REVIEW

by Prof. Dora Tancheva, M.D., Ph.D., D.Sc.

With reference to: dissertation work of doctor Elena Toncheva Ivanova, entitled „**APPLICATION OF POPLITEAL NERVE BLOCK IN LOWER LEG INJURIES IN PEDIATRIC PATIENTS**“ for acquiring educational and scientific degree „Doctor“.

The dissertation work „APPLICATION OF POPLITEAL NERVE BLOCK IN LOWER LEG INJURIES IN PEDIATRIC PATIENTS“ by doctor Elena Toncheva Ivanova submitted for a Review is written according to the Regulations for acquiring educational and scientific degree „Doctor“, contains 32 figures, 18 tables, it is written in 147 pages, distributed in following sections: Literature review- 37 pages; Goal and tasks- 1 page; Materials, methods and technique- 19 pages, Results- 18 pages; Analysis and evaluation- 20 pages; Discussion-8 pages; Conclusions- 2 pages, Recommendations- 1 page, Closure- 2 pages; Contribution- 2 pages, Publications- 2 pages; Bibliography- 17 pages, Annexes №1 and №2- 6 pages. The literature sources are 202, they are detailed, up to date and include 12 titles in cyrillic and 190 titles in latin. A significant part of all literature sources is published in the last 15 years.

The dissertation work is dedicated to up to date and specialized topic, related to development and implementation of modern techniques for optimal pain control by means of peripheral regional nerve blocks in the everyday anesthesia practice. The literature review, presented on 37 pages is well constructed, up to date and detailed. There is introduction in history of anesthesia in general and different anesthesia types. Special section discusses the origin and development of regional anesthesia until nowadays, as well as the ultrasound- guided peripheral regional nerve blocks- methods that have huge impact on regional anesthesia evolution. Implementation of US- guidance facilitates regional block performance and reduces risk of complications. The advantages of US- guidance are pointed out in the course of performing regional blocks. Some of them include reduced doses of local anesthetics, visualization of anatomic structures and reduction of

complications. The benefits of using US- guidance for regional blocks in pediatrics are emphasized, regarding safety and deep analgesia. There is a certain place in the literature review dedicated on the origin, paths and consequences of pain. Essential part includes the risk of insufficient pain control in pediatrics and its consequences on further emotions, reactions, responses and behavior. The modern mechanisms of pain control are presented- systemic, subsequent, complex and multimodal. Regional anesthesia techniques can modulate neuro endocrine stress responses, achieving postoperative analgesia, faster recovery and shorter hospital stay.

In the literature review, there is a detailed exposure of new regional block techniques, including the subject of this dissertation work- popliteal nerve block. This regional block is the most common one used for treating lower leg injuries in pediatrics. There is a detailed description of the anatomy of the popliteal fossa, its muscle and nerve features. Excellent knowledge about the anatomical region is conditio sine qua non in order to accomplish successful regional block. The indications, contraindications, advantages, limitations and approaches of the popliteal nerve block in pediatrics are introduced according to the internationally accepted protocols and guidelines. There is a detailed literature review of the new methods of pain control in Bulgaria and abroad for the last several years. The literature review also includes detailed discussion of various pain scoring scales in children, the incident rate, distribution and demographic characteristics of one of the most common fractures in long bones in children- those of the lower leg.

The literature review presented by doctor Elena Ivanova gives the opportunity to assign the advantages of the technique US- guided popliteal nerve block in pediatric patients with lower leg injuries- higher success rate, shorter onset, longer duration, better quality, reduced complications and also the challenge to develop and implement this technique in our clinical practice.

The assigned **goal-** „To follow and analyze the effectiveness of pain relief by US-guided popliteal nerve block in lower leg fractures in pediatrics and to compare those results with classical conventional intravenous analgesia“ is clear and followed by 5 assigned tasks:

1. To study lower leg fracture characteristics.
2. To assign indications and contraindications for performing US-guided popliteal nerve block in lower leg fractures.
3. To follow up and estimate the effect and satisfaction of the technique- subjective and objective evaluation.

4. To estimate, evaluate and follow intraoperative effect and early and late postoperative effects.
5. To suggest and implement protocol for performing and evaluating US-guided popliteal regional nerve block.

The section „**Materials, methods and technique**“ includes patients data observed during the 2 years (2018-2020) prospective study- 108 patients older than 7years with isolated lower leg fracture, with no comorbidity, scheduled for surgical treatment in UMHATEM „N. I. Pirogov“. All included patients are divided in groups according to including and excluding criteria regarding the regional technique.

The patients are divided into two groups, depending on the technique used:

Group A- 35 children (32.4%) who received US- guided popliteal nerve block.

Group B – 73 children (67.6%) who received general anesthesia.

Intraoperative evaluation includes objective criteria- hemodynamics, SaO_2, respiratory rate and subjective criteria- patients feedback and reactions.

Postoperative evaluation includes Post Anesthetic Discharge Criteria Scale, changes in heart rate, arterial pressure, SaO_2, respiratory rate and subjective evaluation- patient responses, patient reactions, surgical bleeding.

Pain levels during surgery and in the postoperative period (24h) are estimated according to objective criteria- hemodynamics, respiratory rate and subjective criteria- patients communication, pain scoring scales VAS and BOPS coherent to patients age and communication abilities.

The technique for performing popliteal nerve block, the protocol according to which this is accomplished and the card in which all patient data is registered and the effect of the method is followed are very clear, well-structured and detailed.

The next section „**Results**“ presents analysis of lower leg fracture features for the period 2018-2020., including localization, type, incident rate, demographic characteristics, age and sex variabilities, illustrated with tables and figures. Distal fractures are fourth times more often than proximal one and fractures of fibula are 67.6%. Combined fractures are the most rare-11.1%.

In a prospective study, children included in the research are analyzed according to their age, sex, injury etiology, performed anesthesia technique- 35 children (32.4%) with US-guided popliteal nerve block and 73 children (67.6%) with general anesthesia.

A detailed analysis of preoperative preparation, clinical status and history, intraoperative obligatory monitoring of hemodynamics and respiratory function

during performing regional blocks in group A, postoperative monitoring, and technique of general anesthesia in group B are presented.
Each group is illustrated with a clinical case that reveals, on one hand, a detailed overall picture of used techniques, and, on the other hand- serious attitude and participation of doctor Elena Ivanova in the process of introducing this modern analgesia technique in our practice, especially in pediatrics.
In section „**Analysis and results**“ the mean times for different procedures are presented in tables: mean time for popliteal nerve block performance- 7.30min.; mean time for operating room discharge after surgery- 4min.; mean time for recovery room discharge- 6min.; 6 patients (17.15%) in group A received premedication with fentanyl in doses 0.8-0.9mcg/kg single intravenous dose preoperatively and none of the patients in this group need additional intraoperative analgesia- they all remained calm, stable, with no subjective complaints. All results are described in figures.
During the postoperative period, there is a very good level of comfort for patients in group A- with no need of additional analgesia, 33 children (94.29%), VAS evaluation 0-2p. for a 48h period; 2 children (5.71%) needed additional analgesia- a prove for the effectiveness and analgesia duration of the applied technique. All patients in group A were early rehabilitated and dehospitalized on the second postoperative day in stable condition with no subjective complains.
Mean times in patients in group B are as follow: anesthesia induction- 13min., discharge from operating room after surgery-12min, discharge from recovery room- 10min. All patients in that group received additional analgesics and had delayed rehabilitation because of pain and discomfort. They were dehospitalized on third postoperative day. All data and results are illustrated with comparative graphic analysis.
Statistically significant difference is found in the mean times (minutes) of anesthesia induction and anesthesia emergence. There is a significant reduction in time spent in operating room and in recovery room for patients in group A compared to those in group B.
Section „**Discussion**“ presents detailed picture of the features of the US- guided popliteal nerve block. The advantages of the technique are accurately described compared to standard intravenous analgesia. There is a discussion about applied medication, sedation and local anesthetics in the course of popliteal nerve block. These results are compared to those in the literature. Significant part of the analysis made by doctor Elena Ivanova includes intra- and postoperative pain scoring scales, motor and sensory block, pain level after regional block. All

authors individual data, revealed in all stages of the research has essential role in monitoring of pain control in pediatrics. They have significant scientific and practical contribution. Another very important issue is also successfully discussed- incident rates and complications during US- guided popliteal nerve block in children. This matter has a huge practical importance for actual clinic work. Most of the presented and prove results by doctor Elena Ivanova corresponds to the literature study data.

Upon the performed study, the author outlines 5 conclusions that are completely relative to the assigned tasks and discussed problems.

I agree with the attached contributions with original, scientific-practical and confirming character.

A list of 8 publications, that fully cover the topic of the dissertation work are attached, and they reveal systematic, consistent approach in data publications in time and deep analysis with an experience accumulation.

Presented dissertation work is complete, prepared in depth, suggests a modern solution for a current issue in anesthesiology, has certain theoretical and practical contributions and covers the Regulations for presenting a dissertation work.

Based on all above-mentioned characteristics, there is a reason for me to advocate for doctor Elena Toncheva Ivanova to obtain educational and scientific degree „Doctor“.

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