in the sitting position because of the hyperflexion of the neck in the lateral decubitus position, however clear evidence for choosing the best position is still unclear, which makes it dependent on other factors such as the teacher's experience and personal preferences.^{21,22}

The anatomic landmarks for choosing the place to insert the spinal needle, as referenced in our questionnaire, are well known and described in pediatric textbooks. However, in recent years, if a properly trained operator is available, bedside ultrasound could be used to best identify the site and safest depth.²

Post-lumbar puncture headache (PLPH) is the most common complication in children.^{6–11} In the majority of patients, the headache starts in the first 48 hours after the procedure.³¹ It presents with frontal or occipital headache, that is worse with sitting or standing, and relieved by lying flat. Associated symptoms can occur in up to 70 percent of patients, and may include nausea, neck stiffness, low back pain, vertigo, vision changes, dizziness or auditory disturbances (tinnitus, hearing loss).⁴ Some risk factors that have been associated with PLPH are related to the choice of the spinal needle (needle tip and size) and procedural factors (needle orientation and reinsertion of the stylet).^{4,12}

Quincke type needles, with a cutting bevel and the orifice at the needle tip, are the standard needles, and were the most used in our survey. Recent scientific evidence recommends other type of needles, called atraumatic needles, noncutting or pencil-point (for example Sprotte[®], Pajunck[®]) because of a lower incidence of PLPH.⁴ Its use in pediatrics is very low, which may be attributed to a lack of knowledge and little availability of these needles in pediatric services, but also to some disadvantages, such as low CSF flow and longer sampling time, a higher failure rate and higher cost for the healthcare system.^{4,16,32–34}

In newborns “butterfly” needles with no stylet were the choice for 26%. These types of needles have been associated with epidermoid tumor formation and are not indicated. However, they are still being used, especially in neonatology, perhaps because of lower size.^{20,35,36}

Using the smallest possible needle has been shown to prevent or lessen PLPH in adults.^{2,12,13} However the efficacy of using smaller needles in children is not proven. In children, small-gauge needles (25G or smaller) require more technical skill and may result in failure to collect CSF, therefore 22G needles should be preferred by clinicians because they shorten the duration of the procedure and are easier to place without bending.^{2,4,11} In our sample we describe a large percentage of doctors (35.8%) that were unaware of the needle gauge they use, potentially because the LP kits in pediatric emergency service are already prepared and only include one type of gauge needle.

Another important aspect for reducing PLPH is the orientation of the needle bevel.¹² The spinal needle, positioned in the midline, must have the bevel parallel to the direction of the fibers of the ligamentum flavum (bevel facing up for the patient in the lateral decubitus position and sideways for the patient in the sitting position).² This way of introducing the needle, with the described bevel orientation, is thought to decrease CSF leak after the procedure because the needle separates, rather than cuts, the fibers of the dura.²⁵

In our study, orientation of the needle bevel parallel to the longitudinal fibers of the dura was performed only by 24.7%, with significant differences between pediatricians and residents. Residents referred to orient the needle bevel correctly in 39.7%. This difference is contradictory because almost all residents claimed to have learned the technique from a specialist. This aspect of the LP technique, less known, is frequently not very explicit in textbooks, although there is considerable evidence of its efficacy, mainly in anesthesiology and neurology literature. We could only speculate that pediatric residents might have been studying other medical areas more recently.

Regarding the introduction of the stylet before moving the spinal needle, almost all physicians referred to do it. Evidence suggests that the replacement of the stylet before withdrawing the needle results in less incidence of PLPHA when using a noncutting needle.³⁷ However during the procedure some clinicians advocate early stylet removal (also known as “Cincinnati method”) to improve LP success rates.² It involves removal of the stylet immediately after passage through the epidermal and subcutaneous tissues.³⁸ The needle is then advanced through the dura without a stylet, theoretically allowing observation of CSF flow immediately after the subarachnoid space is entered.³⁹ There is some evidence that, for younger infants, early stylet removal is associated with increased success rates.^{20,39} Despite improvements using this technique^{39,40}, the safety of stylet removal with regard to the complication of epidermoid tumors is still uncertain.²

Most doctors recommended rest, even though current scientific evidence shows that bed rest does not appear to prevent headache in children.^{2,41,42} One randomized trial that compared children with 4 hours of lying in the supine position without a pillow and fasting for solids and liquids after LP with children exposed to the same conditions for only 30 minutes showed that resting for less time is not associated with higher incidence rates of PLPH or other adverse event.¹⁷

The performance score was low in both groups and only less than 10% of doctors answered the 5 questions correctly. However, it is important to underline that our analysis did not evaluate the LP success neither its complications, only the way it is performed.

As limitation of our analysis, we can point out the heterogenic distribution of the sample, since most of the participants belong to hospitals located in 2 regions of Portugal, which may not be representative of the country. Nevertheless, the number of participants is very expressive.

In conclusion, our study reinforces the need to create a national protocol for this procedure in children. It is also very important that medical schools and training hospitals

create simulation trainings and courses, to not only teach the correct technique and enhance skills, but also to improve self-confidence. ⁴³⁻⁴⁴

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ATTACHMENTS

I - QUESTIONNAIRE: How do you perform a lumbar puncture (LP)?

Informed Consent

«A punção lombar (PL) é uma técnica mediante a qual se acede ao espaço subaracnóideo espinhal a nível lombar utilizando uma agulha. Na maioria das situações, tem como objetivo extrair uma amostra de líquido cefalorraquidiano com fins diagnósticos, sendo muito útil em doenças do sistema nervoso central (i.e., meningite, encefalite, etc). A técnica foi descrita pela primeira vez em 1891 e é utilizada com grande frequência em Pediatria.

No âmbito da elaboração do Trabalho Final para atribuição de grau de Mestre, o aluno do 6º Ano do Mestrado Integrado em Medicina da FMUC, Tiago Jorge da Silva Costa, propõe-se a analisar os dados recolhidos através deste questionário, sendo garantida a confidencialidade dos dados através da resposta anónima.

Os autores pretendem descrever a técnica de PL utilizada na idade pediátrica em Portugal e avaliar a existência de diferenças por grupo profissional (especialistas e internos de formação especializada).

___ Concordo com a afirmação: "Declaro que compreendi as intenções deste estudo, disponho-me a participar voluntariamente e permito o uso das minhas respostas para os fins referidos, nomeadamente para a análise estatística dos dados e futuras apresentações públicas de resultados".»

Demographic information

1. Age
2. Pediatric resident (yes/no)
 - a. Which year? (1º/2º/3º/4º/5º)
3. Pediatric specialist (yes/no) _____
4. Approximated number of performed LP until now
 - i. <10
 - ii. 11-20
 - iii. 21-30
 - iv. 31-40
 - v. 41-50
 - vi. > 50
5. Workplace (hospital where you work or are doing your residency)

6. With whom did you learn the LP technique? (a specialist/a resident)

Lumbar puncture technique

7. Do you allow the presence of parents during the procedure? (yes/no)

8. Do you use sedation/analgesia to perform a LP? (yes/no)

9. If you answered yes, which of the following do you use?

- i. Local anesthesia (EMLA or ethyl chloride)
- ii. Local anesthesia + sedation (midazolam, nitrogen protoxide)
- iii. Ketamine
- iv. Propofol
- v. Chloral hydrate
- vi. Other

10. Which position do you usually put the child?

- i. Lateral recumbent
- ii. Sitting
- iii. It depends on the age

11. What type of needle do you use, in general?

- i. Quincke
- ii. Sprotte/Pajunck
- iii. Butterfly
- iv. Do not know

12. What type of needle do you use, in newborns?

- i. Quincke
- ii. Sprotte/Pajunck
- iii. Butterfly
- iv. Don't know

13. What needle gauge do you use?

- i. 20G
- ii. 22G
- iii. Less or equal than 25 G
- iv. Do not know

14. In what intervertebral space does the needle enter?

- i. At the level of the iliac crest
- ii. A space above the iliac crest
- iii. A space below the iliac crest

15. How do you insert the needle into the intervertebral space if the child is sitting?

- i. With the bevel facing up (towards the head)

- ii. With the bevel facing down (towards the sacrum)
 - iii. With the bevel to the right or to the left
16. How do you insert the needle into the intervertebral space if the child is in lateral recumbent position?
- i. With the bevel towards the head
 - ii. With the bevel towards the sacrum
 - iii. Bevel up or down
17. If the CSF does not come out when the stylus is removed, what do you do to redirect the needle?
- i. Reinsert the stylet before moving the needle again
 - ii. Do not insert the stylet to move the needle again
18. When the LP ends, before removing the needle, do you reintroduce the stylet?
- i. Always
 - ii. Sometimes
 - iii. Never
19. Do you recommend rest after PL? (yes/no)
20. If yes, how long do you recommend rest?
- i. <4 hours
 - ii. 4-12 hours
 - iii. 12-24 hours
 - iv. More than 24 hours

II – Health Regional Administration of the Center (ARS-Centro, I.P.) ethics committee report



COMISSÃO DE ÉTICA PARA A SAÚDE

PARECER FINAL: Parecer Favorável.	DESPACHO: <i>Humberto</i> <i>13/2/2020</i> Conselho Diretivo da A.R.S. do Centro, I.P. <i>[Signature]</i> Dr. João Reis Morgado Presidente
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ASSUNTO: 130/2019 - “Como se realiza uma punção lombar em Pediatria? Análise da realidade portuguesa”

Esta Comissão de Ética deverá receber cópia do relatório final.

Como primeiro autor este trabalho tem
Tiago Jorge da Silva Costa, aluno do Mestrado Integrado em Medicina, da Faculdade de Medicina da Universidade de Coimbra.

Objetivos:

“Avaliar a prática clínica de profissionais de saúde na área da Pediatria relativamente à realização da punção lombar. Com este projeto, os autores pretendem rever como se realiza uma PL em Pediatria em Portugal, nomeadamente quais as técnicas utilizadas e se estão de acordo com as recomendações atuais.”

Os autores responderam cabalmente às dúvidas suscitadas no nosso parecer de 31 de dezembro passado e aprovado em reunião plenária desta Comissão de ética pelo que o parecer é agora positivo.

Coimbra, 04 de fevereiro de 2020

Carlos Fontes Ribeiro
Presidente da Comissão de Ética

[Signature]
Luiz Miguel Santiago
Relator