

Analysis of Clinical Teaching Difficulties and Countermeasures in Vascular Interventional Surgery

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Abstract: Vascular interventional surgery, as a key branch in the continuous progress of modern medicine, mainly carries out the diagnosis and treatment of related vascular diseases through minimally invasive surgical methods and thus puts forward higher requirements for clinical teaching in this field. Combined with the actual situation of clinical teaching of Vascular interventional surgery at the present stage, it faces various challenges and difficulties, and the effect of knowledge teaching is unsatisfactory. Based on the analysis of the main difficulties in the teaching of Vascular interventional surgery are technical complexity, practical difficulty and equipment dependence. This study proposes targeted innovative countermeasures, aiming to provide a reference for improving the clinical teaching of Vascular interventional surgery.

Keywords: Vascular interventional surgery; Clinical teaching; Teaching difficulties; Innovation

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1. Introduction

With the rapid development of medical technology, the application of vascular interventional surgery has become more and more extensive, and its therapeutic effects in cardiovascular and cerebrovascular diseases, peripheral vascular diseases and many other vascular-related diseases have been significantly recognized. However, interventional surgery usually requires advanced surgical equipment and highly refined operating skills, which makes it more difficult for clinical teaching in this field. First, surgical operations require not only profound theoretical knowledge, but also exquisite operating skills and clinical judgment, but for beginners, it is more difficult to learn this highly specialized and technical field, and they need to receive more guidance and practice opportunities during the learning process. Secondly, vascular interventional surgery often relies on angiography and other specialized interventional tools, the purchase cost and maintenance requirements of these advanced medical equipment limit their popularity in clinical teaching, coupled with patient safety considerations, making it difficult for students to obtain sufficient hands-on opportunities in the initial learning stage, increasing the difficulty of the teaching process. For this reason, it is necessary to implement targeted

teaching countermeasures to overcome the difficulties in clinical teaching of vascular interventional surgery and ensure the effective improvement of students' specialized knowledge and practical ability in vascular interventional surgery.

2. Current status of clinical teaching in vascular interventional surgery

As an important branch of the medical education system, clinical teaching of vascular interventional surgery is mainly divided into two major parts: theoretical teaching and practical operation. Among them, theoretical teaching, as the foundation of teaching, provides students with the necessary basic medical knowledge and professional theory support. The theoretical teaching content often centers on the basic knowledge of vascular interventional surgery, surgical techniques, pathology, pharmacology and the latest research progress. During the teaching process, traditional classroom lectures are usually used, i.e., textbooks, medical literature and case studies are used as the main teaching tools to ensure that students can master the basic concepts and operating principles of vascular interventional surgery by imparting a large amount of theoretical knowledge^[1]. However, relying solely on the transfer of book knowledge has certain limitations. Firstly, the knowledge and technology in the field of vascular interventional surgery are updating rapidly, and it may be difficult to cover the latest medical techniques and treatments by only relying on traditional textbooks. Secondly, the theoretical teaching is too abstract, for beginners, it is difficult to understand the complex surgical techniques and clinical operation essentials only through the book knowledge, obviously cannot meet the requirements of the development of clinical education in the context of the new curriculum reform, and it is necessary to implement a large number of practical teachings to enhance the students' job competence.

Practical teaching in vascular interventional surgery mainly includes clinical internship, apprenticeship and situational simulation, etc. These practical activities make up for the inadequacy of theoretical teaching. Through direct participation in clinical work, students can gain valuable practical experience. In the clinical internship stage, students have the opportunity to directly observe and participate in the diagnosis and treatment process of patients, and learn how to analyze medical records, formulate treatment plans, and perform some basic medical operations under the supervision of the teaching staff, which helps them to apply their theoretical knowledge to practice and cultivate their clinical thinking and decision-making ability. Apprenticeship is a more in-depth form of practical learning and is usually arranged in students' senior years. During the apprenticeship, students have more opportunities to participate in interventional surgical work, through direct observation and learning the operation skills of advanced vascular interventional surgery, so as to obtain the development of clinical professional skills. Contextual simulation is a teaching method that has received more and more attention in the field of clinical education in recent years. Through the implementation of experiential teaching by using advanced simulators and virtual reality technology, students are allowed to practice operations in simulated surgical environments to familiarize themselves with a variety of surgical procedures and techniques, which not only helps students apply their theoretical knowledge to practice but also better cultivates their clinical thinking and decision-making abilities.

3. Analysis of clinical teaching difficulties in vascular interventional surgery

3.1. Technical and operational complexity

Vascular interventional surgery is an extremely demanding medical operation that requires not only highly refined operating skills, but also an in-depth understanding of the complex vascular system of the human body, making it a great challenge for beginners to master these skills. Interventional procedures often require the use

of minimally invasive devices such as catheters, stents, and balloons to perform precise operations within the blood vessels, especially when a limited field of view and relying only on image guidance, the doctor must be required to have a very high degree of operational precision and hand coordination to complete the surgical operation. Thus, students are required to have to learn how to navigate the complex vascular network and to maintain precise control over the instruments. This also requires students to learn how to navigate through complex vascular networks and maintain precise control of the instruments, which not only poses a technical challenge to students, but also tests their spatial perception and mental ability. The learning curve in vascular interventional surgery is steep, in part, because it involves not only extensive theoretical knowledge but also complex surgical techniques ^[2]. The acquisition of theoretical knowledge provides students with the necessary background knowledge, but to truly master practical skills requires gradual accumulation in practice. Therefore, for beginners, every step from basic vascular operations to complex interventional procedures requires a lot of practice. Not only do they have to face the challenges of operating skills, but also learn how to make fast and accurate decisions in complex or emergencies, because any small mistake in interventional procedures may lead to serious consequences, and all students need to remain calm and focused under high-pressure environments. They are required to be not only skillful but also have good psychological quality and emergency handling ability. With the continuous development of modern medical technology, new surgical techniques and methods are constantly emerging, which requires students to constantly learn and adapt to keep up to date with the latest medical technology, thus making it doubly difficult to master all the practical knowledge within the limited study time.

3.2. Equipment and resource constraints

Imaging equipment, specialty catheters, stents, balloons, and other specialized surgical tools and materials required for high-end interventional procedures are often expensive. All teaching hospitals can afford the high cost of such equipment, especially in resource-limited regions or small healthcare organizations, and the lack of such critical equipment not only limits students' opportunities for high-quality hands-on teaching but also limits their ability to access and learn the latest medical technologies and methods. In addition, the inability of students to gain sufficient hands-on experience in resource-limited teaching environments not only limits their mastery of interventional surgical techniques, but also affect their performance in their future careers, or even lead to a disconnect between theoretical knowledge and practical skills ^[3]. In conclusion, equipment and resource constraints are a major challenge to clinical teaching in vascular interventional surgery, and the solution to this problem requires more financial resources and innovative teaching strategies to ensure that students can gain the necessary hands-on experience and understanding of advanced medical technologies.

3.3. Difficulty in acquiring practical experience

The inherently high-risk nature of interventional procedures and the extremely high priority towards the patient's safety make the opportunity for students to be directly involved in procedures in a clinical setting very limited. The operating room is an environment that requires a high degree of precision and control, and any minor errors in surgical procedures can have serious consequences. As a result, there are significant limitations for beginners to participate directly in complex interventional procedures, with few opportunities to improve surgical skills and clinical judgment through direct practice. Although theoretical teaching can provide the necessary medical knowledge, the lack of hands-on experience poses an obstacle to students' understanding of the entire interventional procedure and clinical decision-making process, thus preventing them from effectively translating academic knowledge into practical operative skills, with the direct consequence that after completing

their studies and entering their professional careers, it takes them longer to adapt to the real-world clinical environment and to obtain additional guidance and support before they can operate at a fully independent level.

4. Analysis of countermeasures to improve the quality of clinical teaching in vascular interventional surgery

In response to the above problems, this paper proposes the following countermeasures:

4.1. Innovative teaching models

4.1.1. PBL teaching model application

Problem-Based Learning (PBL) is a modern teaching model that is student-oriented and teacher-oriented. The PBL teaching model guides students to actively participate in the learning process by taking the overall case diagnosis and treatment process as a precursor to the specific problem. Under this teaching framework, the whole process of teaching through questioning, hypothesizing, collecting information, arguing hypotheses, and summarizing is aimed at developing the students' comprehensive abilities and improving them. In the PBL model, the teacher is no longer the knowledge transmitter in the traditional sense but changes his role to a guide and facilitator, while the student becomes the leader of the learning process, prompting students to learn in an interactive and collaborative environment through exploration and discussion, which not only effectively enhances the interest and participation in learning, but also allows for a more in-depth understanding of the course content. Especially in the vascular interventional surgery clinical teaching education, PBL teaching method can make students establish an effective connection between theory and practice by simulating real clinical scenarios, which can significantly improve students' clinical thinking and clinical processing ability, help students develop the habit of lifelong learning, promote the development of students' critical thinking and problem-solving ability, and strengthen students' teamwork and communication skills.

4.1.2. Application of the CBL teaching model

Case-Based Learning (CBL) teaching method is based on typical cases, centering on specific teaching objectives, providing students with specific case situations, simulating real clinical scenarios, and guiding students to use the theoretical knowledge they have mastered to analyze and solve problems through independent thinking and group discussion. In the practice of CBL teaching in vascular interventional surgery, students are allowed to collect the patient's medical history first, then simulate real diagnostic scenarios through group discussion under the guidance of the teacher to diagnose and identify the disease, and finally formulate treatment plans. In the CBL teaching practice of vascular interventional surgery, by allowing students to collect the patient's medical history first, then simulate the real diagnosis and identification of the disease through group discussion under the guidance of the teacher, and finally formulate the treatment plan^[4]. This active learning process can fully stimulate the student's interest in learning, enhance their independent thinking and problem-solving ability, make the learning process more exploratory and active, and gain a deeper understanding of the diagnosis of the disease, the process of treatment, and the surgical decision-making, to better cope with the various challenges in clinical practice.

4.1.3. PBL combined with CBL teaching model application

PBL combined with CBL teaching method is a student-centered, case-led, innovative teaching mode that closely integrates theoretical knowledge with clinical practice. In the teaching of vascular interventional surgery, the scientific application of this comprehensive teaching mode makes the teaching process more practical and

attractive, more likely to resonate with the students, effectively promotes the students' independent learning and practical ability training, helps the students to accept their future professional roles, and thus significantly improves the student's learning motivation. In the process of the discussion, the students not only pay attention to the symptoms of interventional vascular techniques, but also should analyze the relationship between special factors and multiple etiologies in detail, to obtain logical and clinical thinking in the process. This can promote the consolidation of theoretical knowledge based on the cultivation of logical thinking, helping them to master the relevant clinical skills in a more comprehensive way while improving their adaptability and innovation ability in clinical practice, thus laying a solid foundation for their future medical practice ^[5].

4.1.4. Other teaching methods

In addition to PBL and CBL, the use of virtual reality (VR) and simulator technology is also an effective means of enhancing the quality of teaching and learning. VR and simulators provide a low-risk environment in which students do not need to be directly involved in patient interventional vascular surgical procedures, but rather only practice surgical procedures in simulated scenarios to gain increased technical proficiency and reduce the risk of patient surgical procedures.

4.2. Strengthening teacher training

Teachers are the key to the quality of teaching and are essential to improving the quality of teaching. Teachers not only need to have solid professional knowledge and rich clinical experience, but should also be familiar with the latest educational technology and teaching methods. Through regular professional training and seminars, teachers can constantly update their knowledge base, understand the latest medical technology development, and master the application of the latest technology, so that they can implement education and teaching with the most cutting-edge educational concepts to improve the effectiveness of teaching and learning in the practice of clinical education.

4.3. Increase opportunities for clinical practice

To effectively improve the quality of clinical teaching in vascular interventional surgery, the learning process should establish a close cooperative relationship with hospitals to provide more opportunities for clinical medical students to observe and participate in real surgeries. For example, allowing students to observe real surgeries and participate in surgeries under the supervision of specialized physicians helps students understand complex surgical procedures and improve their surgical skills. In addition, through hands-on experience, students can gain a more in-depth understanding of the various aspects of interventional surgery, including preoperative preparation, surgical operation, postoperative management, etc. This enables them to gain valuable clinical experience under the supervision of specialized physicians, thus effectively enhancing their practical skills and laying a solid foundation for them to become skilled interventional vascular surgeons in the future ^[6].

4.4. Promoting the sharing of educational resources

In order to alleviate the limitations of equipment and resources in some teaching hospitals, hospitals need to establish educational alliances or cooperative networks to effectively promote the sharing of educational resources, and improve the efficiency of the utilization of teaching resources through the sharing of teaching materials, research results, teaching methods, and best practices, making it possible for even hospitals that are relatively resource-poor to have access to high-quality information on advanced medical technologies, clinical case studies, and innovative teaching methods. In addition, resource sharing facilitates the exchange of knowledge and experience among different institutions, enabling students to gain a wider range of learning

perspectives and practice opportunities, thus enhancing their clinical skills and professional knowledge comprehensively, and thus rapidly growing into new-age integrated medical talents.

5. Conclusion

The complexity of vascular interventional surgery teaching, equipment and resource constraints, and the difficulty of acquiring hands-on experience are key issues that need to be addressed in the current education system. To actively address this challenge, innovative teaching modes such as PBL, CBL, and the combination of VR and simulators have been implemented to achieve the goal of effectively increasing students' interest in learning, facilitating the integration of theory and practice, and enhancing students' clinical thinking and operational skills. At the same time, there is a need to further increase faculty training, establish close partnerships with hospitals to increase students' clinical practice opportunities, and promote the sharing of educational resources to train more interventional vascular surgeons with high-quality and comprehensive skills, thus providing patients with better healthcare services and promoting the development and advancement of the entire medical field.

Disclosure statement

The authors declare no conflict of interest.

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