REVIEW

by Prof. Dora M. Tancheva, MD,PhD

ABOUT: PhD thesis of Dr. Albena Sashova Atanasova entitled "ULTRASOUND-GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN CHILDREN" for awarding the educational and scientific degree "PhD"

Dr. Albena Atanasova's PhD thesis is written on 136 pages. It is structured as follows: introduction — 3 pages, literature review — 31 pages, aim and tasks — 3 pages, material and methods — 22 pages, results and discussion — 47 pages, discussion — 6 pages, conclusion — 2 pages, conclusions - 1page, scientific contributions - 1 page, publications and reports - 2 pages, references - 11 pages and appendix - 4 pages. The work is illustrated with 27 tables and 26 figures. A questionnaire for the assessment of postoperative pain is presented in the appendix. The references include 103 literary sources, of which 14 are written in Cyrillic and 89 in Latin. A large part of the cited scientific works were published in the last 12 years.

The literature review is detailed and thorough. The morphological features of the bones, the risk factors for bone fragility, the prevalence of injuries to the musculoskeletal system in children and, more specifically, the frequency of upper extremity fractures in children, are presented in details. The PhD student has described in detail the anatomical features of the Plexus brachialis and the necessary knowledge for the successful implementation of the supraclavicular block (SCB) of the brachial plexus.

It is presented the most comprehensive historical review of peripheral nerve block techniques used over the years. The advantages of the ultrasound-guided technique in performing the block, allowing visualization of the subject's anatomical structures over the application of a neurostimulator, a technique difficult to apply in children, are highlighted. The essential advantages of peripheral nerve blocks over general anesthesia, providing both effective intraoperative and adequate postoperative analgesia, are also emphasized; restriction the appearance of the side effects of a number of medications administered during general anesthesia and after, as well as the relatively faster recovery of patients in the postoperative period. The techniques for performing the ultrasound-monitored peripheral nerve blocks and in particular those for the plexus brachialis block, the introduced new approaches for the plexus brachialis block are discussed in details, as well as the benefits of SCB.

The different types of complications related to peripheral nerve blocks, as well as the possibilities for their reduction, after the introduction of ultrasound guidance, have a special place. Regional anesthesia is increasingly used as part of a multimodal analgesia approach. It is a very good alternative to conventional opioid-based analgesia. There is growing evidence for

the benefits and advantages of regional anesthesia in pediatric population - reduction of using an opioid analgesics and reduction of complications such as nausea and vomiting, significantly reduced pain feelings in the early postoperative period, and reduced risk of respiratory complications. Other significant advantages of regional anesthesia are also highlighted - the possibility of early rehabilitation, shortened hospital stay and the resulting economic benefits.

A comparative analysis is presented between the initially applied technique for localizing the nerve structures by a neurostimulator, difficult to apply in children, with a high risk of developing pneumothorax after SCB, puncture of a. subclavia, hematoma or even intravascular injection of local anesthetic, and the used of ultrasound guidance technique allows the visualization of the anatomical structures and a much more precise realization of the plexus block. The possibilities of imaging the localization of nerve structures provide significant advantages of this technique — high success rate, significant reduction of the volume of injected local anesthetic and limited risk of complications.

The advantages of sonographically monitored peripheral nerve blocks in children, ensuring safety in the implementation of the block and achieving deep analgesia - with the ability to image all anatomical structures and the position of the needle in relation to the nervous tissues, direct control of the spread of local anesthetic, etc. ability to predict the quality of the block. With the reduced volumes of local anesthetic in children, there is a more rapid onset of sensory and motor block and a prolonged duration of effect. The possibility of reduced postoperative pain levels, the significant limitation of the dosages of the administered opioids and the risk of nausea and vomiting, and a reduced risk of respiratory complications are demonstrated.

An overview of the development of regional anesthesia in Bulgaria and the ever-increasing expansion in anesthesiology practice over the last 20 years is presented.

The literature review in the dissertation of Dr. Albena Atanasova presents, on the one hand, very precisely the advantages of the ultrasound-guided technique in SCB in children — the higher success rate, the shorter onset time, the extended duration and improved quality of the block, the possibility of being few complications were avoided, and on the other - the challenge of developing this technique and quickly applying it in clinical practice.

The aim of the PhD thesis "To investigate and evaluate the effectiveness of analgesia in ultrasound-guided supraclavicular block of the brachial plexus in children undergoing operative intervention for arm, diaphyseal, or proximal forearm fracture" is clearly formulated and shows the great desire of Dr. Atanasova, through its implementation, to significantly contribute to the expanded application of this modern technique of pain relief in children.

To achieve this goal, Dr. A. Atanasova sets herself 6 tasks, which are precisely defined and:

1. To analyze the medical-demographic profile of patients with upper extremity fractures and those undergoing surgical treatment.

2. To make a prospective study, depending on the applied anesthesia — experimental group (A) with supraclavicular block of brachialis plexus under ultrasound visualization and control group(B) with standard intravenous intraoperative anesthesia.

3. To follow the analgesic power of the two methods intraoperatively by hemodynamic stability expressed in monitoring of PR and BP of each 10 minutes.

4. To evaluate and compare the time to perform the anesthesia, as well as the time to wake up in the two groups.

5. To evaluate and compare the intensity of pain in the two groups immediately after awakening, on the 1st, 3rd, 6th, 12th and 24th hours, as well as the need for additional analgesia in the two groups of patients.

6. To monitor and compare the complications in the patients in the two groups.

In the Material and methods, the following is presented: a very well-written protocol of the examination with inclusion and exclusion criteria of the patients, as well as the indications and co-indications for the implementation of this technique in childhood.

The prospective study included 60 children, aged 3 - 17 years, undergoing surgical treatment for fractures of the proximal, diaphyseal or distal arm, proximal or diaphyseal forearm, distributed in:

• experimental group A (n=30) — with light or deep sedation, and supraclavicular blockade of the brachial plexus under ultrasound control and

• control group B (n=30) — with general anesthesia with standard intravenous, intraoperative analgesia with opioid analgesics.

The in-depth analysis of the preoperative monitoring in terms of history and clinical examination, as well as the mandatory hemodynamic and respiratory monitoring during the implementation of SKB by means of the electronic database created for the purpose of the study for each individual patient, is impressive.

The data were processed using modern methods of statistical analysis, allowing the results of the study to be summarized and accurately interpreted.

All stages of the applied methods are described very precisely and in detail - pre-operative preparation of the children and intra-operative period, including the implementation of the two possible techniques. With great detail and very well-made figures, the individual stages of performing SCB in children are presented. This part of the PhD thesis perfectly demonstrates the author's excellent theoretical and practical training. A review of the different possibilities for pain assessment in children in the postoperative period is presented. The level of pain perception was assessed by means of generally accepted scales, adapted to age and the ability to communicate in different age groups, during 24-hour postoperative monitoring. The amounts of non-steroidal anti-inflammatory drugs (NSAID) used and the hours of onset of pain in both groups of patients were recorded.

The presented results are various and give, on the one hand, a comprehensive picture of the applied technique, and on the other hand, an idea of the very serious involvement and influence of Dr. Albena Atanasova in the introduction of this modern and, for the time being, still limited application method of pain relief in our country, especially in pediatric population.

An analysis of the frequency and distribution of injuries to the shoulder in children, as well as those undergoing surgical treatment, was carried out. The presented demographic comparative analysis between the two groups of children included in the study in terms of sex and age, body weight, ASA classification and accompanying diseases, very well illustrated with tables and figures, shows that the two groups are comparable in terms of demographic indicators, without being found statistically significant differences.

The analysis of the parameters observed in the intraoperative period includes: time for completion of anesthesia, duration of the operative intervention, hemodynamic stability of the patient - assessed by dynamics in pulse rate and blood pressure every 10 min,

- time to wake up a patient, is illustrated with numerous excellently composed tables and graphs. A comparative analysis of a series of criteria in the postoperative period was also carried out, such as: pain intensity in the recovery room according to VAS scale, numerical scale, behavioral FLACC scale.

- pain intensity in the in 1st post-operative hour, on the 3rd, 6th, 12th and 24th postoperative hour according to VAS scale, numerical scale, behavioral FLACC scale

- total amount of used NSAIDS and opioids in the experimental and control group

- the occurrence of complications.

Results showed that in the recovery room, a significantly greater percentage of patients in the SCB group were free of pain with greater pain intensity, compared to the control group. The greatest difference in pain levels between experimental and control group was found in the early postoperative period up to the 6th hour.

Ultrasound-guided supraclavicular brachial plexus block was achieved in all patients in group A. A successful block with a sufficiently high level of analgesia was reported in 96.6% of patients (n=29), and in one patient (3.3%) — additional analgesia with an opioid analgesic was initiated due to insufficient density of the block. The author's own data, for all stages of the study, are of decisive importance for the monitoring of anesthesia in children. They have a significant practical and scientific contribution. The average time achieved was 7.50 min (+/- 3.19 min) to perform SCB under ultrasound needle visualization, consistent with data published in the medical literature.

In both types of conducted anesthesia, quite good results were achieved in hemodynamic stability and adequate intraoperative analgesia.

The advantages of SCB in the experimental group are the quick awakening and quick removal from the operating room, as well as the possibility of faster postoperative feeding, which is of particular importance in children.

The “total" time expressed on the basis of "anesthesia induction time" + time of patient "awakening" /US-SCB time + patient "awakening" time is shorter in the experimental group, allowing better economic efficiency.

From the analysis of the obtained data in both groups, the need for anesthesia gradually increased until 12 postoperative hours, after which there was a decrease. The results clearly show the significant superior of the need for analgesia in the period 6-12 postoperative hour in both studied groups. For the entire studied period - up to the 24th hour postoperatively, the patients from the group with SCB had to use significantly less analgesics.

The use of ultrasound, in addition to safety, covers the guiding principles in regional anesthesia in pediatric population, precisely — lower dose, lower volume and lower concentration of less toxic local anesthetic.

Peripheral nerve block provides no or limited need for postoperative analgesia. Excellent analgesia in the early postoperative period of patients with regional anesthesia reduces the medical staff engagement in the implementation of postoperative care and patient monitoring.

None of the patients in group A developed pneumothorax, puncture of the subclavian artery, hematoma formation, or Horner-syndrome after SCB was performed. No neurological complications have been reported. Complications of nausea and vomiting occurred in 6 of the patients or in 10% of the treated population. In the group with regional anesthesia, nausea at the end of the operative intervention was observed in one patient, and postoperative vomiting in one patient or in 6.7% of the patients in group A, and in the remaining 28 patients (93.3%) no complications were reported. In the general anesthesia group, three of the patients had vomiting and one complained of nausea, i.e. in 13.3% of the control group.

The results presented by Dr. A. Atanasova, as well as the analyzes performed, fully correspond to the data of a number of modern studies.

On the basis of the analyzed studies, the author makes 8 conclusions, which fully correspond to the tasks and problems developed in detail.

I agree with the scientific-applied and scientific-practical contributions presented by the author.

I want to emphasize the very good presentation of the work with well-made figures and tables.

It is attached a list of 8 publications that fully cover the subject of the PhD thesis and show both systematicity and consistency in the publication of results over time and deepening of the analysis with experience.

The PhD thesis contains scientific, scientific-applied and practical results, which represent an original contribution to the study and meet all the requirements for the development of such works and the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB).

Bearing in mind all the above, the research and professional qualities of the PhD student Dr. Albena Sashova Atanasova, I express my categorical opinion "YES" for the purpose of awarding the PhD thesis “Ultrasound-guided supraclavicular brachial plexus block in children" and fully delegate my support to be awarded the educational and scientific degree "PhD".

02.11.2022 Prof. Dora Tancheva, MD, PhD

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