

## Practices in performing lumbar puncture procedure in the Children Welfare Teaching Hospital / Baghdad

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### Abstract:

**Background:** Lumbar puncture is a procedure that is frequently performed in the pediatric practice.

**Objective:** To review some (patient, provider and technique- related) characteristics of lumbar puncture performed at the Children Welfare Teaching Hospital, Baghdad / Iraq.

**Methods:** A descriptive cross-sectional study was conducted in the period from April to September, 2017. A self-prepared questionnaire was used to collect the data. It included 32 items, which were divided into three sections: Residents doctors' information (3 items), patient's information (2 items) and procedure's information (27 items).

**Results:** The total number of performed procedures was 103, of which 51 (49.5%) were performed in the oncology ward. About half (50, 48.6%) of the patients were preschool-aged. Lumbar puncture was indicated for diagnostic purposes in 52(50.5%) cases. Nearly two thirds (67, 65.9%) of the procedures was performed by senior residents (3rd/4th Board residents). A written consent was obtained in only one case, the couch sheet were not renewed in 92 (93.9%) cases, a drape were not used in 92 (93.9%) cases, sitting upright position was assumed in 90 (91.8%) cases, gloves were worn by the doctor in all cases, anesthesia was used in 47 (48%) cases, antiseptics were used in 97 (99%) cases ,one holder was noted in 93 (94.8%) cases ,SpinocanQuincke and 22 Gage needle type was used in 98 (100%) cases, one entry attempt per procedure was reported in 79 (80.6%) cases and no documentation in the patients' notes was reported in any of the procedures.

**Conclusion:** Lumbar puncture load was found in the oncology ward both for the patients and the residents. Safety was considered but was suboptimal in all wards.

**Keywords:** Lumbar Puncture, Pediatrics, Baghdad

### Introduction:

Lumbar puncture (LP) is a procedure during which a needle is inserted into the subarachnoid space to obtain cerebrospinal fluid (CSF) for laboratory analysis to assess for an acute or a chronic central nervous system (CNS) disease process. It was first introduced by Heinrich Quincke in 1891 to relieve elevated intracranial pressure in cases of meningitis.(1)LP is often performed to examine the CSF in infectious and non-infectious disorders of CNS like blood dyscrasias (leukemia and lymphoma), hemorrhage, some metabolic disorders and to measure CSF pressure if there is clinical suspicion of intracranial hypertension and

intracranial autoimmune disorders.(2,3,4)The procedure is commonly done for two purposes: Diagnostic and therapeutic, for example to administer intrathecal chemotherapy, and therefore encountered often in emergency, neurology and oncology wards.(3)Despite being a comparatively invasive procedure, it can cause some inconsequential complications, like headache, low back pain, radicular pain or numbness and bleeding.(3)There has been no hospital-based study to describe that procedure in the Iraqi hospitals. This study aggregates information that is related to the practices of performing LP, including the frequency of its performance at three different units in the Children Welfare Teaching Hospital (CWTH) where LP is presumed to be highly considered, indications, success rate, different LP approaches used (patient's positioning, equipment and even the specialty of the providers). Awareness about the current practices related to this procedure is important because it

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reflects the equipment and training resources needed to adequately perform the procedure.

**Cases and Methods:**

A descriptive cross-sectional study was conducted in CWTH, Baghdad / Iraq, in the period from 5th of April to the 6th of September 2017. One hundred and three procedures were randomly allocated, attended and reported. Children aged 30 days to 13 years were included. Pediatric neurology (14 cases), oncology (51 cases), and emergency (38 cases) wards were included. Six cases refused to give consent. A self-prepared questionnaire form was used to collect data. It included 32 items, which were divided into three sections: resident doctor's information (three items) including years of residency and the order of the procedure performed by the resident on that day. Experience was addressed by the question "how many similar procedures have he/she performed since graduation", and this was answered in a "10-100" scale. Patient's information (2 items) including: Age, place of residency, number of previously experienced LP. The procedure information (27 items) including: Total number and distribution among the three wards, time of performing LP, success status, obtaining consent, indication, place at which LP was performed, number of persons attending the procedure, using drape, use of anesthesia and types, use of antiseptic material and types, wearing gloves, consciousness status of the patient, position of the patient, number of holder, their gender and specialty, level of needle entry and the way to identify it, needle type, frequency of stylet removal, number of attempts per procedure, duration, documentation, advice for positioning.

Attending procedures and gathering information were through convenient sampling. The researchers were often contacted as soon as the procedure was decided and planned for by the physicians in the three units. Few of the visits were made on weekends (Friday/Saturday) and were labeled as outside the official working's hours. The form was filled by the researchers themselves instantly while watching the procedures.

**Statistical analysis**

Data was gathered, organized and tabulated using Microsoft Office Word 2013 and percentages and tables were done by Microsoft Office Excel 2013. Discrete variables were presented as numbers and percentages and continuous variables presented as median and mean ± SD (standard deviation). An approval from the local ethical committee was obtained.

**Results:**

One hundred and three Lumbar Puncture procedures were attended by the researchers in the three wards

during the study period. Table 1 shows that nearly two thirds (n = 67, 66%) of the procedures were performed by a senior residents (years 3 or 4), remarkably so in the emergency wards. Almost all doctors have performed more than 100 LPs during their career (101, 98%). Performing more than one procedure a day by the same provider was reported in 67/103 cases, of whom 69% were in the oncology ward.

**Table 1: Characteristics of doctors performing LP at the neurology, emergency and oncology wards**

| Variables  | Wards – No. (%)         |                         |                        | Total No. 103 (100%) |
|--|-------------------------|-------------------------|------------------------|----------------------|
|  | Neurology<br>Total = 14 | Emergency<br>Total = 38 | Oncology<br>Total = 51 |                      |
| Year of Board residency                              |                         |                         |                        |                      |
| 1st -2nd   | 7 (50.0)                | 3 (7.9)                 | 26 (51.0)              | 36(35.0)             |
| 3rd -4th   | 7 (50.0)                | 35 (92.1)               | 25 (49.0)              | 67(65.0)             |
| No. of LPs performed along carrier period            |                         |                         |                        |                      |
| 10-100   | 2 (14.3)                | 0                       | 0                      | 2(1.9)               |
| >100   | 12(85.7)                | 38 (100.0)              | 51(100.0)              | 101(98.1)            |
| No. of LPs performed by the provider at the same day |                         |                         |                        |                      |
| 1st  | 11 (78.6)               | 20 (52.6)               | 5 (9.8)                | 36(35.0)             |
| 2nd  | 3 (2.9)                 | 12 (31.6)               | 5 (9.8)                | 20(19.4)             |
| 3rd  | 0                       | 2 (5.3)                 | 5 (9.8)                | 7(6.8)               |
| 4th and more   | 0                       | 4 (10.5)                | 36 (70.6)              | 40(38.8)             |

Patients' information shows that about half of the patients (50, 48.6%) were school-aged, and the remainder were younger (infants: n = 27 (26.2%) and preschool: n = 26 (25.2%)). In 45 (43.7%) patients, this was the first LP, most of which (84.4%) were encountered in the emergency department. The remaining 58 (56.3%) patients experienced one or more LP procedures prior to the attended one, of whom 51(88%) patients experienced more than four previous procedures in the oncology ward.

**Table 2: Characteristics of lumbar puncture procedure in the neurology, emergency and oncology wards.**

| Variables   | Wards - No. (%)        |                        |                       | Total (100.0) |
|---|------------------------|------------------------|-----------------------|---------------|
|   | Neurology<br>14 (13.6) | Emergency<br>38 (36.9) | Oncology<br>51 (49.5) |               |
| <b>Indication</b>                                   |                        |                        |                       |               |
| Infection   | 11 (78.6)              | 38 (100.0)             | 0 (0)                 | 49 (47.6)     |
| CSF pressure  | 3 (21.4)               | 0 (0)                  | 0 (0)                 | 3 (2.9)       |
| Chemotherapy + assessment                           | 0 (0)                  | 0 (0)                  | 51 (100.0)            | 51 (49.5)     |
| <b>No. of persons (staff or family) in the room</b> |                        |                        |                       |               |
| 1   | 0 (0)                  | 1 (2.6)                | 0 (0)                 | 1 (1.0)       |
| 2   | 1 (7.1)                | 5 (13.2)               | 0 (0)                 | 6 (6.1)       |
| 3   | 2 (14.3)               | 10 (26.3)              | 13 (25.5)             | 25 (25.5)     |
| 4   | 4 (28.6)               | 14 (36.8)              | 33 (64.7)             | 51 (52.0)     |
| 5+  | 6 (42.9)               | 4 (10.5)               | 5 (9.8)               | 15 (15.3)     |
| <b>Analgesics and sedative drugs</b>                |                        |                        |                       |               |
| Not used  | 13 (92.9)              | 27 (81.8)              | 11 (21.6)             | 51 (52.0)     |
| Phenobarbitone                                      | 1 (7.1)                | 1 (3.0)                | 0 (0)                 | 2 (2.0)       |
| Diazepam  | 0 (0)                  | 1 (3.0)                | 0 (0)                 | 1 (1.0)       |
| EMLA cream  | 0 (0)                  | 4 (12.1)               | 40 (78.4)             | 44 (44.9)     |
| <b>Antiseptic use &amp; type</b>                    |                        |                        |                       |               |
| Not used  | 1 (7.1)                | 0 (0)                  | 0 (0)                 | 1 (1.0)       |
| Bovidine  | 12 (85.7)              | 32 (97.0)              | 51 (100.0)            | 95 (96.9)     |
| Bovidine + Alcohol                                  | 1 (7.1)                | 1 (3.0)                | 0 (0)                 | 2 (2.0)       |
| <b>Identification of needle entry</b>               |                        |                        |                       |               |
| Marker used   | 3 (21.4)               | 6 (18.2)               | 5 (9.8)               | 14 (14.3)     |
| Imaginary line                                      | 11 (78.6)              | 27 (81.8)              | 46 (90.2)             | 84 (85.7)     |
| <b>Patient's holding person</b>                     |                        |                        |                       |               |
| Number  | One                    | 12 (85.7)              | 30 (90.9)             | 51 (100.0)    |
|   | Two                    | 2 (14.3)               | 3 (9.1)               | 5 (5.1)       |
| Gender  | Male                   | 12 (85.7)              | 33 (100.0)            | 51 (100.0)    |
|   | Female                 | 2 (14.3)               | 0 (0)                 | 2 (2.0)       |
| Specialty   | Doctor                 | 4 (28.6)               | 1 (3.0)               | 6 (11.8)      |
|   | Nurse                  | 7 (50.0)               | 24 (72.7)             | 45 (88.2)     |
|   | Parent                 | 3 (21.4)               | 8 (24.2)              | 0 (0)         |
| <b>Stylet removal frequency</b>                     |                        |                        |                       |               |
| 1   | 9 (64.3)               | 18 (54.5)              | 32 (32.6)             | 59 (60.2)     |
| 2   | 1 (7.1)                | 8 (24.2)               | 15 (15.3)             | 24 (24.5)     |
| 3   | 1 (7.1)                | 5 (15.2)               | 4 (4.1)               | 10 (10.2)     |
| 4   | 2 (14.3)               | 1 (3.0)                | 0 (0)                 | 3 (3.1)       |
| 5 +   | 1 (7.1)                | 1 (3.0)                | 0 (0)                 | 2 (2.0)       |
| <b>No. of attempts per procedure</b>                |                        |                        |                       |               |
| 1   | 11 (78.6)              | 24 (72.7)              | 44 (86.3)             | 79 (80.6)     |
| 2-3   | 3 (21.4)               | 7 (21.2)               | 6 (11.8)              | 16 (16.3)     |
| 4 +   | 0 (0)                  | 2 (6.1)                | 1 (2.0)               | 3 (3.1)       |

Note: five procedures were refused, all of which came from the emergency group. Therefore, the calculations for this table were made based on the modified totals.

Almost all the procedures (101, 98%) were attended during the normal working hours and only two were performed during weekends. Nearly half (51, 49.5%) of the procedures were performed in the oncology ward. A written consent was obtained in only one procedure, while verbal consent was taken in the rest. Table 2 demonstrates the technique profile of LPs. Five LPs were refused. CSF was accessed and collected in 92 cases (oncology unit = 51(52.0%), neurology unit =11(11.2%), emergency unit = 30 (30.6%)). The two main indications to do LP were diagnostic purpose for suspected clinical central nervous system infection (49, 47.6%) and therapeutic for injection of intrathecal chemotherapy (51, 49.52%). Only three procedures (in patients with a provisional diagnosis of idiopathic intracranial hypertension) aimed to measure CSF pressure and were done in the neurology department. The procedures were performed in a separate room in 96

(98%) cases. In most of the procedures (91, 92.8%), three or more persons were present in the room where it was performed (including performer). Sitting upright position was assumed in 90 (91.8%) procedures while eight procedures (mostly in the Emergency unit) were performed in lateral recumbent position. The procedure was performed on conscious children in 97 (99%) cases. Anesthesia was used in 47 (48%) procedures, mostly (40 procedures) in the oncology ward. The children were hesitant and showed resistance in 60 (61.2%) procedures. The couch sheet was not renewed and drape was not used in 92 (93.9%) procedures. Antiseptics were used in almost all the cases (97, 99%), while it was not used in one procedure for an unknown reason as the researchers were allowed to observe the procedure only and not to discuss the maneuver details with the performer. Third to fourth lumbar spine level was entered in all cases. To identify the level of entry, an

imaginary line was drawn in 84 (85.7%) procedures and a marker was used in the rest. The type of needle used was SpinocanQuincke and 22 Gage in all procedures (98, 100%) and gloves were worn by the performers in all cases. In 93 cases (94.8%), one person held the patient, mostly by a man (96, 98%), 11 were doctors (11.2%), 76 were nurses (77.6%) and 11 (11.2%) were parents. The needle stylet was removed once in 59 (60%) cases and more than once in the remainder (39, 19.8%). One entry attempt per procedure was reported in 79 (80.6%) procedures and more than once in 18 (18.4%) ones. The doctors did not advise the caregivers to place their children on their back after the procedure in 59 (60.2%) procedures. A procedure duration of five minutes or less was observed in 80 (81.7%) procedures. There was no documentation in the patients' notes in any of the procedures.

#### Discussion:

Children Welfare Teaching Hospital is one of the biggest tertiary centers in Baghdad where LP is daily performed in different wards, particularly emergency, oncology and neurology wards. Procedures attended were those which were decided without any contraindications, therefore, this characteristic was not assessed during the present study. CSF was collected successfully in all procedures observed in the oncology ward, which can be explained by the fact that all the procedures in that ward were performed using anesthesia and with well-trained holders, increasing the success rate. The present study showed a procedure refusal rate of 4.9%, that is much lower than rates estimated in studies conducted worldwide. (5,6,7,8,9,10) Factors that govern behaviors toward the LP procedure include geographical area, cultural ideology, and knowledge standards. (6,5,11) Problems like unnecessary hospital admission and prolonged stay, iatrogenic complications, nosocomial infections, unnecessary antibiotics and increased antibiotic resistance can inflict the patients. (6,8,12) Only one written consent was obtained and no procedure was documented in the patient's records. LP is an invasive procedure, which needs both consent and documentation. Information included are post-lumbar puncture headache (PLPH), that was reported in 32% of the procedures in the literature; (13) procedure failure; bleeding and pain or bruising confined to the injection site, while other rare events like iatrogenic meningitis and nerve root injury may not be included. (14,3) Information related to the patient and procedure (indication, position, site, anesthesia, CSF collected, advice about post LP headache (PLPH)) ought to be documented in the patient's notes or special forms. Comparing our results to those seen by Patel et al in a study conducted in the USA (2014) (15) where most (86 %) of the patients in the emergency department had a signed general consent form, half of which was a LP form. In paediatric practice, residents are classically trained by experienced persons (observe and perform). (16) Uncertainty of their skills and

concerns of causing harm to the patients result in revulsion at the performance of LP. (17) Most of the procedures were found to be performed by senior residents (3rd/4th Board residents) and only one third were done by more junior residents (1st / 2nd Board residents), yet an equal proportion of residents were seen in the neurology and oncology wards, while it was predominately performed by senior residents in the emergency ward. This can be explained by the emergency situation of the procedure and the rapid turnover of cases that urged more senior and better experienced/skilled residents to perform it. In CWTH, this procedure is traditionally performed by pediatric residents with other specialties being involved according to the ward, so pediatric neurology, oncology and less likely emergency fellows are involved in their relevant wards. LP is generally indicated for the diagnosis of meningitis. But it can be decided as part of the diagnostic work up in disorders like Guillain-Barre syndrome, other demyelinating diseases and to diagnose and treat Pseudotumor cerebri. (3) The current study showed that LP had two main indications in the oncology and neurology wards (diagnostic and therapeutic) and only one indication (diagnostic) in the emergency ward. In CWTH, It was observed that the procedure was usually performed in the sitting position (90, 91.8%). However, the favored position mentioned in the literature is the left lateral decubitus as the former one is uncomfortable to the patient and carries an increasing risk of PLPH. It is an unaccepted position during CSF pressure measurement. (18) The significant landmark for deciding the entry site is established by palpating the lateral aspect of the superior iliac crest and drawing an imaginary line that intersects the midline of the spinal column at level L3-L4 inter space, (19) a level at which the needle was inserted in all procedures included in the present study. The site of needle entry was identified by either using a marker (14, 14.3%) or drawing an imaginary line (84, 85.7%) and no imaging guidance has been used for this purpose in the local practice. There is an increasing frequency trend to perform LP under fluoroscopic or ultrasound guidance to increase success rate and reduces the number of attempts and traumatic tap. (20, 21) Analgesics and sedative drugs were administered in nearly half of the patients, most of which were in the oncology ward, where only EMLA (Lidocaine and Prilocaine) was used in the study period, while diazepam and phenobarbital were given in the other wards. The benefit of topical anesthesia to increase success rate of the residents in performing LP was confirmed in some studies, (22) but not in others. (23) Generally, it is recommended to control pain for infants during lumbar puncture. (24,25,26) Medications like oral midazolam and chloral hydrate can be used effectively. (27) The unavailability of anesthetic agents may be an additional reason for not practicing this maneuver in CWTH and need to be addressed in future studies. The ward may be an appropriate setting for diagnostic LP. It is a sterile procedure that needs preparations

like sterile dressing, drapes, gloves and antiseptic material, as the probably routes of infections are performer's hands and patient's skin. (28,29) Wearing masks is recommended in certain situations like LP performer with upper respiratory tract infections or catheter placement or injection of material into the spinal canal. (30,31,32) The skin at the injection site need to be sterilized by antiseptic material like Povidone-Iodine or 0.5% chlorhexidine and 70% alcohol and are allowed to dry before starting the procedure. These disinfectants can breach the stratum corneum layer that protects bacteria nearby sebaceous glands and hair follicles. (29) In the present study, antiseptic techniques (aseptic sheet, drape use and antiseptics) were observed to be very suboptimal except that of wearing gloves. No spinal tray was available in the hospital, which could not be in any form an excuse to neglect that essential preparation. Two main types of needles are used for lumbar puncture, Quincke needle with cutting, beveled tip, and atraumatic pencil-point needle with a side aperture. The preferred one is a 22 gauge atraumatic needle. A needle smaller than 20 G can result in headache in almost 70% of cases. (28) So, 20 G or 22G LP needle is the ideal one for diagnostic spinal tap. A 22 gauge Whitacre needle, was found to be a standard stock LP needle in CWTH.

We found that 80.6% of the procedures were completed with one attempt, while 19.4% of the cases required more than one attempt. Ahmed et al. (33) suggested that a lower number of attempts of LP could lead to a lower incidence of PLPH due to lesser dural fiber disruption.

The best location to perform a LP is a treatment room, or somewhere calm and quiet that is preferred to a ward bay. (28) There was no special room for LP in the three wards (96 (98%)), and the rooms used were those where blood sampling, intravenous access placement or bone marrow aspiration is done, apart from the oncology outpatient.

Bed rest for a short period of time after LP can be helpful with respect to monitoring the vital signs or to detect any immediate complications in addition to reducing the incidence of PLPH, a subject of constant controversy. (33,34,35) Advice for post-procedural bed rest was observed in 39 (39.8%) procedures.

Factors influencing LP success are many, yet a good holder is an outstanding one to reduce risk of traumatic LP. (36) Data collected in regard to the holders were one male holder in almost all procedures (for each characteristic) and paramedics in three fourths. One study found that all the holders were paramedics who had more than five-year-experience in emergency department. (22)

Almost all (91, 92.8 %) the procedures were attended by more than two persons (including the performer). No documented data to idealize that practice were found in the literature. An assistant, a nurse or parent may stand beside the child to help him/her stay still or explain what the doctor is doing. Nevertheless, this practice is presumed to increase the risk of transferring infection.

Up to our knowledge, this is the first study that broadly assessed this practice in a health facility in Iraq, although some local work has studied very few aspects of the procedure like positivity and frequency or parental refusal rate. (37,38,39,7) Limitations of the study were small sample size, single center-based assessment and attending the procedure exclusively during the official working hours of the hospital.

#### Conclusion:

We concluded that LP load was found in the oncology ward both for the patients and the residents, and that patients' safety (particularly sterilization and pain management) was considered but was not up to standards in all wards.

We recommend introducing a LP proforma for documentation to be part of the hospital policy, conducting further multi-center study involving all major teaching hospitals throughout Baghdad with larger samples that can provide better insight into the practice of LP and help to improve and upgrade this skill, preparing and maintaining the equipments needed for the LP procedure by the health services of the hospital that meet the wards' needs and conducting a training course for junior doctors.

#### Authors' contribution:

Nebal Waill Saadi: conception, design, data interpretation, drafting manuscript, critical revision  
Dhulfiqar A. Mohammed: data acquisition, interpretation, drafting

Yousif W. Kareem: data acquisition, interpretation, drafting

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### أحوال إجراء البزل القطني في مستشفى حماية الأطفال التعليمي- بغداد

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#### الخلاصة

المقدمة: البزل القطني هو إجراء يجرى في أحيان كثيرة في ممارسة طب الأطفال الباطني.

الأهداف: لمراجعة بعض خصائص البزل القطني (المتعلقة بالمريض و المقيم و التقنيّة) الذي أجري في مستشفى حماية الأطفال التعليمي في بغداد – العراق.

الطريقة: أجريت دراسة وصفية مستعرضة في الفترة من نيسان إلى أيلول ٢٠١٧. أستخدم فيها استبيان معد ذاتيًا لجمع البيانات، وهو مكون من اثنين و ثلاثين فقرة موزعة على الأقسام التالية : ثلاث فقرات ضمن معلومات المقيم الأقدم، فقرتان حول معلومات المرضى و سبعة و عشرون فقرة عن عملية البزل.

النتائج: تم تعيين مائة و ثلاثة عملية بزل قطني. تم إجراء نصف العمليات (٤٩,٥%) في ردهة الأورام. نصف المرضى (٤٨,٦, ٥٠%) كانوا من فئة قبل المدرسة العمرية. إجراء الفحص التشخيصي كان سبباً لإجراء البزل القطني في ٥٢ حالة (٥٠%). حوالي ثلثي الحالات (٦٧, ٦٥%) تم إجرائها بواسطة مقيم أقدم ذو مستوى عالٍ، إعطاء موافقة كتابية في حالة واحدة فقط، لم تتغير غطاءات الأسيرة في ٩٢ (٩٣,٩%) حالة، لم تستخدم الأغشية في ٩٢ (٩٣,٩%) حالة، تم تنفيذ العملية في وضعية الجلوس في ٩٠ (٩١,٨%) حالة، تم إرتداء القفازات في كل الحالات، تم استخدام المواد المخدرة في ٤٧ (٤٨%)، و المواد المطهرة في ٩٧ (٩٩%)، والإبرة نوع و حجم SpinocanQuincke and 22 Gage في ٩٣ (٩٤,٨%) حالة، تم تسجيل محاولة دخول واحدة في عملية البزل في ٧٩ (٨٠,٦%) حالة، لم يتم توثيق المعلومات الخاصة بالبزل في سجلات المرضى في أي حالة.

الاستنتاج: نستنتج وجود عبء للبزل القطني في ردهة الأورام على الأطباء و المرضى على حد سواء. تم أخذ سلامة المريض بعين الاعتبار لكنها كانت دون المستوى الأمثل في جميع الردهات.

مفتاح الكلمات: البزل القطني، طب الاطفال، بغداد