OPINION
By Prof. Dr. Dora M. Tancheva, PhD
REGARDING: Dissertation by Dr. Dimcho Georgiev Genjelyev, titled "ENHANCING ADJUVANT TECHNIQUE IN PERIPHERAL NERVE BLOCKADES OF THE UPPER LIMB" for the award of the educational and scientific degree "Doctor"

Dr. Dimcho Georgiev Genjelyev's dissertation is written on 123 pages and covers the following sections: Introduction - 2 pages, Literature Review - 35 pages, Objectives and Tasks - 2 pages, Materials and Methods - 25 pages, Results - 30 pages, Discussion - 7 pages, Conclusion - 2 pages, Findings - 1 page, Contributions - 2 pages, and Bibliography - 12 pages. The dissertation includes 29 figures and 35 tables. The bibliography contains 160 sources, 4 in Cyrillic and 156 in Latin script, with nearly a third (56 publications) published in the last 10 years.

In search of the best methods for applying peripheral nerve blockades of the upper limb in terms of safety, block duration, and providing optimal conditions for surgical intervention and patient comfort, Dr. Dimcho Genjelyev systematically develops his dissertation work.

The literature review begins with a comprehensive historical overview of pain control, focusing in detail on various techniques for local pain suppression or elimination. The development and refinement of different peripheral nerve blockades over time are extensively tracked. A modern, expanded definition of pain and the importance of its removal, both during surgery and in the postoperative period, through various anesthesiological techniques and medications, are presented. The anatomical review of the nerve structures that form the brachial plexus, the areas of innervation of individual nerves, and the specific electrophysiological processes in the nerve structures are accurate and very useful, showing the author's good preparation and expertise. The literature review also covers the most widely used local anesthetics regarding their chemical structure, mechanism of action, potency, and duration of effect. The pharmacokinetic and pharmacodynamic properties of local anesthetics and possible complications arising from systemic toxicity with local anesthetics are also analyzed.

The different techniques for verifying individual nerves and plexuses, as well as various access points to the brachial plexus for performing peripheral nerve blockades of the upper limb, are discussed in great detail. Not least, the author conducts an in-depth review of different options for prolonging motor and sensory block, both regarding the technique used and the choice of adjuvants.

In the literature review, Dr. Dimcho Genjelyev emphasizes the significance of effective and prolonged pain relief through regional blockade on one hand, and on the other hand, the ongoing research of numerous researchers for the best approach to achieve this goal.

The aim of the dissertation: "To determine the place, significance, and role of the enhancing adjuvant technique in peripheral nerve blockades of the upper limb" is clearly formulated. The specific tasks set for its achievement are:

1. To track and analyze the onset and duration of the motor block in brachial plexus blockade with different adjuvants added to local anesthetics.
2. To track and analyze the onset and duration of the sensory block in brachial plexus blockade with different adjuvants added to local anesthetics.

3. To compare the effects of different adjuvants on the above parameters.
4. To track complications arising from the anesthesia.
5. To examine the average time required for performing a brachial plexus blockade with the three access methods used in the study (interscalene, supraclavicular, axillary).
6. To propose and validate a protocol for performing peripheral nerve blockades with an enhancing adjuvant technique for upper limb surgical interventions with minimal risk of complications and maximum postoperative sensory block duration.

In the Materials section, the structure of the prospective randomized study conducted from June 2020 to July 2023 is analyzed, with 200 patients undergoing brachial plexus blockade for upper limb surgery. The inclusion and exclusion criteria for the study and the distribution of patients in different groups are presented. In the Methods section, the tasks and monitoring of the preoperative preparation, pre-anesthesia, and intraoperative periods are described. The set of preoperative tests, consultations, and informed consent is outlined. The monitoring of vital signs, preparation, and technical execution of the peripheral nerve blockade under ultrasound guidance is well described. Clear descriptions of the techniques for performing interscalene, supraclavicular, and axillary blocks, depending on the location of the surgery, are presented. The motor and sensory block assessment scales, as well as the sedation scale by Ramsey, for intraoperative sedation, are also included. The timing of sensory and motor block completion in the postoperative period, and the need for additional pain relief, are registered at distinct intervals up to 24 hours postoperatively. Patients are followed for any anesthesia-related complications.

What stands out is the excellent knowledge and skillful use of modern statistical methods, allowing for the summarization and precise interpretation of study results. The detailed analysis of the statistical methods shows Dr. Dimcho Genjelyev's deep knowledge and expertise, as well as his intention to fulfill the study's tasks accurately.

In the Results chapter, a comparative demographic analysis is made between the experimental and control groups, as well as subgroups based on the adjuvant used, considering gender, age, ASA classification, pathology location, and type of surgery. No statistically significant differences ($p > 0.05$) were found in the demographic comparison, ensuring that the study was conducted properly and the results are valid. The intraoperative data show the number and percentage of the three access methods used for peripheral brachial plexus blockade in the different groups, with no statistically significant differences. In analyzing the time to perform different types of peripheral nerve blocks, it was found that the axillary block took the longest (average 9.00 min, SD 1.21), with statistically significant differences. A comparative analysis of the intraoperative complications related to anesthesia showed no statistically significant differences ($p > 0.05$).

Statistical analysis of the results for motor block onset in the different groups showed a statistically significant difference. The fastest onset of motor block occurred in the DEX subgroup (dexamethasone) with an average of 6.64 min (SD 0.96), while the slowest was in the CLO subgroup (clonidine) at 9.41 min (SD 1.16). Similarly, a statistically significant difference was found in sensory block onset time, with the sensory block occurring fastest in the DEX subgroup at 5.07 min (SD 0.91) and slowest in the control group at 8.67 min (SD 0.96).

The analysis of motor block duration revealed statistically significant differences between the experimental and control groups and among the subgroups with adjuvants. The average

duration in the experimental group was 637.81 min (SD 140.54), compared to 414.88 min (SD 60.35) in the control group ($p < 0.05$). The longest motor block duration was in the DEX + DMM (dexamethasone + dexmedetomidine) subgroup at 798.50 min (SD 110.79), and the shortest was in the CLO subgroup at 511.63 min (SD 47.84). A similar pattern was found in the sensory block duration, with the longest block in the DEX + DMM subgroup at 1002.25 min (SD 148.44) and the shortest in the CLO subgroup at 565.25 min (SD 45.95).

Comparative results for the need for additional pain relief showed that significantly fewer patients in the experimental group required extra pain relief compared to the control group at different postoperative intervals.

No postoperative anesthesia-related complications were observed in patients from both groups.

All data in the in-depth statistical analysis are well illustrated in tables and graphs.

In the Discussion chapter, the advantages of ultrasound-monitored regional anesthesia over standard drug pain relief are presented in detail. The significance of preoperative preparation in determining the success of the anesthesiological technique is emphasized. A thorough analysis of different techniques for performing upper limb peripheral nerve blocks is provided. The use of ultrasound navigation for optimal and safe local anesthetic application and ensuring patient and surgical team comfort is highlighted. The analysis of block duration shows the significant advantage of using an adjuvant over a pure local anesthetic. The results are compared to other modern publications. A significant part of the study is the analysis of comfort achieved and the substantial reduction in the need for additional pain relief depending on the adjuvant used in different postoperative intervals.

The observed intraoperative complications align with those reported by other authors. The results and in-depth analysis match findings from several contemporary studies.

Based on this comprehensive study, the author creates a protocol for anesthesia planning and execution in upper limb surgery, following current trends in modern regional anesthesia techniques.

The dissertation concludes with 8 findings that fully align with the set tasks and thoroughly developed issues.

I agree with the confirmatory and scientific-practical contributions presented by the author. A list of 5 publications covering the dissertation topic, showing both systematicity and consistency in publishing results over time, is included.

The dissertation is well-prepared, provides a modern solution to intraoperative anesthesia in anesthesiology, has significant scientific-practical contributions, and meets the requirements for such works according to the Law on the Development of Academic Staff in the Republic of Bulgaria (ZRASRB).

Given all the above, I strongly support the defense of the dissertation titled "ENHANCING ADJUVANT TECHNIQUE IN PERIPHERAL NERVE BLOCKADES OF THE UPPER LIMB" by Dr. Dimcho Georgiev Genjelyev and fully support the awarding of the educational and scientific degree “Doctor.”

03.12.2024
Reviewer:
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