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Anesthesiology education: A discussion on the current reform for training in the hypoxic environment of the highlands of China

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In recent decades, great changes have taken place in the anesthesiology of China in anesthesia equipment, anesthesiology theory of basic, clinical research, and clinical anesthesia technology. Despite this, there is still a shortage of doctors with higher medical education in anesthesiology, which is also a major problem facing for anesthesia discipline of China, especially in Tibet, Xinjiang, and Inner Mongolia and other regions. Due to the high cold and low oxygen environment in the Tibet Autonomous Region, the development of medical education is backward, especially anesthesia medical education. With the improvement of anesthesia medical technology, we should continue to optimize and reform the local anesthesia medical teaching methods, so as to make substantial reform of anesthesia medical education in Tibet. This paper discusses the main problems in anesthesia medical education and clinical anesthesia in Tibet, as well as its reform ideas and methods. It aims to improve the level of anesthesiology education in Tibet, so as to improve the clinical professional ability of doctor anesthesia, and then better benefit to the local people.

Highlights

- Anesthesiology education in Tibet is lagging behind, and clinical anesthesia needs to be improved.
- To improve the overall quality of anesthesiology teachers in Tibet is beneficial to the development of local anesthesiology.
- Improving the teaching ability of anesthesiologists not only promotes the improvement of the independent learning ability of young doctors, but also lays a solid foundation for the smooth development of clinical work.

KEYWORDS

anesthesiology education, Tibetion Plateau, hypoxic highlands, training, anesthesiologist

Introduction

The Tibet Autonomous Region is located in the southwest of the Qinghai-Tibet Plateau, with an average altitude of over 4,000 m. Due to its objective conditions and geographical environment (high altitude hypoxic environment) and other factors, the development of medical education in Tibet is restricted, especially the development of anesthesia education in Tibet. With continuous development in medical technology for use anesthesiology, the continuous change of the concept of anesthesia work, and the continuous improvement of the quality of anesthesia work, the author has

explored and thought about the reform of anesthesiology education in Tibet based on years of clinical work and teaching experience.

The main problems in the education of anesthesiology and clinical anesthesia work in Tibet

Anesthesiology education is lagging behind, anesthesia professionals are lacking, and the subspecialist anesthesiologists is inadequate with reference to professional knowledge

There is a shortage of anesthesiology education teachers in the Tibet Autonomous Region. Most of the young anesthesiologists are taught by the anesthesiologists in the hospitals where they worked in. And they are trained in the form of "old leading the new." Even some of the anesthesiologists in the hospitals, who were originally surgeons, obstetricians, and gynecologists, or even general practitioners, were sent by their hospitals to the superior hospitals for further training in the department of anesthesiology for 6–12 months. Then they return to their hospitals for switching to the specialty of anesthesia or for part-time jobs.

Although they have rich clinical experience, who were not majored in anesthesiology, they had not studied anesthesia related knowledge systematically and lack relevant clinical anesthesia experience. This also leads to the anesthesia medical education of "old leading the new" is still imitating the model of the medical education.

The teaching materials and tutoring materials do not highlight the characteristics of the Tibetan Plateau Region

Tibet is an alpine and hypoxic region, and the incidence of diseases has its own unique local characteristics. In the textbooks and teachings compiled uniformly across the country, the characteristics of related diseases in the Tibetan Plateau Region are not highlighted. Therefore, teachers of professional courses will also encounter great difficulties when teaching professional courses.

Anesthesiologist staff shortage

Studies have indicated that the allocation of anesthesiologists in tertiary general hospitals is seriously unreasonable (Duan et al., 2014). And anesthesiologists are an unpopular career choice compared to other professions, which is directly related to their lower earning potential than other professions. In addition to this, it is believed to be related to the lower prestige associated with anesthesiologists, who are not directly involved in patient management on the ward, so clinical anesthesia work is seen as "work that nurses can do"(Brouillette et al., 2017). Hence, the post of anesthesia nurse was derived (Vreede et al., 2019). Unlike anesthesiologists, nurse anesthetists cannot perform patient-related invasive procedures because they are not licensed as physicians. Such as tracheal intubation, arterial puncture, central venipuncture, spinal anesthesia, et al. They mainly perform perioperative monitoring and initial management of patients under the guidance of anesthesiologists. In spite of this, nurses anesthetists account for more than 50% of the medical staff in my department and play a very important role in clinical anesthesia. As far as I know, this situation also exists in some low-income and middle-income countries.

The difference of anesthesiology education between the remote areas of Tibet (except Lhasa) and the mainland of China

New doctors start performing anesthesia by training in the form of "old leading the new" to become an anesthesiologist in the local area.

However, in mainland of China, all new medical clinicians with bachelor's degree or above are required to receive standardized resident training. The specific mode is "5+3+2" mode. "5" refers to medical undergraduates, who need to complete 5 years of medical college education. "3" means that medical graduates receive 3-year medical practical training in medicine, surgery and clinical anesthesia, as resident doctors in the accredited anesthesia professional training base(hospital), which focusing on the cultivation of clinical diagnosis and treatment ability (People's Daily, 2015). "2" means that doctors, who have obtained the standardized training certificate for resident doctors, receive 2-year subspecialty medical practice training in the accredited anesthesia professional training base(hospital) as specialists, such as cardiovascular anesthesia, pediatric anesthesia, and advanced general anesthesia, which focusing on the cultivation of clinical subspecialty diagnosis and treatment ability.

During the training, they must obtain the corresponding qualification certificate. After the above training, they can become an anesthesiologist who can administer anesthesia independently. But this is not the end of learning, continuing medical education every year will last all the lifetime.

Thoughts and methods of anesthesiology education reform in Tibet

Changing concepts and improving teaching methods

Clinical anesthesia work has changed from the traditional "one-shot injection" to "perioperative patient safety management." First of all, anesthesiologists must have a new understanding of the concepts of clinical anesthesia work, doctor-patient communication, and perioperative patient management, and fully cooperate with the reform of anesthesiology teaching. Secondly, the teaching methods of traditional anesthesiology should be reformed, and more relevant and practical courses should be set, and on this basis, the teaching, interval, and internship time should be strengthened. This will make undergraduates have a strong interest in anesthesiology, shorten the time of students' knowledge of anesthesiology, and increase their interest in learning; internship during undergraduate study can not only solve the problem of disconnection between theory and clinic, but also broaden students' clinical thinking ability. This teaching method is not only suitable for students from the mainland, but also more suitable for students from Tibet.

Strengthen the construction of faculty and improve the professional level of teachers

In the teaching of medical colleges, in addition to the previous teaching of basic theoretical knowledge, we must also pay attention to

the teaching mode that focuses on the cultivation of clinical practice ability. Only such a teaching reform can meet the needs of the development of modern anesthesiology. In order to cultivate qualified practical anesthesiologists in the new century, we must have a team of high-quality teachers.

In order to make up for the lack of local anesthesiology teachers and the phenomenon of low education, excellent doctors are sent out for advanced studies with high degree and high level by adopting the method of "inviting in, sending out, and keeping" (Zhiying, 2004). We can also recruit senior anesthesiologists with high education and titles and rich clinical experience from the mainland on favorable terms.

Through the method of further education, it can improves the phenomenon of disconnection between theory and clinical work, and also improve the professional level and teaching quality of teachers to a certain extent.

Improving the overall quality of anesthesiology teachers

Cultivation of professional ethics

Anesthesiologists should educate young doctors in their daily teaching and clinical anesthesia work to always maintain a loving heart and treat patients as their own relatives, reduce patients' pain to the greatest extent possible, and promote early recovery of patients. And always guide the young doctors to establish a good professional ethics of love, dedication, diligence, precision and devotion by their own words and actions.

Cultivation of theoretical knowledge of anesthesiologists

Anesthesiologists should continuously consolidate their professional knowledge in their daily work. In addition, they should also regularly participate in continuing medical education activities certified by professional institutions (including online training, videos, lectures, etc.), through which to maintain their own business proficiency (Narouze et al., 2012). In modern society, online learning is becoming more and more popular. And e-learning is increasingly recognized as facilitating learning, and although it has not proven to be better than traditional teaching methods in terms of knowledge acquisition, it can provide a rich curriculum for learners and be available at almost any time and any place (Ramlogan et al., 2021).

Cultivation of clinical anesthesia operations

Modern anesthesiology requires anesthesiologists to be proficient in all basic anesthesia operations, so anesthesiologists need to mobilize young doctors' enthusiasm and initiative as much as possible and stimulate young doctors' sense of active participation. In teaching, young doctors are allowed to practice continuously on models and perform specific operations on patients in clinical anesthesia work. At the same time, simulation teaching courses such as crisis resource management (Burden, 2020) can be used to improve the ability of young doctors to deal with various kinds of problems they may encounter in clinical anesthesia work, and also to improve their emergency handling ability.

Cultivation of perioperative emergency ability

In clinical anesthesia work, in addition to the management of common perioperative diseases (coronary heart disease, abnormal liver and kidney function, stab wounds, etc.) and special events (anaphylaxis, hemorrhagic shock, sudden cardiac arrest, etc.), anesthesiologists should also prepare auxiliary teaching materials or manuals to teach young doctors the knowledge of emergency management of some plateau diseases, taking into account the characteristics of the low oxygen environment on the Tibetan plateau For example For example: ① Tibetan region is cold and hypoxic with dry and windy climate, therefore, water evaporates faster in human body, plus Tibetan compatriots have the habit of drinking alcohol, which leads to much higher water loss in skin and respiratory tract than in the mainland, so it is necessary to keep in mind that calculating the amount of fluid rehydration for patients in the perioperative period is different from that in the mainland. ② Some studies have shown that because the water in Tibetan areas is rich in minerals (Zhang and Yun, 2019). Therefore, for patients who develop acidosis in the perioperative period, it is necessary to be cautious when applying alkaline fluids for correction, and to shorten the interval between arterial blood gas analysis and closely observe the changes of the patient's internal environment. ③ Because of the low oxygen environment of the plateau in Tibetan area, compared with the plains in the mainland, people's blood is viscous and the hemoglobin, platelets and red blood cells in human body will be abnormally increased (e.g., the normal range of hemoglobin is 120–160 g/L, and the hemoglobin value of residents in the plateau area is more than 180 g/L; Wang, 2020). Therefore, the judgment of bleeding volume and anemia of patients in the perioperative period needs to be different from that of the mainland.

> As a result of the hypoxic drive i.e., low O2 partial pressure → hypoxia → kidneys → increase EPO → increase in erythropoiesis in the bone marrow (Bai et al., 2022; Zhang et al., 2022), people who live in the plateau environment for a long time have viscous blood, which leads to their chances of developing hypertension, hypercardia, coronary heart disease, cerebrovascular accidents, and other diseases are much higher than those in the mainland. Therefore, for the management of such patients in the perioperative period, it is necessary to strengthen the monitoring of vital signs, especially the management of blood pressure, to avoid the risk of cerebral infarction due to low blood pressure.

Cultivation of professional competencies of anesthesiologists

In teaching, anesthesiologists should not only focus on the teaching of theoretical knowledge, but also strengthen the bedside teaching of clinical anesthesia, and they also need to pay attention to the cultivation of clinical practice ability. While educating young doctors to establish the consciousness of lifelong learning, only when young doctors master the ability of self-acquired knowledge can they benefit from it for a lifetime. While teaching the young doctors the theoretical basis of clinical sciences and competencies in clinical practices, it is important for anesthesiologists to teach critical thinking and problem solving related to emergency clinical presentations in the highlands.

Strengthen anesthesia training and expand clinical thinking

Young doctors still need to constantly update their knowledge and improve themselves after they take up their jobs. In addition to the usual strengthening of clinical anesthesia skills, they also need to attend more teaching activities such as difficult case discussions, death case discussions, etc., to continuously learn from the experience of others. In addition,

anesthesiologists need to change their identity perspective and understand the interests of young doctors. Therefore, anesthesiologists also need to focus on the training of anesthesiologists on doctor-patient communication and language expression skills. Especially, Tibetan doctors have poor language expression ability, thus they can adopt various educational activities, such as preoperative discussion of cases, role-playing, anesthesia protocol development, and emergency rescue drills to strengthen the language communication between doctors and patients (Wong, 2012). This will not only enable young doctors to continuously exercise and improve their language skills, but also lay the foundation for independent clinical anesthesia work in the future.

Conclusion

In summary, medicine is a practical science, which requires not only solid theoretical knowledge, but also rich clinical experience and practical ability. Clinical anesthesiology is very practical, and it is directly related to medical safety (Chen, 2019). It is the only way to improve the teaching ability of anesthesiologists. Only by continuously improving the teaching ability of anesthesiologists can we promote the independent learning ability of young doctors and lay a solid foundation for the smooth development of clinical work. Only through continuous teaching optimization and reform can the quality and effectiveness of teaching be improved. Especially in plateau areas like Tibet, we should combine the characteristics of highland hypoxic medicine, and then make corresponding improvements. In conclusion, only by actively exploring, boldly practicing and figuring out a path of modern anesthesiology teaching reform suitable for Tibetan reality can we cultivate practical talents with innovative spirit, innovative ability, and comprehensive implementation of clinical anesthesia. In order to meet the needs of modern new anesthesiology—perioperative medicine, so that the cause of anesthesiology in Tibet can be developed faster, and then better benefit the people in Tibet.

Author contributions

HC helped with substantial contributions to the conception and design of the work, the analysis and interpretation of the data, and wrote the manuscript. LZ helped with implementing the study. ZW helped with the analysis and interpretation of the data for the work, and editing the manuscript. JC helped with the acquisition of the data for the work. WZ and TZ helped edit and revise the manuscript critically for important intellectual content and final approval of the version to be published. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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