

The application of multi-part collaboration in improving the on-time opening rate of the first interventional surgery

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Abstract: Objective To explore methods for improving the on-time opening rate of the first interventional procedure and further enhance the efficiency of the catheterization laboratory. Methods: A retrospective analysis was conducted on the on-time opening rate of the first surgeries in our hospital from April to September 2024, and the reasons for the delay in the opening time of the first surgeries were analyzed. Systematic intervention was carried out with the aid of scientific management tools. The results showed that the rate of on-time opening of the first operation was increased to 88.08% after systematic intervention. Conclusion Through the collaboration and close coordination of multiple departments and departments, the efficiency of the catheterization laboratory was effectively improved, and the satisfaction of patients and medical staff was also enhanced.

Keywords: Interventional catheterization laboratory; Management; Work efficiency; Opening time of the first operation

With the rapid development of science and technology, interventional therapy techniques are constantly evolving, and interventional surgery accounts for an increasingly large proportion of clinical treatment methods. As one of the high operating cost centers in the hospital, the catheterization laboratory has strict environmental monitoring requirements, numerous precise and expensive instruments and equipment, and a wide range of high-value medical consumables. The catheterization laboratory serves a wide range of departments. The high price of the DSA leads to a general shortage of catheterization rooms in hospitals, with a relatively large number of surgeries. If the first surgery cannot be performed on time every morning, it is easy to cause a backlog of subsequent surgeries, a decline in patient satisfaction, frequent overtime work by medical staff, and the spread of dissatisfaction, which directly affects the quality and efficiency of work. However, surgical delays are a common problem plaguing the management of most hospitals and one^[1] of the important factors affecting the continuous development of hospitals. Therefore, improving the efficiency of operating rooms can speed up bed turnover, shorten patient stays, avoid unnecessary waste of resources, and also increase the social and economic benefits^[2] of hospitals. Operating time is the most important indicator of the improvement of efficiency in catheterization laboratory time management, and it is one of the measures reflecting the management capabilities and levels of hospitals and departments, as well as the overall collaboration capabilities and operational efficiency. Therefore, the delay

in the opening of the first elective surgery not only reduces the overall efficiency of the catheterization laboratory and wastes medical resources, but also leads to a decrease^[3] in patient and family satisfaction. After investigation, it was found that the on-time rate of the first operation in our catheterization laboratory was low. In order to improve work efficiency, scientific management tools were used, combined with the characteristics of our hospital, and multiple departments and disciplines of the hospital were coordinated to carry out systematic intervention for the current situation of delayed first operation. The analysis is as follows:

1 Data and methods

1.1 General Information

Our hospital was founded in 1917 and is a national tertiary general hospital. Our interventional catheterization laboratory currently has five operating rooms. The number of surgeries has increased in recent years. In 2023, the number of surgeries was 5,956, an increase of 9.7% compared to 2022. Departments involved: Cardiology, Interventional surgery, neurosurgery, vascular surgery, cardiac surgery, oncology, pain management, etc., but there is a common problem of inaccurate table opening. In 2023, in a survey of patients' satisfaction with interventional surgery, it was found that patients repeatedly reported that the waiting time for the first catheterization was too long after being admitted to the catheterization room. They arrived at the catheterization room at 7:30 and the surgery did not start until nearly 9 o'clock. Patients were dissatisfied and had severe anxiety. The delay of the first operation is often reported^[4] in operating rooms at home and abroad. Because it involves many departments, the delay of the first operation is also a difficulty in the daily management of our department. In response to the above issues, under the leadership of the hospital, with the coordination of the medical affairs department and the nursing department, our department has systematically and comprehensively reviewed all preoperative preparation procedures, improved relevant improvement measures, urged elective interventional surgeries to be performed on time, and improved the effective utilization rate of the catheterization laboratory.

According to the characteristics of our hospital, after coordination with the medical affairs department, nursing department, operating room and other departments, it is stipulated that the first interventional catheterization will be performed at 08:30 (disinfecting the skin).

1.2 The first operation is scheduled on time

Our interventional catheterization laboratory has a total of 4 operating rooms. We collected data on the opening time of the first surgeries from April 19 to May 30, 2024. There were 87 first surgeries during working days. Of the 87 first surgeries, 58 were performed on time, while the remaining 29 were delayed. The on-time opening rate of the first surgeries was 66.67%, and the reasons for

the delayed surgeries were analyzed.

1.3 Analysis of the reasons for the delay in the opening time of the first operation

There are various reasons for the delay of the first operation : ① Patient factors, such as using the toilet, changing surgical gowns, making appointments for examinations, waiting for family members, etc. ② Nurse factors, insufficient human resources, busy and disorderly, affecting the opening of the first operation; ③ Surgeon factors, subjective mindset, large number of patients, severe conditions, and failure to reasonably control ward rounds; ④ Incomplete preparation of items and instruments, sudden malfunction of instruments and equipment; ⑤ Other factors such as changes in the patient's condition, last-minute cancellation of surgery, long elevator waiting time, lack of assessment mechanism, etc.

1.4 Methods

1.4.1 Develop interventions

Our hospital will implement a series of comprehensive intervention measures starting from January 2024. ① The medical Affairs Department formulates the catheterization laboratory plan, which is based on operating room management principles and arranged by operating day and operating room according to the volume of surgeries in each department. ② Train the staff of the department, assist in improving the workflow, and ensure that the first patient for surgery is transferred in time. ③ Communicate with the ward nurse by phone, inform the first patient to be operated on by phone in advance, and reserve time for preparation. ④ The catheterization nurse arrives early and gets into working mode: Start the DSA, monitor the performance of the equipment, keep it in standby mode, prepare common and high-value consumables in advance, and get ready for the first operation. ⑤ Each department should avoid scheduling teaching rounds, case discussions, etc. on the operation day, and at least one doctor from each operating room should arrive at the catheterization room in advance to carry out routine preoperative preparations and disinfect the skin in a timely manner. ⑥ If general anesthesia is required, communicate with the anesthesiology department the day before and arrange the number of operating tables reasonably. The anesthesiologist will visit and assess the patient in advance and make adequate preparations based on the condition to avoid surgical suspension due to inadequate visits. ⑦ Establish wechat groups for communication among medical staff in each department to enhance communication between surgeons and catheters. On the next day of the surgery, a dedicated person in each department should promptly send information such as the patient's test and examination results, surgical arrangements, and whether general anesthesia is needed to the wechat group to improve the communication process. ⑧ The head nurse of the catheterization room records the time when the patient arrives at the operating room,

the readiness of the head nurse in the catheterization room, the time when the surgeon arrives, and the completion of anesthesia for the patient. ⑨ Establish an assessment mechanism: The catheterization laboratory counts the opening time of each operating room every day, keeps records and reports, and submits them to the medical Affairs department on a regular basis. The medical Affairs Department will assess each department and each doctor separately and link it to performance, and stipulate that surgeons who are delayed more than two times will suspend the arrangement of the first operation day for one month.

1.4.2 Investigation and Analysis Methods for the Punctuality Rate of the first operation

Each working day from April to May 2024, the head nurse of the catheterization laboratory conducted on-site investigations and recorded the opening time of the first operation on that day, using “disinfected skin” as the starting point of the operation. In addition, information such as the name of the first operation, the surgeon, and the reason for the delay should also be recorded.

2. Statistical methods

Statistical analysis was performed using SPSS 19.0 statistical software. Chi-square test was used for comparisons between groups, and $P < 0.05$ indicated a statistically significant difference.

3 Results

3.1 Survey Overview (before rectification)

April 19- May 30, 2024. investigate the on-time opening rate of the first surgeries in the catheterization laboratory and the reasons for the delay. The results indicated that a total of 87 first surgeries were performed, 58 were opened on time, and 29 were delayed. The on-time opening rate of the first surgeries was 66.67%, including 8 cases of delay in the coronary group and 10 cases of delay in the electrophysiological group. 6 cases in the neurointerventional group, 4 cases in the vascular interventional group, and 1 case in the structural interventional group. The reasons for the delayed opening and the proportions included: 1. The doctor's ward round time was too long, 32.81%; 2. Patients make appointments for tests, 26.56%; 3. Inadequate preoperative preparation by nurses, 21.88%; 4. Instruments and equipment are not in place, 7.81%; 5. Long elevator waiting time 6.25%; 6. Changes in the patient's condition 3.13%; 7. DSA machine failure, 1.56%. See Tables 1 and 2 for details.

Table 1. First Operation Delayed Opening Delay Statistics (before Rectification)

Delayed departments	Number of units n=87	Delay number
Coronary arteries	39	8
Electrophysiology	21	10
Neural intervention	14	6
Vascular intervention	8	4
Structure	5	1

Table 2. Statistics on the reasons for Delayed Opening of the First operation

Reason	Times	Cumulative count	Percentage
Doctors' ward rounds are too long	21	21	32.81%
Patient Appointments for examination	17	38	26.56%
The nurse's preoperative preparation was incomplete	14	52	21.88%
Instruments and equipment were not in place	5	57	7.81%
Long elevator waiting times	4	61	6.25%
The patient's condition changed	2	63	3.13%
DSA machine failure	1	64	1.56%

3.2 Overall Survey (after rectification)

2024.7.09-9.17 Investigate the on-time opening rate of the first surgeries in the catheterization laboratory. A total of 151 first surgeries were investigated. Among them, 131 were scheduled on time and 20 were delayed, namely: coronary artery, 6, accounting for 11.5%; Electrophysiology, 6 units, 14.6%; Neuro-intervention, 5 units, 15.2%; Vascular intervention, 3, 17.6%; Structure, 1 unit, 12.5%. The on-time opening rate of the first operation was 88.08%, which was a significant improvement compared to before the improvement, and was statistically significant ($P<0.001$). See **Tables 3** and **4** for details.

Table 3. Analysis of Delayed Opening of First Surgery by Department (after rectification)

Delayed departments	Number of units n=151	Delay number
Coronary arteries	52	6
Electrophysiology	41	6
Neural intervention	33	5
Vascular intervention	17	3
Structure	8	1

Table 4. Statistics on Delayed Opening of First Surgeries (after rectification)

	On-time operation ()	Not on time	Kafang	P
Control group	58	29	13.74	<0.001
Improvement group	131	20		

4 Discussion

Minimally invasive interventional techniques have now become the third most popular treatment after surgery and internal medicine, and are increasingly

recognized and accepted by patients due to the characteristics of “less trauma and faster recovery”. The catheterization laboratory has become an important place for diagnosis, treatment and rescue of patients. With the development of various interventional techniques, the catheterization laboratory has become an important link in the hospital, involving many departments, high consumables, high added value and high efficiency, and is an important link in hospital management. Improving the efficiency of the catheterization laboratory is an important part of hospital management. And optimizing the opening time of the first operation is also one of the important measures to improve the management efficiency of the catheterization laboratory.

The catheterization laboratory is a passive functional department involving multiple disciplines and departments. It has developed gradually and is not as early as the operating room, and thus does not have as standardized and advanced surgical management. The development of catheterization rooms varies from hospital to hospital, and there are many more details that need to be improved. Through the investigation, we found that there were many factors restricting the opening time of the first operation, such as the lack of a unified management system, the absence of a supervision and assessment mechanism, patients not changing surgical gowns, conflicts with scheduled examination times, family members not arriving at the hospital, tight human resource allocation of medical staff, weak subjective awareness, lack of time sense, and failure to supply instruments and consumables in a timely manner.

In the course of daily operation, with the maturity of interventional techniques, the number of surgeries has been increasing year by year, and the involved departments have gradually expanded from the original cardiology department, interventional department to neurology department, neurosurgery department, vascular surgery department, macrovascular surgery department, pain department, etc. Although our hospital has increased investment in recent years, the catheterization laboratory has increased from 2 to 4 DSA, but due to the development of some departments, Interventional procedures take longer, such as a one-stop operation for atrial fibrillation which takes more than three hours, causing the catheterization laboratory to operate under strain, with frequent large-scale overtime, exhausted medical staff, and a large number of patient complaints and a decline in satisfaction.

Does the catheterization laboratory have to increase its staff and operating rooms to solve the problem? The rectification measures also improved the satisfaction of medical staff, with 92.0% of surgeons and 76.0% of operating room staff believing that the start time of the first operation and the interval between next operations in the operating room were significantly shorter than before the improvement. ^[5]In response to the above situation, we conducted a study on methods to increase the on-time opening rate of first surgeries. First, we sorted out a summary of the problems of delayed opening times for catheterization laboratory surgeries, listing almost all the problems of delayed opening by frequen-

cy, excluding the reasons that could not be improved, such as sudden machine failure, etc., and found that many reasons could be improved. For example, in the statistics, it was found that the most common reason for delayed opening was the doctor's long ward round time, 32.81% and 26.56% of patients' appointments can be overcome in the work, such as having physicians make their rounds earlier, adjusting the physician's operation day and operation schedule, changing the patient's appointment time, etc.

Wang et al. showed^[6] that the on-time opening rate of the first operation in the intervention group was 95.79%, 7.03 percentage points higher than that in the control group. Surgical grade, whether it was minimally invasive surgery, and RW value were factors affecting the on-time opening of the first operation. The incidence of postoperative complications, average length of hospital stay, total hospitalization costs and Western medicine costs in the intervention group were all lower than those in the control group. Increasing the on-time opening rate of the first operation is conducive to improving the quality and efficiency of medical care, ensuring patient safety, reducing the economic burden on patients, and promoting high-quality medical development. With the strong support of the hospital, the medical affairs department and the nursing department, we have reallocated the number of operations and the number of operations in the relevant surgical departments based on the number of operations and operation time, taking into account the allocation of the number of operations and operation time, with the main guiding principle of revenue per unit time, The catheterization laboratory time allocation method based on revenue per unit of time was proposed to many departments and management methods were formulated; The department regularly conducts training, rationally optimizes work processes, and implements a subcontracting management model for drugs, instruments, and catheters, with responsibilities assigned to individuals; Strengthen communication with ward nurses, notify them in advance by phone, and leave sufficient preparation time for both nurses and patients; Establish wechat groups for communication between medical staff, enhance teamwork among medical staff, shift from passive management in the past to active participation, communicate and feedback in a timely manner in case of any emergencies, and solve them quickly and efficiently; Appoint a dedicated person to manage consumables, track them in a timely manner, and communicate in advance; Each department sets up a daily operation schedule to ensure that there is a doctor in the operating room to prepare for the operation in advance; Register the opening time of the first operation every day and keep a record. Report to the Medical Affairs Department on a regular monthly basis, and the Medical Affairs Department will assess each surgeon in each department.

Through the above methods, the on-time rate of the first operation has significantly increased, from 66.67% previously. Through comprehensive improvement and statistics, it was found that the on-time rate of the first operation after the improvement was 88.08%, which was a significant improvement compared with before the improvement and had statistical significance. The efficiency of

our catheterization laboratory was significantly improved, the number of medical staff working overtime was significantly reduced, the waiting time for patients in the morning was significantly reduced, and the efficiency of the catheterization laboratory was significantly increased. However, we found that there were still some departments that did not open on time, and some of the reasons were investigated. There were irresistible factors, such as sudden changes in the condition of patients in the ward requiring rescue, and some, such as emergency surgeries occupying the table, causing delays in the first operation. The rest can be improved by human intervention, mainly due to the lack of awareness and lax behavior of some physicians. The study at West China Hospital suggested that the rate of the first elective surgery opening at 9:10 a.m. in 2018 was only 44.7%, with an average opening time of 9:20 a.m. The main reason for the delay was “waiting for the doctor to enter the room”. After the supervision and assessment of on-time operation, the on-time operation rate rose to 96.8% in 2019, and the average operation time was advanced to 8:59^[7] a.m. We will continue to improve and may consider adding penalties, such as changing surgeries for those who do not want to start on time to receiving them.

In summary, this study, when applied to practical work, can indeed increase the rate of first surgeries, shorten the waiting time for patients and their families, reduce patients’ anxiety and fear, lower surgical risks, enhance patients’ satisfaction, and thereby improve the economic and social status of the hospital. In the future work, we still need to constantly optimize the process and make continuous improvements.

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