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Original Articles

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ORIGINAL ARTICLE

Establishing Zhaoqing Medical Service System to Build the Guangdong, Hong Kong, and Macao Health Community

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Abstract: The construction of the Guangdong, Hong Kong, and Macao health community is not only an inherent requirement for the economic development and social progress of the Pearl River Delta region, but also an inevitable requirement for the realization of the healthy China strategy and the internationalization and modernization of medical and health care in the three cities. This article discusses answers to issues related to the Guangdong, Hong Kong, and Macao health community. It takes the construction of Zhaoqing medical service system in Guangdong Province as an entry point.

Keywords: Zhaoqing Community; Medical Service System; Guangdong, Hong Kong, and Macao; Sanitation and Health; Community

With the rapid development of China's regional economy, a partial, spontaneous, and non-institutional cooperation between Guangdong, Hong Kong, and Macao on sanitation and health is no longer sufficient. Although it shows an institutionalized development trend, it has not yet achieved the institutional cooperation stage. There is not yet a cooperative result of the breakthrough or comprehensive system[1]. Under the new situation, Guangdong, Hong Kong, and Macao should actively promote the free flow of health resources with a broader market to realize the optimal allocation of health and medicine resources. This paper talks about some thoughts on ways to build a community medical service system in Zhaoqing to push the development of health and wellness community in Guangdong, Hong Kong, and Macao.

1. Problems in Zhaoqing community medical service system

1.1 Low credibility

In the traditional medical and health system, community residents do not have a fully understood about the basic medical services of public health institutes, so they do not trust these medical and health service institutions. The traditional medical concept is deeply entrenched. Once they got sick, many will choose to go to large hospitals for treatment, resulting in the inability of community health service institutions to fully perform their functions.

1.2 The overall qualification of the staff is insufficient

The overall qualification of health technicians in Zhaoqing community health service institutions is low. The education level and professional skills of the staff are not at the same level as large hospitals. Because of the lack of perfect protection mechanisms, well-educated health technicians with professional titles can not be effectively promoted in community health service institutions. The proportion of personnel officially recruited in the health and personnel departments is rela-

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-tively small, and the identity of technical personnel is not clear, which greatly affects the enthusiasm of the staff.

1.3 Lack of a perfect system

At this moment, most of the grassroots health service institutions in Zhaoqing community are privately invested, and there is no complete institutional system, operation mechanism, and perfect management system, which has caused the work of community health services to be limited everywhere. The health service function is restricted, and the service capacity and conditions are not kept abreast of the times. The basic health and health needs of local residents cannot yet be effectively met, which directly hinders the pace of construction of the health community in Guangdong, Hong Kong, and Macao[2].

2. Establish Zhaoqing medical service system to build the Guangdong, Hong Kong, and Macao health community

2.1 The government should focus on promoting the systematic development of ecological medicine

Yibin Hou, the former member of the Standing Committee of Zhongshan City, said: "In the process of the construction of the primary health care industry in Guangdong, Hong Kong, Macao, and the Greater Bay Area, in the overall reform of the national MAH regulatory policy and regulatory system, all parts of Guangdong should actively seize the opportunity with constant improvement of the environment and service level, so as to promote the healthy and fast development of the health and wellness industry." First of all, we must focus on optimizing the service system, accelerating the systematic construction of bio-medicine based on CSO, CMO, CRO, CDMO, etc., to promote health and wellness development. The cause is developing in the context of industrialization and digitization that focuses on optimizing the development environment to lay a solid foundation for the construction of the health and wellness community in Guangdong, Hong Kong, and Macao[3,4]. Second, it is important to promote the development of medical innovation. As one of the most representative communities in Guangdong Province, Zhaoqing Community has always been ahead of other grassroots communities in health and wellness. In order to continuously improve the quality of health and wellness, Guangdong, Hong Kong, and Macao should focus on forming synergies and establishing relevant scientific research institutions. The three cities should actively build a public technology research and development platform in cooperation to form a high-quality scientific research and innovation team. Besides, creating their innovation strength and giving full play to the advantages of financial capital are also crucial. In addition, based on the actual situation, preferential policy documents are needed to promote various preferential policies toward medical devices, bio-medicine, and grassroots special medical services. Financial incentives should be provided for the implementation of high-quality projects in the community, technological transformation, and expansion to continuously improve the construction of basic medical and health infrastructure.

2.2 Adhere to the community demand oriented principle and fully integrate health service resources

With fully respect for the government's dominant position, grassroots communities must improve the structure of health resources, the level of health resource allocation and the efficiency and level of resource utilization[5]. In addition, in the process of building the Guangdong, Hong Kong, and Macao health and wellness community, attention must be given to the guidance and encouragement of private medical institutions to build a strong brand effect, high management level, strong reputation, and excellent service atmosphere. It is necessary to include them in the community health service system based on policy and financial support. In addition, it is also demanded to pay attention to innovative financing channels with more social capital investment, manpower, and material resources in community health services.

2.3 Strengthen operation and management to improve the quality of community health and wellness services

With the implementation of the healthy China

strategy, China has attached great importance to the development of grassroots medical and health care. Zhaoqing community should insist on providing good services to gain the trust of community residents and breaking new ground in the development of grassroots medical and health care[6]. First, it is recommended to provide high-quality, efficient, and professional community medical services. As we all know, grassroots community health and wellness institutions are set to provide medical services such as medical care, health care, health education, and family planning for community residents. With the social progress and economic development, people's demands for medical and health services is increasing every day. Zhaoqing community and other grassroots health service institutions should insist on advancing with the times, better management models and methods, optimizing business activities that do not match the health needs of people and economic development. Therefore, it will be possible to stimulate the internal driving force of community health and wellness to speed up the construction of the health community of Guangdong, Hong Kong, and Macao.

2.4 Innovation performance assessment and evaluation system

The quality and level of community medical services in Zhaoqing is directly related to the level of local medical and health development. Its importance is self-evident. At this stage, it should actively improves the community health care and security system to build a comprehensive performance evaluation mechanism, and a revenue and expenditure mechanism. It is also necessary to adopt the innovative double-line management system of service and revenue & expenditure, so as to continuously improve the standardization of the operation of financial revenue and expenditure. As shown in **Figure 1**, the modern advanced DRG management platform can be introduced into the system. With the help of modern professional financial management computer software systems, it can comprehensively improve the quality and efficiency of fund management and decision-making[7,8]. Second, attention needs to be paid to strengthen the management of fund revenues and expenditures to ensure a fair, transparent, open, and democratic management of fund revenues and expenditures. It is also crucial to optimize the performance appraisal mechanism with full play to the leverage of fund management and utilization. Last but not least, the community has to focus on improving the overall quality of health technicians by raising the threshold for staff access and introducing high-quality professionals.

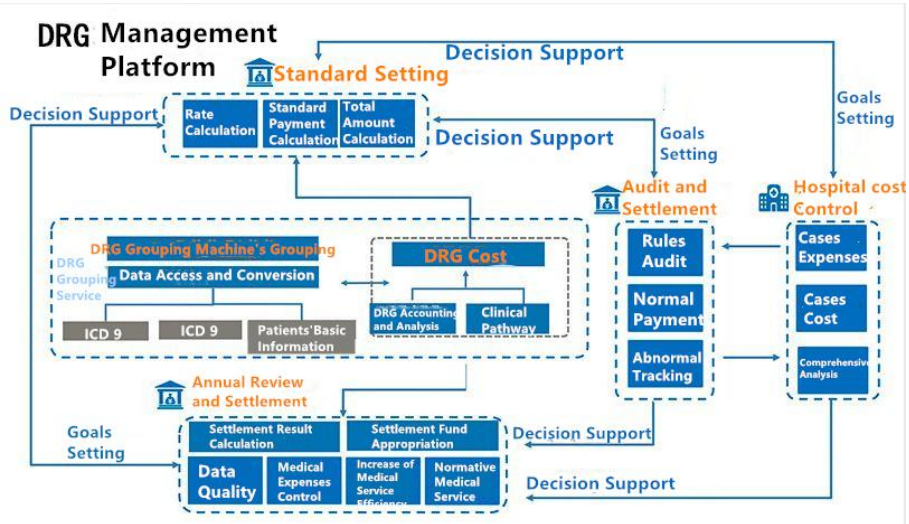

Figure 1. Operation process of assessment of diagnosis and treatment performance on the DRG management platform.

3. Conclusion

With the implementation of the healthy China strategy, the primary health care system is playing a more and more important role in meeting people's health needs and accelerating the pace of social development. Under the new situation, with the integrated development of

economic, cultural, and other undertakings in Guangdong, Hong Kong, and Macao, the health and wellness department should actively establish service institutes to play a leading role in the community of Zhaoqing. Under the leadership if the government, it will thoroughly promote the health demands of people by actively innovating the performance evaluation system with continuously improvement of the quality and level of primary-level medical and health services on a solid foundation for the sound and rapid development of the local economy and society.

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ORIGINAL ARTICLE

The Application of Augmented Reality Technology for the Anesthesiology Major

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Abstract: Anesthesiology is an important subject for in-depth research in the fields of clinical anesthesia, critical care medicine, first-aid and resuscitation, and pain treatment. As an important branch of clinical medicine, it has strong practicality and applicability. It has the commonality of clinical medicine and the specialty of anesthesiology. Carrying out anesthesiology practice teaching using augmented reality (AR) to simulate the experimental environment and scene simulation is of great significance to promoting the development of anesthesia practice teaching. This article mainly introduces the augmented reality technology. It not only analyzes the main forms of augmented reality technology in anesthesiology, but also explores the application of augmented reality technology for anesthesiology in the new era.

Keywords: Anesthesiology; Augmented Reality Technology; Practical Teaching

Nowadays, the application of intelligent technology is becoming more and more extensive and it is gradually developing and infiltrating from all walks of life. Medicine at the same time is also constantly developing and the level of anesthesia technology application is continuously improved. Through the application of augmented reality technology, medical students can truly see the virtual objects in the real world to create a fusion world when studying the anesthesiology courses, so that this technology will enhance the students' perception of the real-world. AR technology applications can also simulate learning objects where students can see virtual objects in the real environment to create a sense of immersion. With the aid of AR technology, the development of anesthesiology learning will enable an autonomous learning environment for students to visualize the closest images to the real interaction. This is very important for the teaching of some abstract content in the curriculum of anesthesiology.

1. The augmented reality (AR) technology

Compared with the virtual reality (VR) technology, the two technologies have certain common points, but there are also differences. VR technology is to create a complete virtual environment for learners to learn in a virtual environment. However, AR technology is to add some images with the help of camera equipments and angle calculations, so that the combination of real environment and virtual images allow students to use virtual technology in a real surrounding to achieve better environmental perception. In terms of the current AR technology, there are mainly the following two types:

1.1 AR technology based on display devices

This kind of augmented reality technology is to transfer the image data captured by the camera to the computer. Next, it integrates the corresponding pictures with other images in the computer, and synchronously transfer it onto the display. The process is similar to the

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special effects added in the middle and late stages of a movie, but the difference is that this technology is applied in real-time, not in the later phase. This technical advantage is that with the help of a display users can watch the composite images without wearing another professional AR devices. The problem is that the precipitation of this system is not always satisfying. At present, such AR technology has been developed relatively well and it has been applied in many fields.

1.2 Optical perspective AR technology

This AR system uses a special headset display to present the information content. It includes two types of technologies: the videofluoroscopy AR and the optical AR. The first one is more or less similar to the display-based AR systems with which users can see the processed integrated image but not in the real environment. The optical AR technology, on the other hand, is to see the real environment and images processed by the camera through the display worn by the user, making the user feel totally immersed.

2. The main forms of application of AR technology in anesthesiology

Considering the current application forms of AR technology in anesthesiology, they mainly include the following three types: the desktop, headset, and hand-held AR devices.

2.1 The desktop AR device

The application of desktop AR device first appeared in the US virtual all-in-one machine in 2013, and has now evolved into the third generation. At present, this AR technology device has been applied in multi-disciplinary teaching. In the teaching of anesthesiology, teachers can give lessons with the desktop AR device to develop independent visions. In 2015, China introduced a desktop AR device platform that achieved coverage in primary and secondary school courses. This kind of equipment application realizes the on-site 3D effect by tracking the supporting devices. In the practical application of anesthesiology courses, teachers can use the holographic camera and projection equipment to display the images through the projector.

2.2 Application of helmet AR equipment

Equipment used here includes helmet displays, position trackers, and data gloves. The helmet displays also include two kinds of devices, namely mobile and split ones. In foreign countries, Google, Samsung, Microsoft, and other companies have already developed AR helmet-related products, and there are also companies, such as Storm Mirror, Wei Shiku, LeTV, Xiaomi, and Huawei, are doing research in such helmet AR devices. The application of this kind of equipment to the teaching of anesthesiology courses can helo achieve real effects. Besides, with the help of related helmet equipment, the content in the teaching materials can become more vivid, touchable, and perceptible. When the teacher talks about the preparation of anesthetic drugs, students will wear the AR helmets through which they can see the specific drug-dispensing scenarios to understand the specific preparation process and dosage, etc., so that they can experience the preparation process of anesthetic drugs more directly.

2.3 The hand-held AR device

The application of this AR device is generally combined with apps or related mobile devices, such as software, 4D bookstores, AR handbooks, etc., all of which have corresponding support. The principle of application of this device is to use the mobile phone cameras to obtain images that exhibit characteristics through superimposing virtual images. This application can provide a wealth of educational and curriculum resources specifically for anesthesiology to meet the learning needs of students. Students can use the smart phone and the corresponding supporting handbook to present the AR effect. They can also be used to express abstract content images. In addition, app is used to realize the download of augmented reality resources and superimpose the display scenery. At present, real effects are able to be obtained to meet the needs of anesthesiology teaching.

3. Reflections on the application of augmented reality technology in anesthesiology

To realize the effectiveness of AR technology in anesthesiology teaching, professionals are urged to change their teaching thinking at this stage to introduce

the AR technology into teaching as soon as possible. To introduce the augmented reality technology into the teaching of anesthesiology, teachers must first understand that the application of this curriculum method needs to be distinguished from the traditional teaching method. With the aid of augmented reality technology, it can also change the traditional course teaching environment, in terms of which teachers are dominant in the traditional way whose words and deeds have a great impact on students' learning process. With the aid of AR technology, students are able to feel the real learning cases by wearing AR glasses. In this kind of setting, the role of teachers is not as obvious as before. In the traditional anesthesiology classroom, the studying content and progress are unified so teachers can control the teaching progress in the same way for all students whereas. With the assistant of AR tech, teachers do not need to control the progress of classroom teaching in a unified way and students can study at their own pace. The scenes seen in the virtual content overlay reality are different for each one so they can perform different operations with various knowledge from training on diversified interfaces. In this way, the specific teaching content often varies from person to person so that students can achieve personalized learning objectives according to their talent and aptitude and the learning efficiency will no doubt be significantly improved. In order to meet the curriculum teaching targets, teachers must grasp the characteristics and methods of AR application in the classrooms. They should change the traditional teaching ways with respect for students' dominant position. What's more, arranging the AR learning according to students' real needs is worthy of attention, and it is neccessary to promote the AR tech in abstract knowledge teaching to improve the learning efficiency of students' majored in anesthesiology.

4. Summary

The realization of AR technology in anesthesiology is of great significance to the development of anesthesiology teaching. At present, there are many types of AR devices available related to the anesthesiology major. Taking their responsibility in the teaching design, teachers need to grasp the combination of AR and traditional teaching methods. They should introduce AR assistance in a timely manner to promote the visualization of abstract-learning and professional teaching effectiveness.

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ORIGINAL ARTICLE

Research Progress on the Relevance between Intestinal Flora and Colorectal Cancer

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Abstract: Cancer is a common chronic disease all over the world, which will cause serious health burden. At present, the debate about the role of intestinal flora in the prevention and control of cancer has always existed. Therefore, researchers should pay close attention to the impact of intestinal flora on several cancers (such as colon cancer, liver cancer and breast cancer). In addition, it is reported that intestinal flora may also affect the efficacy of cancer chemotherapy and immunotherapy. This paper introduces some energy research results to help clear the relationship between intestinal flora and cancer, even cancer micro environment. It can help clarify the mist of cancer and gut microbiota, let those little creatures to serve the progress of improving mankind living condition and of health and medicine.

Keywords: Intestinal Flora; Colorectal Cancer; Anti-cancer; Mechanism of Cancer Micro Environment; Review

Foundings:

1. Preclinical study on the treatment of rectal cancer with Chinese medicine "Ehuang Enema"

2. Effects of Ehuang enema on intestinal flora and intestinal mucosal barrier function in rats with rectal cancer by high throughput sequencing

3. Study on the effect of aspirin on intestinal flora of rats by high throughput sequencing

1. Introduction

Colorectal cancer is one of the most common malignant tumors in the digestive tract and its etiology has not been fully elucidated[1]. Intestinal flora plays an important role in the pathogenesis of colorectal cancer, but its mechanism is unknown. The number of intestinal flora is 10 times that of human eukaryotic cells, 150 times that of the human genome, with a total of more than 100 trillion and more than 1000 species, of which anaerobic bacteria account for the vast majority[2]. Physiologically, the intestinal flora maintains relative homeostasis and interacts with the host. It plays an important role in nutrition, resisting pathogen invasion and promoting and maintaining normal immune function. When the intestinal flora is in equilibrium, the digestion, metabolism and immune system of the human body are in equilibrium. When the balance of intestinal flora is destroyed by various factors inside and outside the body and exceeds the regulating ability of the human body, it will affect the normal physiological function of the human body and lead to the occurrence of disease when it is serious. Intestinal microecology with the highest abundance and largest number of bacteria in the digestive tract is closely related to inflammatory bowel disease, colon polyps and colorectal cancer. Homeostasis is destroyed, which can lead to intestinal flora imbalance, and then induce colon cancer. But the mechanism is not

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very clear. The main ones reported are: inducing chronic inflammation, synthesizing biotoxins to hinder intestinal epithelial cell cycle regulation, producing toxic metabolites, activating carcinogens such as heterocyclic amines. Research suggests that in the case of human intestinal flora disorder, some metabolic components cause inflammation by binding to receptors, which stimulates the secretion of inflammatory factors, and other reaction, leading to colon cancer.

The dominant bacteria in coliform are pseudomonas, snail, verruca microbe, clostridium, prevo, lactic acid bacteria, etc[3]. There are obvious differences in intestinal flora between patients with straight colon cancer and normal people. The current study found that the structure of intestinal flora in patients with colorectal cancer has changed greatly compared with those in health. Enterobacteria such as bacteroides, clostridium, bacteroides fragilis, enterococcus faecalis, streptococcus mutans and so on are associated with the development of colorectal cancer[4]. Scanlan *et al*[5] found that in colorectal cancer patients and adenomatous polyposis patients, the flora and their metabolites changed significantly, among which C. coccoides subgroups and clostridium leptum increased significantly. Sobhani *et al*[6] found that bacteroides and prevotella in the feces of colorectal cancer patients were higher than those of healthy people. Tingting Wang[7] and Na Wu[8] found that bacteroides, enterococcus, shigel, escherichia, streptococcus, klebsiella and pepso streptococcus were significantly increased in fecal flora of patients with colorectal cancer; However, the number of trichiaceae (Lach-nospiraceae), faecalibacterium and roseburia producing butyrate decreased significantly.

2. Intestinal microflora can inhibit and promote the occurrence of colon cancer, which is mainly related to the specific types of microflora

Probiotics such as lactobaci llus and bifidobacterium can inhibit the occurrence of colon cancer. Lactobacillus can induce the production of many cytokines, including IL-12, TNF - α, etc[9]. The known physiological functions of lactobacilli are: to prevent the invasion and colonization of the intestinal tract by pathogenic bacteria, to maintain the micro ecological balance of the intestinal tract, to prevent and inhibit the occurrence of tumors, to enhance the immunity of the body, to promote digestion, to reduce cholesterol, to inhibit the production of endotoxin, to delay aging and anti radiation, etc. Bifidobacterium is the most numerous probiotics in the intestinal tract. Experiments show that bifidobacterium can enhance the expression of bax, which can induce the apoptosis of cancer cells and prevent the occurrence of colon cancer by down regulating the expression of bcl-2. In addition, as the ligand of toll like receptor, the phospholipid wall on its surface can activate the natural immune response and induce apoptosis of tumor cells, which has antitumor effect[10].

As opposed to probiotics, harmful bacteria are a general term for bacteria that can cause disease in the host. The intestinal bacteria that cause colon cancer are streptococcus (streptococcus), enterococcus faecalis (ente-rococcus faecalis), enterotoxin producing bacteria (enteroto-xigenic bacteroides fragilis) and so on. Abdulamir *et al*[11] found that after streptococcus infection in mice, the bacteria over expressed flagellin, which was beneficial to colonize the bacteria in tumor tissues, and the bacteria promoted the high expression of inflammatory-related signaling pathways in mouse intestinal epithelial cells, including the high expression of cyclooxygenase-2 (COX-2), which triggered intestinal inflammation. Through high-throughput sequencing technology, the fecal samples and intestinal cavity microbes of colon cancer patients and normal people were analyzed and compared, and it was found that the number of digestive streptococcus in the excreta of colon cancer patients increased compared with that of healthy people[12-15].

Wang *et al*[16] confirmed from animal experiments that some enterococcus faecalis can produce superoxide anion, which induces colon cancer. IL-10 knockout mice were infected with enterococcus faecalis which could produce superoxide anion in the experimental group and in the control group with enterococcus faecalis which did not produce superoxide anion IL-10 knockout mice. Experimental mice showed intestinal inflammation, DNA injury and colon cancer. The mice in the control

group only caused enteritis and had no tumor. Enterococcus faecalis-induced colon cancer has been shown to be a diffusive chromosomal breaker (e.g. 4-hydroxy-2-non, 4-h by inducing mucosal macrophages ydroxynon-2-enal), which mediated DNA damage through bystander effects.

For example, bacteroides fragilis can secrete a kind of bacteroidin fragilis, which can cause DNA damage of colon epithelial cells. By activating the signal pathways of Wnt, NF-κ B, STAT3, and so on, it can cause the inflammatory reaction of intestinal epithelium and promote colon cancer. The formation of intestinal microflora through the influence of inflammatory microenvironment leads to the imbalance of intestinal microflora in colon cancer, which leads to the conditional pathogenicity, the increase of mucus permeability, the migration of bacteria and the activation of innate immune system[17]. It can cause inflammatory cells to secrete a large number of inflammatory factors and form intestinal inflammation microenvironment together with toxic metabolites of bacteria. Long-term repeated intestinal inflammation is easy to induce mutation of intestinal epithelial cells with generating malignant proliferation, which causes tumors. At present, there are two theories about the promotion of inflammation by intestinal flora leading to colon cancer: alpha bug theory and driver passenger theory.

In alpha bug model, enterotoxin fragilis (ETBF) was used as an example. ETBF was implanted on the surface of colon mucosa to secrete fragile bacteroidin (BFT). It changed the structure of colon epithelial cells and mucosal immune function and finally led to the formation of colon cancer. It has been found that BFT can change the structure and function of colonic epithelial cells rapidly, including destroying tumor suppressor protein, e-cadherin and cadherin-e. These protein molecules can inhibit the formation of colonic tumors[18-19]. The decomposition of cadherin-e increases the permeability of colonic epithelial cells, which is the beginning of tumor development. Due to the release of cytokines, BFT can activate the transcription factor NF-κ B and promote the synthesis and secretion of inflammatory cytokines by colonic epithelial cells. According to the theory of alpha bug, ETBF can directly lead to precancerous lesions of colon mucosa, and change the mucosal immune function and the structure of other intestinal flora can further promote the occurrence of colon cancer. Driver passenger model thinks that driver bacteria is the intestinal bacteria that may cause tumor, while passenger is the bacteria that has existed in the intestinal tract before. First of all, the bacteria in the intestinal driver cause caking the DNA damage of intestinal epithelial cells is the initial stage of colon cancer. Secondly, it induces the change of intestinal microenvironment. Passenger has a competitive advantage, surpassing driver in colon cancer and in quantity, and driver may disappear in tumor. According to the driver passenger theory, first of all, the colonization of driver bacteria in the colonic mucosa leads to the continuous inflammatory response of the mucosa, which leads to the precancerous lesions of the colonic mucosa by promoting the proliferation of colonic epithelial cells and producing DNA damage substances. With the accumulation of DNA damage material, the colonic epithelial cells mutated, and then changed from adenomatoid to adenocarcinoma. Whether probiotics can inhibit colon tumor tissue and whether passenger bacteria can promote the development of colon tumor tissue need further study. In a word, driver bacteria and passenger bacteria have different relations with colon tumor tissue and play different roles in the development of colon tumor.

Although some specific microflora will increase the risk of cancer, some beneficial intestinal bacteria can prevent various cancers by transforming phytochemicals into bioactive metabolites and fermenting dietary fiber into SCFAs, thus maintaining the integrity of intestinal mucosa and immune system. In addition, intestinal flora can affect the extragastrointestinal tissues by affecting the level of estrogen, that is, the risk of breast cancer. In addition, the potential mechanism of the interaction between beneficial flora and anticancer effect is still worth further exploration. On the other hand, harmful intestinal flora can be reduced or eliminated to maintain the homeostasis of intestinal flora. In general, intestinal flora may be an important mediator of diet cancer association, which suggests that we should go further to conduct the relationship between intestinal and cancers[20].

In the past, the study of intestinal microorganisms

mainly depended on the traditional pure culture technology of microbial separation. When the method was used to restore the microflora in the laboratory, the amount of information obtained by anaerobic microorganisms was limited. In the past few years, researchers have studied the methods of fluorescence in situ hybridization, terminal restriction fragment length polymorphism (PCR), denaturing gradient gel electrophoresis (PGGE), biochip, and so on. For example, at a loss what to do with the detection of the dominant bacteria in the intestine, denaturing gradient gel electrophoresis can only detect the trace microorganisms, but the sensitivity is low. Fluorescence in situ hybridization technology must rely on the specificity of oligonucleotide probes, only detect the known bacteria but not identify the unknown microorganisms. It can verify the known, can not explore the unknown, and has defects in the judgment of microbial abundance. With the rapid development of detection technology and the maturity and promotion of the second generation sequencing technology, at present, high-throughput sequencing technology is mainly used to detect intestinal microorganisms. High throughput sequencing technology is a revolutionary change of traditional sequencing. It can sequence hundreds of thousands to millions of DNA molecules at a time. At the same time, high throughput sequencing makes it possible to analyze the transcriptome and genome of a species in a detailed and comprehensive way, so it is also called deep sequencing. High throughput sequencing technology, with its characteristics of large data volume, low cost and fast speed, has made a qualitative leap in the study of intestinal microbial metagenomics. It can more accurately and deeply analyze the microbial structure, composition, gene function, metabolic pathway and the impact of drugs on intestinal microorganisms.

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Universe Scientific Publishing

ORIGINAL ARTICLE

Construction of Clinical Biobanks and the Medical Ethics

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Abstract: Nowadays, various types and forms of clinical biobanks have been gradually established worldwide, which have become one of the important components and research platforms of life science and related disease researches in the medical system. This article mainly introduces the construction, management and operation of clinical biobanks, and discusses the medical ethics faced by it.

Keywords: Clinical Cases; Medical Ethics; Biobank

1. Introduction

Clinical biological samples are of scarcity and non-renewal, the research results and conclusions of which accord with the actual situation of human pathology, effectively reflect the characteristics of the disease, and can provide reference to clinical diagnosis and treatment. In addition, clinical biological samples have become a valuable resource to explore the pathogenesis of the disease, master the law of disease development, develop medical means, and research and develop pharmacy[1].

2. Establishment, operation and management of clinical biobanks

The establishment, operation and management of clinical biobanks should be scientific, systematic and comprehensive. Clinical samples of patients to be collected include body fluids, blood, pathological tissues, nucleic acids and proteins. The following will introduce several requirements for the establishment of clinical biobanks should meet the following requirements: 1. In order to ensure the updating and replenishment of samples, stable sample sources are needed. 2. Standardized collection process of biological samples and sound clinical diagnosis and treatment conditions are needed to ensure the timeliness and reliability of samples. 3. Laboratory personnel are required to possess clinical medical knowledge to perfectly take up this job. 4. Perfect medical facilities and software systems for sample information management are needed. 5. The follow-up processing technology of the samples is necessary to ensure that they can be used in the research of cell biology and molecular biology.

The increasing sample amount is followed by gradual increase of sample information, both of which are under dynamic changes. Therefore, it is an important process to establish a safe, reliable, stable and efficient biobank management system with complete functions for collecting and inducing information of biological samples, so as to ensure the establishment and management of biobanks. Registration of the biological sample information consists of the

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following three aspects: first, the basic information of biological samples, such as number, type, amount, date, location, storage location, usage time, situation, personnel, and research. Secondly, information of sample patients, such as citizen information, medical history, family genetic information, diagnosis and treatment indicators and measures, and follow-up information. Finally, the experimental results and feedback of data, such as analysis, collection, follow-up, sample allocation and cooperation of samples, correlation research, and research topics, to reduce repetitive work.

In the application of samples, there should be standard and perfect management measures for the clinical biobanks to prevent the occurrence of unexpected situations such as lost samples and pollution on samples caused by improper management or practices. In order to meet the needs of repeated use, samples should be sub-packed to ensure their survival, and then a scientific and reasonable storage system for biological samples should be established, as well as the follow-up processing and verification technologies, such as cell separation, cell identification, cell detection and nucleic acid extraction technologies. Through that, it can ensure the quality of the extracted products to be provided to the experimenters. Regular sampling inspection should be carried out to the stored biological samples so as to ensure their activity, reduce the loss and improve the work efficiency, thus achieving the purpose of biological research.

The clinical biological sample resources should be carefully protected and rationally utilized, combining the disease of patients, diagnosis and treatment results, routine detection and treatment methods. Specifically speaking, it is necessary to observe and study the occurrence and development of diseases, and comprehensively evaluate the different levels of organs, tissues, cells and molecules; adopting new medical technologies in difficult diagnosed cases is helpful to improve medical quality and accumulate medical experience. Moreover, a large number of confirmed samples of single and multiple diseases are provided for medical research and teaching, which can reduce research time and is benefit to carry out targeted research work.

3. The medical ethics faced by the clinical biobanks

In the past, researchers often needed to select and test clinical samples according to the research subject. However, the collected samples were only used for research. The collection and preservation of biological samples ended along with the completion of the subject. Both researchers and sample providers often treat the remaining samples as medical waste after clinical diagnosis and treatment. In the process of collecting clinical cases and operation of biobanks, it is easy to ignore the review and constraints of medical ethics[2].

During collecting samples and running and managing biobanks, the medical ethics involved include the following points: 1. Whether providers agrees to the collection of samples and related information, and the scope and specific contents agreed by providers; 2. When samples are taken in the biobanks, whether the sample providers have the right of personal ownership, the right to be informed about the research, and whether the research results and conclusions are fed back to providers. 3. The direction of sample research, researchers and research content should be clear and whether providers still need to cooperate in the process of research. 4. Whether sample providers can benefit and how to benefit more patients. 5. Whether sample providers will be affected by providing samples and whether the samples will be used for commercial purposes. 6. What measures can be taken to ensure the privacy and safety of providers and samples. 7. How to dispose and destruct samples after the research[3,4].

As a public resource for medical research, biological samples inevitably involve interests. Although the collection of biological samples is different from the clinical research carried out in human body, its essence is human body research and involves the personal interests of the samples providers. Therefore, the principles of medical ethics in clinical research also apply to the ethical review of biobanks.

4. Ethical review points of clinical biobanks

4.1 The benefits and risks of biobanks, and the determination of the ownership

of biological samples

The research results of biobanks have improved the medical level of a certain disease, and promoted the development of medicine, by adopting the group research method instead of individual experiments. There is a remarkable difference between in vitro study of biological samples and direct interventional clinical study of human body, and there is almost no damage to sample providers. When samples and their information are included in the biobanks, the individual attributes of these samples are transformed into disease types or group biological attributes of sample types to a certain extent. Therefore, the individual samples become public scientific research resources, thus achieving the sharing of the individual interests of sample providers and the common interests of society.

4.2 Protect the privacy of biological sample providers and the safety of the samples

In the actual operation of biobanks, in order to prevent the privacy of sample providers from being disclosed, and ensure the objectivity and accuracy of the research, the unique coded identification is often adopted to encrypt the samples, and the anonymity is applied to protect the privacy of sample providers, thus ensuring that sample providers are not affected by the research[5]. At the same time, different levels of access rights should be established so as to clarify the relevant information of the visitors. When external or foreign organizations are involved, corresponding protection measures need to be formulated to prevent the information of clinical biological samples and sample providers from disclosure, which may cause loss of disease information and ethnic heritage information.

4.3 Set the contents of the informed consent of biobanks

The basic principles of informed consent are fully informed, fully understanding, independently choosing, personally deciding, etc., while the contents of which include signed consent and oral consent. When designing and defining the contents of the informed consent, it is necessary to fully inform the functions of biobanks and the obligations of the researchers, specify the risks and possible accidents, and emphasize that sample providers have the right to terminate the informed consent at any time. In addition, it is also necessary to set up provisions to restrict researchers, including the qualification level of the personnel in biobanks and the supervision contents for the supervision department, so as to ensure that biological samples are only used for medical research and are destroyed and processed after the research is completed, and ensure that the personal information and privacy of sample providers will not be disclosed. This is not only conducive to the protection of the rights and interests of sample providers, but also can improve the participation of sample providers, as well as protect the researchers. On the basis of full understanding and acceptance of the contents of the informed consent, sample researchers independently choose to sign it and are authorized to use the biological samples and related information under the review of the ethics committee[6,7].

5. Conclusion

This article analyzes the establishment, operation and management of clinical biobanks, then briefly expounds the medical ethics faced by the research of clinical biobanks, and finally summarizes the key points of ethical review. In general, to establish, operate and manage biobanks, it is necessary to set up the requirements of collection and induction, classification, data collation, security, and so on, improve the control and management system, and give effective protection to biological samples and their information. With the continuous in-depth work, a system of resource development and utilization of biological samples has been gradually established to provide help, cooperation and mutual assistance for subsequent medical research, and finally the sharing of biological samples can be realized, thus promoting the sustainable development of biobanks[8].

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ORIGINAL ARTICLE

Discussion on the Effect of Emergency Tracheal Intubation on Cardiopulmonary Resuscitation by Emergency Medical Staff[i]

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Abstract: Objective: To study the positive effect of emergency tracheal intubation on cardiopulmonary resuscitation. Methods: 90 patients with cardiopulmonary arrest were randomly selected from the emergency department of our hospital from November 2017 to November 2019, and were randomly divided into the control group and the experimental group (n=45). The control group was given routine anesthesia combined with cardiopulmonary resuscitation, while the experimental group was given emergency tracheal intubation combined with cardiopulmonary resuscitation. The effect of cardiopulmonary resuscitation and operation time of the two groups were observed and discussed, and the results were recorded. Results: Under different intervention measures, the time from visiting a doctor to tracheal intubation in the experimental group was obviously shorter than that in the control group ($P < 0.05$). There is no significant difference in the time of intubation between the two groups ($P > 0.05$). In addition, the success probability of cardiopulmonary resuscitation and the discharge survival rate in the experimental group were higher than those in the control group ($P < 0.05$). The above-mentioned results with $p < 0.05$ indicated the statistically significant differences. Conclusion: In clinical practice, emergency tracheal intubation for patients with cardiopulmonary arrest by emergency medical staff can bring a higher success probability of cardiopulmonary resuscitation, buy valuable time for rescue operation, and obviously improve the prognosis of patients. Therefore, it is worthy of wider promotion and application.

Keywords: Emergency Tracheal Intubation; Emergency Department; Cardiopulmonary Resuscitation

Cardiopulmonary arrest is a common acute and critical illness in the emergency departments, which may cause damage to various important organs of patients and even induce death in severe cases. Such kinds of patients must be treated immediately[1]. In the process of first aid, cardiopulmonary resuscitation (CPR) is a common intervention measure. However, in practice, the success probability of this measure will be affected by many objective factors. Whether tracheal intubation can be completed in time and smoothly is very important for the effect of cardiopulmonary resuscitation[2]. With the help of effective tracheal intubation, a safer breathing channel can be constructed to ensure patients to breathe smoothly. However, currently, in most primary hospitals it's the anesthesiologist who carries out tracheal intubation during cardiopulmonary resuscitation. As it usually takes an anesthesiologist 7 to 15 minutes to arrive at the emergency room, it can easily lead to delayed rescue[3]. During cardiopulmonary resuscitation, if the medical staff in emergency department can give emergency tracheal intubation, better clinical results will be obtained.

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This article studies the effect of emergency tracheal intubation on cardiopulmonary resuscitation by emergency medical staff as follows.

1. Materials and methods

1.1 General materials

90 patients with cardiopulmonary arrest were randomly selected from the emergency department of our hospital from November 2017 to November 2019. The selection criteria are as follows: patients meeting the diagnostic criteria of clinical cardiopulmonary arrest; patients with no autonomous breathing, significant disturbance of consciousness, or no obvious pulsation of the aorta; patients with $SpO_2 < 80\%$, $PaCO_2 > 50$ mmHg and pH < 7.13; there is no significant change in oxygen inhalation through mask (or nasal catheter), and respiratory rate (RR) is less than 10 times or more than 30 times per minute, and the value of blood pressure is below 80/55 mmHg[4]. Meanwhile, the exclusion criteria are as follows: patients with obvious airway stenosis or deformity; family members are unwilling to participate in research, etc.

By casting lots, the patients were randomly divided into two groups (n=45). The control group included 24 male patients and 21 female patients, all aged from 25 to 75 years old, with an average of 47.23 years old. The experimental group consisted of 23 male patients and 22 female patients, all aged from 24 to 76 years old, with an average of 48.08 years old. There is no obvious difference in general data between the two groups, thus the study can be carried out.

1.2 Methods

The control group was given routine anesthesia combined with cardiopulmonary resuscitation. The anesthesiologist arrived immediately after the patient was admitted to hospital and carried out intubation.

The experimental group was given emergency tracheal intubation combined with cardiopulmonary resuscitation. The specific operation is as follows. During tracheal intubation, keep the patient in supine position, extend the head slightly backward, keep high oxygen flow, and clean the secretions and foreign bodies in the respiratory tract. Take out the false teeth if the patient wears them. During the operation of tracheal intubation, use a laryngoscope to slowly enter the mouth from the right corner, gently push the patient's tongue to the left to expose the uvula, and then slightly lift the epiglottis upward to expose the patient's glottis. After alignment, accurately and quickly insert the tracheal tube and withdraw the laryngoscope, and fix the catheter at the same time. During intubating, give effective cardiopulmonary resuscitation, keep a pressing frequency of 1000 times per minute, and always keep a pressing depth of more than 50 mm. Stop for 50 seconds to confirm whether the tracheal insertion is successful. If there are defibrillation indications, defibrillation shock should be given, with properly opening the venous access, and injecting adrenaline.

1.3 Clinical indicators

Observe and discuss the effect of cardiopulmonary resuscitation and the operation time of the two groups of patients, and make statistics on the results. The indicators are as follows:

Firstly, the index of the rescue efficiency is the length of time between the start of treatment and intubation and the time of intubation operation. Secondly, the curative effect of cardiopulmonary resuscitation includes the success probability of tracheal intubation and cardiopulmonary resuscitation, and the discharge survival rate of patients (the standard of successful tracheal intubation is that after intubation enters glottis and controls the breathing of patients, the heave of both sides of the chest are basically symmetrical; the respiratory sounds of the lungs are uniform and symmetrical; the number of continuous CO2 waveforms is more than four. The standard of successful cardiopulmonary resuscitation includes that: the patient's complexion and lip color return to normal with obvious improvement from cyanosis; the pupils of the patient is almost reduced to normal condition, and there is autonomous activity of the eyeballs, which can normally respond to light again; the heartbeat is normal and there is atrial or sinus rhythm at the atrioventricular junction under the observation of ECG; the patient's blood pressure is above 90/60 mmHG, with $SpO_2 > 90\%$).

1.4 Statistical methods

According to the data types of this study, the statistical software SPSS20.0 is selected to process the

data. The data related to probability are expressed in the form of (number of cases, percentage), and chi-square test is carried out. The data involving variables are expressed in the form of ($\bar{x} \pm s$), and t test is carried out[5]. In this article, it can be considered that there are statistical differences when $p < 0.05$.

2. Results

2.1 Analysis of rescue efficiency of two groups of patients

The time from treatment to tracheal intubation in experimental group was significantly shorter than that in control group ($P < 0.05$). There was no significant difference in the time of intubation between the two groups ($P > 0.05$). The specific data is in **Table 1**.

2.2 Analysis of the efficacy of cardiopulmonary resuscitation in two groups of patients

The success probability of cardiopulmonary resuscitation and the discharge survival rate in the experimental group were higher than those in the control group ($P < 0.05$). The above results with $p < 0.05$ all indicate the statistically significant differences. The specific data is in **Table 2**.

Group	Intubation time (minutes)	Operation time (minutes)
Control group	3.15±0.84	1.89±0.28
Experimental group	1.69±0.51	2.02±0.36
T value	9.966	1.912
P value	0.000	0.059

Table 1. Analysis of rescue efficiency of two groups of patients ($\bar{x} \pm s$)

Group	Successful probability of intubation	Success probability of cardiopulmonary resuscitation	Discharge survival rate
Control group	42 (93.33%)	13 (28.89%)	8 (17.78%)
Experimental group	43 (95.56%)	24 (53.33%)	17 (37.78%)
T value	0.212	5.553	4.486
P value	0.645	0.018	0.034

Table 2. Analysis of the efficacy of cardiopulmonary resuscitation in two groups (n,%)

3. Discussion

Under the influence of different interventions, the time from treatment to tracheal intubation in the experimental group was significantly shorter than that in the control group, while there was no significant difference in the time of intubation between the two groups. In addition, the success probability of cardiopulmonary resuscitation and the discharge survival rate in the experimental group were higher than those in the control group. This research result shows that emergency tracheal intubation for patients with cardiopulmonary arrest performed by emergency medical staff can obtain a higher probability of successful cardiopulmonary resuscitation. The research results have also been proved in Wu Jiyou's works[6], which shows its correctness.

There has been an obvious increase in clinical cases of cardiopulmonary arrest in recent years. The causes of this disease are complicated, such as electric shock, drowning, severe cardiovascular and cerebrovascular diseases and severe trauma. Following the sudden stop of the heart beating, the internal effective blood drainage of the patient stops at the same time, resulting in the symptoms of hypoxemia in all tissues and organs of human body. After cardiopulmonary arrest occurs, the patient's condition often rapidly goes worse. If effective intervention is not given in time, especially effective cardiopulmonary resuscitation, there will be irreversible damage to the important organs of the patient[7]. Relevant studies have proved that over 5 minutes of hypoxemia in brain tissue can lead to serious damage. Therefore, it can be concluded that relieving hypoxemia as soon as

possible will play a very positive role in improving the prognosis of patients.

At present, the most effective intervention for cardiopulmonary arrest is cardiopulmonary resuscitation. Active tracheal intubation is the guarantee of the effective implementation of cardiopulmonary resuscitation. Tracheal intubation can clean the patient's airway well, and build a smoother artificial airway, so as to win the rescue time and appropriately improve the success rate of cardiopulmonary resuscitation. In cardiopulmonary resuscitation, it is easy to carry out effective cardiac compression and electric shock operation, but the most critical operation is to construct artificial airway by tracheal intubation, which requires mature intubation technology of medical staff. In the past clinical experience, most of the operations were done by anesthesiologists, most of whom have rich clinical experience and mature operation technology. They can ensure the success rate of intubation. However, as far as the actual situation is concerned, it takes an anesthesiologist some time to arrive at the emergency department, which wastes the rescue time and increases the risk that the patient's rescue may lag behind. Therefore, it is very necessary for the medical staff in the emergency department to carry out emergency tracheal intubation. It can gain precious time for the operation of opening airway and mechanical ventilation in the first aid of cardiopulmonary resuscitation. In addition, it can relieve the symptoms of hypoxemia and acidosis of patients as soon as possible[8]. During the operation of tracheal intubation, the medical staff must pay attention to the following conditions: whether the patient wears false teeth, whether there is tonsil enlargement and loose teeth. These conditions may lead to the failure of tracheal intubation. In practice, it is necessary to ensure that the glottis are fully exposed, which is conducive to the rapid completion of intubation. Blind intubation must be avoided to prevent unnecessary injury to the patient.

4. Conclusion

To sum up, for the clinical first aid of patients with cardiopulmonary arrest, a higher success probability of cardiopulmonary resuscitation can be obtained through emergency tracheal intubation by emergency medical staff. It can gain precious time for rescue operation, significantly improve the prognosis of patients, enable patients to return to their normal life as soon as possible, and strengthen their quality of life at the same time. Emergency tracheal intubation by emergency medical staff is worthy of more extensive promotion and in-depth research in clinical practice.

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ORIGINAL ARTICLE

Prion Interaction with Normal Protein in Topological Changing Secondary Structure to Aggregation

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Abstract: Prion is a protein smaller than virus and it infects host in the absence of nucleic acid. The secondary structure of protein folds incorrectly from α-helices to β-sheets through breaking and re-formation of hydrogen bond. Structural analogy of α-helix and DNA double helix and comparing differences between α-helix and β-sheet show prion's infectivity and propagation. Aggregates of dimers and polymers generate β-amyloid fibril in Alzheimer's disease.

Keywords: Prion; α-helix; β-sheet; Hydrogen Bond; Aggregation

1. Introduction

Prions, also known as protein infectious factors or infectious proteins, are small non-immune hydrophobic proteins that can infect animals. They replicate in host cells. Prions are as infectious and pathogenic as conventional viruses but much smaller than the smallest known conventional viruses (about 30-50 nm). The structure of virus particle is not observed under electron microscope. Prion protein is the coding product of human and animal normal cell genes and its human gene is located in the short arm of chromosome 20. It causes degeneration of the central nervous system in humans and livestock. There are four kinds of prion diseases in human: Kuru's disease, K-ya's syndrome, Germain's syndrome and fatal familial insomnia. It is also linked to Alzheimer's disease[1].

Prion diseases in mammals are caused by a conformational transition of the cellular protein from its native conformation (PrPc) to a pathological isoform called "prion protein scrapie" (PrPSc)[2]. There is no difference in primary structure between PrPc and PrPSc. As to secondary structure, 42% are α-helices and 3% are β-folds in PrPc, 3% are α-helices and 42% are β-folds in PrPSc. There is only PrPc in the brain of normal animals and no PrPSc. The transition from α-helix to β-sheet of PrPc and PrPSc means a lot.

2. Materials and methods

2.1 Structural analogy of α-helix and DNA double helix

The basic unit of protein or polypeptide is 20 kinds of amino acids. Secondary structure of a protein refers to specific conformation of polypeptide main chain, which does not involve the position of amino acid side chains. The forms of secondary structure include α-helix, β-sheet, β-corner and random curl. The secondary structure of a polypeptide chain is a combination of these different types of conformation. The main force to maintain the secondary structure is hydrogen bond.

Each circle of a right-handed α-helix has 3.6 residues on average. The H that covalent binds to N at the first amino acid and the O at the fourth amino acid

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forms a hydrogen bond (**Figure 1A**).

The molecular weight of nucleic acid ranges from 100,000 to 1,000,000 and the average molecular weight of a single nucleotide is 330. The molecular weight of protein ranges from 10,000 to 1,000,000 and the molecular weight of a single amino acid ranges from 90 to 200, and the average molecular weight is 128. Prions are protein particles with molecular weight of 27,000-30,000.

In DNA double helix, there are two types of hydrogen bond. Both H covalent bind to N. One type is formed by O and H and the average energy is 8 kJ/mol and the other type is formed by N and H and the average energy is 13 kJ/mol (**Figure 1B**).

Comparing with DNA double helix, the gap between α-helix circles is wide enough to accommodate prion proximity and interaction.

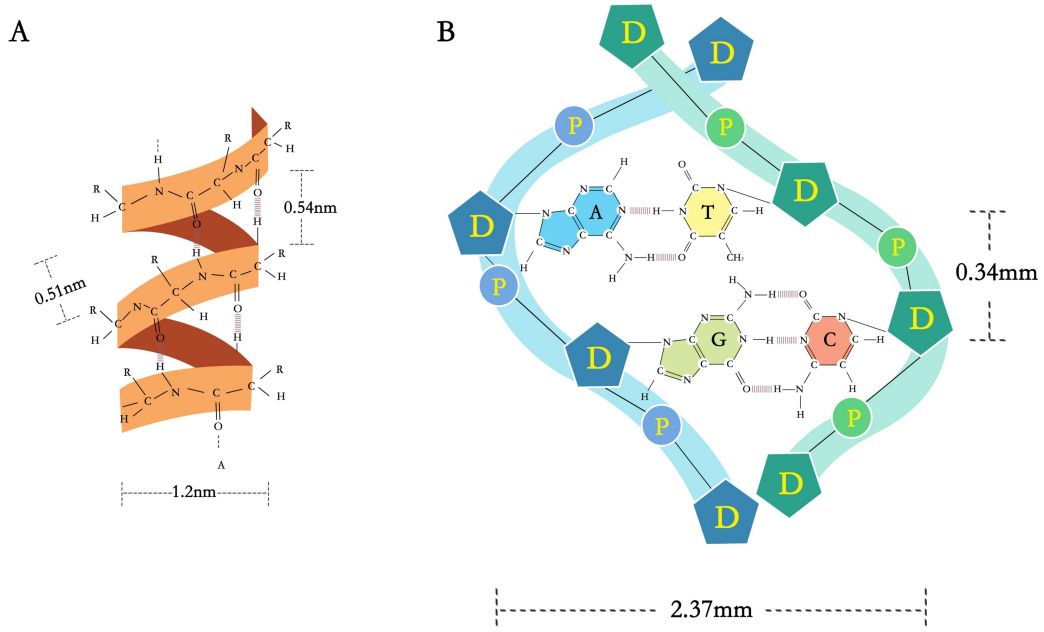

Figure 1. The hydrogen bonds of α-helix and DNA double helix.

A α-helix. A right-handed helix formed by a peptide chain. The H that covalent binds to N at the first amino acid and the O at the fourth amino acid forms a hydrogen bond. B, DNA double helix. Two kinds of hydrogen bonds in base pairs: one formed by N and H and one formed by O and H. Both of H covalently bound N.

2.2 Comparison of two secondary structures of protein: α-helix and β-sheet

While α-helix is formed by a single strand peptide chain, β-sheet is a plane structure formed by two or more peptide segments. These peptide chains are parallel or antiparallel with hydrogen bonds formed by H and O on opposite amino acids.

Topological changing secondary structure starts from interaction of PrPSc with PrPc. PrPc hydrogen bonds at α-helix break down and the peptide chain strand extends and binds to PrPSc with new hydrogen bonds (**Figure 2**). β-sheet formation ends with aggregation of multiple peptide segments. The process undergoes multiple hydrogen bond breaking and re-formation.

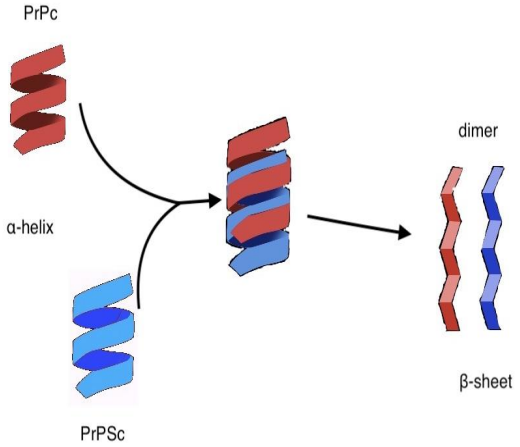

Figure 2. Prion interaction with normal protein in transformation from α-helix to β-sheet.

2.3 Aggregation and disaggregation of prion monomers

Aggregates consist of groups of misfolding proteins and every discrete size should be larger than the critical nucleus size[3]. The aggregation and disaggregation process is dynamic. When aggregation overcome, it is beneficial to folding.

3. Results

3.1 Topological change of transformation of α-helix to β-sheet

If the hydrogen bonds maintaining α-helix are broken, the peptide chain can combine with another peptide chain to form a dimer. Through structural topological change, the original right-hand α-helices, with side chain groups of amino acid residue extend to the outside, and it forms a β-sheet conformation, with side chains of amino acid residue distributed above and below the lamella.

3.2 β-sheet forms and monomers aggregate

Small polypeptide chains in β-sheet are connected by hydrogen bonds. In β-sheet, hydrogen bonds are formed by H and O. It may also be formed by H and N. Combination of peptide segments. Two hydrogen bonds make structure have more stability, greater diversity and more possibilities. Thus, monomers aggregate to oligomers and polymers (**Figure 3**).

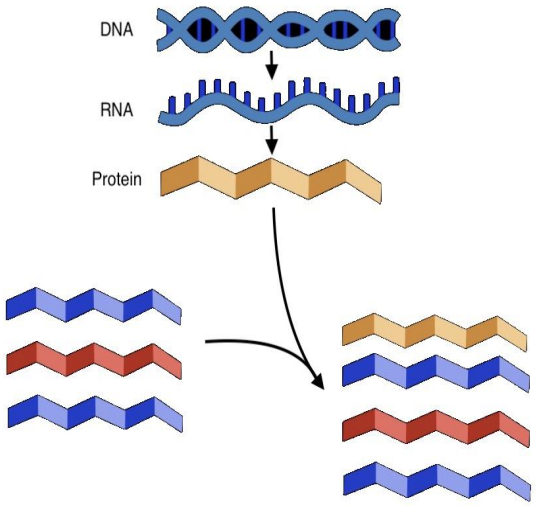

Figure 3. Misfolding proteins induced fit to aggregate.

The insoluble protein is resistant to proteolysis. The protein particles have such strong resistance to various physical and chemical actions that cause diseases of typical features, including extensive cavernous degeneration, amyloid deposition and neurodegeneration, and it even leads the host to death.

3.3 Protein transformation causes protein denaturation

Theoretically, the smallest PrPSc aggregate is a dimmer containing disulfide bond and PrPSc dimerization may contribute to prion diseases. Fatal familial insomnia brain biopsies formed more PrP dimmers[4]. Through the increase of molecular size and hydrophobic amino acid number, solubility of protein in water decrease, generating precipitation. In this case, as under action of some physical and chemical factors, the spatial structural change leads to protein denaturing, that is, the change of physical and chemical properties and the loss of biological activity. Therefore, changing protein secondary structure may be fatal. The transformation of α-helix and β-sheet deprives the original properties and functions.

4. Discussion

4.1 The effect of hydrogen bond on secondary structural topological change

While DNA double chain is stable as genetic material for four bases in the formation as A and T connected by two hydrogen bonds and C and G connected by three hydrogen bonds, the H and O of amino acids form hydrogen bonds of protein secondary structure. The two atom types, H and O, determines whether the secondary structure is α-helix or β-sheet, which explains why proportion of α-helix and β-sheet converse totally in prions.

4.2 Independent propagation and pathogenicity based on topological changing secondary structure of normal protein as the 'protein-only hypothesis'[5]

If PrPSc exists for some time, it may interact with other normal proteins and fold incorrectly. The topology structure changes through breaking and re-formation of hydrogen bond, so the types of protein and amino acid sequence are less important. The misfolding protein propagate and enlarge layer by layer to a huge spherical fourth structure. Chemical bonds on a layer may break down and chemical bonds between two layers may be formed. Due to changing spatial structure that leads to dysfunction, prions need not reverse to generate nucleic acids to express in host cells under catalysis of reverse transcriptase as ordinary viruses.

4.3 'Protein-only' refractory diseases

Though protein translation codons containing genetic information are universal, mismatched proteins all function abnormally. Aggregation of proteins to a certain extent inevitably generate amyloid-β and irreversible dysfunction of nervous system that have observed in the brain of Alzheimer's patient. It may signify that these diseases are less correlate with heredity and environmental related.

5. Conclusion

Prion topological changing protein secondary structure leads to protein dysfunction and it causes several diseases. From α-helix to β-sheet through breaking and re-formation of hydrogen bond, proteins aggregate and prion propagates in the absence of nucleic acid. Protein structural topological changing displays an important role in prion infectivity indeed.

Compliance with Ethical Standards: This study wasn't funded.

Conflict of Interest

The author declares that there is no conflict of interest.

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