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# The Development of Interventional Radiology Suite and the Roles of Interventional Radiology Nurses in China

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**Abstract:** By summarizing the literature and our experience, this paper analyzes the development trends of interventional radiology suite and the roles of nurses in China, also proposes countermeasures in order to provide the basis for clinical nursing management of interventional therapy. Interventional Radiology Center, interventional hybrid operating room and cardio-cerebrovascular first aid center are the 3 development trends of interventional radiology suite. These development trends reflect that the characteristics of interventional radiology suite is getting more centralized, specialized, diversified and advanced, which means that interventional therapy is becoming more and more important in modern medicine. As the roles of administrator, coordinator and caregiver of interventional radiology suite, interventional radiology nurses are responsible for important jobs like reasonably arranging interventional therapy schedule arrangement, assisting arranging therapy professionally and saving lives. Interventional radiology nurses are suggested to keep in step with the development of interventional radiology suite and strengthen the skills to provide professional and scientific nursing services, which is the gateway to propel the construction and development of Interventional Radiology. In addition, hospitals in China can also configure nursing human resources according to the different development levels and specialties of the interventional operating suites, in order to optimize the nursing workflow, improve the efficiency and reduce waiting time of patient.

**Keywords:** Interventional Radiology Suite, Interventional Radiology Nurse, Digital Subtraction Angiography

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## 1. Introduction

Interventional therapy is a young discipline that has emerged in the past 30 years. Because of its advantages such as high precision and minimally invasiveness, it has shown a strong development trend in recent years. In China, the Interventional Radiology Suite (IRS) mainly originated from the digital subtraction angiography (DSA) room, which used to be a part of the radiology department and got regulated and developed after the implementation of relevant encouragement by the Ministry of Health in 1990 [1]. Among them, Cardiac Catheterization Laboratory has the fastest development and the largest scale. In recent years, neurovascular interventional therapy, peripheral vascular interventional therapy, and tumor interventional therapy have gradually kept up with the pace of cardiovascular interventional therapy. The IRS has been continuously improved as well. It was mainly the medical auxiliary

department, and now it has become the clinical department with its own characteristics. With the increasing professional requirements for nursing, the Interventional Radiology Nurses (IRNs), who used to be concurrently performed by radiology nurses, ward nurses or CCU nurses, now have become specialized practiced nurses, and gradually assume more duties and discipline construction jobs.[1-5]

As an emerging multi-disciplinary treatment place, IRS is still developing rapidly in multiple directions in China. Currently, there are three development trends of IRS in China:[6-10] (1) Interventional Radiology Center, the centralized management of multiple IRS, which helps to meet the increasing demand for interventional therapy (2) Interventional Hybrid Operating Room (OR), providing therapy place to complete hybrid surgery, which was a perfect fusion of the accuracy of interventional therapy and the effectiveness of surgery. (3) Cardio-cerebrovascular First Aid Center, where to race against time to complete coronary

or cerebral vessels reperfusion within the therapeutic time window (TTW) to save lives. With the rapid development of interventional therapy, the personnel training of Advanced Practice Nurses in IRS has also received more and more attention.[11]

## 2. Interventional Radiology Center

### 2.1. Development of Interventional Radiology Center

Traditionally, there are no more than 4, mostly 1 or 2 IRS in most Chinese hospitals. While interventional therapy has been getting vigorous improvement and promotion, the workload of IRS has also increased, making it difficult to suffice the demand. Efficiency in IRS is exceptionally challenging because of the mixture of inpatients and outpatients being scheduled throughout the day, using the same rooms, for procedures of fluctuating lengths [12]. The inevitable result is the birth of interventional radiology centers like the surgical OR centers. The Henan Provincial People Hospital, who was perceived as a pioneer in interventional therapy in this country, became well known for its management of interventional radiology center which called HENAN MODE. The centralized management mode integrates medical resources such as DSA devices of different functions and models, numerous medical equipment and supplies, meeting the needs of multiple wards and achieving good social and economic benefits. IRNs technologists and other staff could be more efficient in interventional radiology centers. The centralized management mode of interventional radiology center has optimized the human resource deployment, maximized efficiency of equipment resource, rationalized management of interventional therapy materials, rationalized the interventional therapy schedule arrangement, improved the treatment effect of joint medical imaging technology, normalized nursing quality management and standardized the development of interventional radiology nursing.[7]

### 2.2. Roles of IRNs in Interventional Radiology Center

In interventional radiology center, the role of the IRNs was like housekeepers, undertaking the following tasks.[7] (1) Arranging the interventional therapy schedule reasonably and prioritize arrangements for emergencies. (2) Making better use and management of the interventional radiology equipment, maximizing the effectiveness of the equipment. Contacting engineers in time to maintain and repair equipment. (3) Managing sterile supplies and high-value supplies, making appropriate turnover for high-value supplies to avoid the risk of being out of stock or expired. (4) Providing standardized and high-quality interventional perioperative nursing with various wards, cooperating with the cardiovascular, neurovascular, peripheral vascular and tumor interventional therapy professionally. Just like the surgical OR centers, the interventional radiology center would develop into one of the most important platforms for interventional radiology nursing disciplines. IRNs should the role of managers, improve themselves and contribute to building a high-quality and

efficient interventional radiology treatment platform.

## 3. Interventional Hybrid Operating Room

### 3.1. Development of Interventional Hybrid Operating Room

Today's interventional hybrid operating room mainly refers to the one-stop interventional hybrid operating room, which was first proposed by Jordan and used for the treatment of congenital heart disease.[13] The first interventional hybrid operating room in China was established by FUWAI Hospital in Beijing for cardiothoracic surgery in 2007. In the following few years, the construction of interventional hybrid operating rooms in China has developed rapidly, and it has been widely used in cardiovascular, neurovascular and peripheral vascular surgery. Interventional hybrid surgery combines the strength of surgery and interventional therapy in an effective and precise way, solving problems that cannot be solved by one method. In addition, it could avoid repeated anesthesia and transport, reduce the duration, trauma, and risk of the treatment. Interventional hybrid surgery has been favored by various departments in terms of benefits. Interventional hybrid surgery such as SYNTAX (Synergy Between Percutaneous Coronary Intervention with Taxus), hybrid neurovascular surgery, hybrid endovascular aneurysm repair (EVAR) and caesarean section of pernicious placenta previa were widely promoted in recent years.[14-16] The interventional hybrid operating room has great potential, but it is still in the promotion stage, with a series of problems to improve. Studies show that there were more than 200 so-called interventional hybrid operating rooms in China in 2013, but there were only 57 hospitals had established interventional hybrid operating rooms in the true sense.[13] In addition, there were currently two main types of interventional hybrid operating rooms: (1) Most interventional hybrid operating rooms were transformed from the original interventional radiology suite through upgrading laminar flow equipment, operating beds and other facilities. (2) A part of the newly built interventional hybrid operating room was established in surgical OR centers, providing a better sterile environment and more professional surgical equipment.

### 3.2. Roles of IRNs in Interventional Hybrid Operating Room

As most interventional hybrid operating rooms were upgraded from the original interventional radiology suite in China, IRNs became supervisors of the interventional hybrid operating rooms. According to our experience, the roles of IRNs during interventional hybrid surgery were like "Commanders". The duties of IRNs were as follows: (1) At present, the construction of interventional hybrid surgery was immature. IRNs needed to take part in the construction design, space layout, and equipment configuration. (2) On the other hand, IRNs needed to negotiate with doctors regarding the schedule of interventional hybrid surgery, the

surgery plan and process, how to use the equipment reasonably and reduce operating time in order to confirm that it could achieve the requirements of surgery, simplify the surgical process and ensure the safety. (3) As interventional hybrid surgery involved multiple disciplines, numerous medical staff and took a long time, IRNs should handle many details properly, such as reducing personnel movement, protecting laminar flow environment, keeping the operating room clean and sterile, arranging medical staffs of different functions to enter and leave the operating room in batches, assisting surgeons in completing surgery, monitoring vital signs of patients. Each interventional hybrid operation took hours from the patient's entry to the exit, and the IRNs needed to monitor and coordinate well during the entire operation. As the supervisors of interventional hybrid operating room, IRNs should summarize and promote the excellent and mature experience of the construction and management of the interventional hybrid operation room, so that the interventional compound operation could develop faster and more perfectly.

## 4. Cardio-cerebrovascular First Aid Center

### 4.1. Development of Cardio-cerebrovascular First Aid Center

In recent years, 5 types of emergency centers and emergency treatment systems for critically ill patients had been established throughout China under the guidance of the national health policy. The chest-pain center and stroke center were among these 5 centers and IRS was usually the frontline department of them, which called the cardio-cerebrovascular first aid center. In chest-pain center, interventional physicians and IRNs tried their best to keep the Door-to-Balloon (D2B) time under 90min. In stroke center, they strived to complete thrombectomy for patients with acute ischemic stroke (AIS) in 6 hours [17]. The ideal mode of cardio-cerebrovascular first aid center was as follows: [18-20] (1) The emergency department, imaging department, and IRS were built near each other. It's better that there was a fast access to IRS in the emergency department. (2) After the patient arrives in the emergency department, the emergency physician could make the first diagnosis and evaluate the condition to confirm whether to initiate the cardio-cerebrovascular first aid process. If it was during the out-of-hours (OOH) time, the emergency physician should notice interventional physicians and IRNs at the same time. In addition, the emergency nurses should change patient clothes, complete skin preparation, indwell venous access and take blood tests in time, then arrange the patient await in the monitoring room. (3) After the process was initiated, a cardiologist or neurologist would arrive for a specialist consultation and preoperative evaluation to decide whether further imaging studies or anesthesiologists were needed. (4) During OOH, at least one IRN should arrive in 15min to complete pre-operative preparations. (5) When the IRS was ready, interventional physicians and IRNs cooperate

to try to complete the treatment within the time window.

### 4.2. Roles of IRNs in Cardio-cerebrovascular First Aid Center

The cardio-cerebrovascular first aid center mainly runs around the TTW, competing with time. The role of IRN is the pioneer of the life-saving battlefield, performing the following duties: (1) During the in-hours (IH) time, IRNs should arrange an available room to receive the patient as soon as possible. During the OOH time, IRNs should return within the required time. The interventional emergency was different from surgical emergency as there were many uncertainties, so IRNs were usually at on-call duties at home instead of staying in hospital. There were usually 2 IRNs on duty. When they got called, they should return in 15min, and then one of them competed the preparation, and the other contacted the emergency department and receive the patient. (2) As most cardio-cerebrovascular emergency patients are life-threatening, IRNs are the cooperators of interventional physicians as well as lifesavers. They should monitor the patient while the treatment, and report to physician in time if anything abnormal. If necessary, IRNs should follow the doctor's instructions to stabilize the patient's condition or assist the doctor in the rescue measures such as CPR and defibrillation. (3) IRNs are also the recorders, accurately recording data related to TTW during treatment, such as arriving time, puncture time and reperfusion time.[6, 17, 21] The data benefited the review of treatment, scientific research and quality improvement of the process. The control of treatment time was closely related to the prognosis, rehabilitation and the economic burden of patient, which was also the value of cardio-cerebrovascular first aid center. IRNs should master their own roles, strengthen their professional skill of treatment cooperation and first aid, and get ready to save lives.

## 5. Conclusion

The interventional radiology disciplines were developing rapidly, the IRS was also constantly developing and transforming, and these development trends reflected that the characteristics of interventional radiology suite was getting more centralized, specialized, diversified and advanced, which means that interventional therapy was becoming more and more important in modern medicine. The interventional radiology nursing disciplines was improving and expanding as well. As the roles of administrator, coordinator, and caregiver of the interventional operation room, the nurses are suggested to keep in step and strengthen the skills to provide professional and scientific nursing services, contribute to the development of interventional radiology. In addition, hospitals in China could also configure nursing human resources according to the different development levels and specialties of the interventional operating suites, in order to optimize the nursing workflow, improve the efficiency and reduce waiting time of patient.

## Competing Interests

The authors declare that they have no competing interests.

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