

# Analysis of Urgent Neurologic In-Hospital Consultations in a Large Tertiary Hospital Center in China

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## Abstract

**Objective:** To determine the current state of urgent neurologic in-hospital consultations, this study investigated urgent neurologic in-hospital consultations in a large tertiary hospital in China over a 4-year period. **Methods:** We conducted a retrospective study of urgent neurologic in-hospital consultations in a large tertiary hospital for 4 consecutive years (Jan. 1, 2014 to Dec. 31, 2017). The clinical data of patients who received urgent neurologic in-hospital consultations were obtained from the electronic medical record system and analyzed. **Results:** A total of 1437 cases (age range: 9–103 years old; average age: 60.3; males: 54.6%) were included in the study; 57.5% of the consultations were in line with urgent consultation criteria. The departments applying for urgent consultation involved 29Twenty-nine clinical departments were involved in the urgent consultations. consciousness disorder (36.0%), tics/stiffness (13.6%), limb weakness (8%), and mental disorders (5.6%). Urgent consultation diseases were divided into three categories: neurological diseases (77.8%), non-neurological non-neurological diseases (10.4%), and undiagnosed diseases (11.8%). The common neurological disorders included urgent cerebrovascular disease (33.6%), epilepsy/status epilepticus (15.8%), and metabolic or infective toxic encephalopathy (14.9%). **Conclusions:** Most urgent neurologic consultation is in line with consultations followed the guidelines for urgent neurologic consultation criteria. Non-neurologic. Non-neurological physicians in clinics should enrich their knowledge of frequently occurring urgent and critical neurological diseases.

## 1. Introduction

Neurology is a branch of medicine that deals with disorders of the nervous system, including the central and peripheral nervous systems. Neurological practice relies heavily on knowledge of neuroscience and the nervous system; thus, most people recognize that neurology is a complex and difficult subject [1]. According to one survey, difficulty understanding neurology is common among not only medical students but also older physicians [1,2], which presents some challenges for non-neurologists, especially for young physicians[3,4].

Acute and critical neurological diseases are characterized by rapid onset and rapid progression. If the disease is not correctly diagnosed and not treated in time, there will be more complications and higher mortality. It has been reported that the demand for neurology specialists exceeds the supply [5, 6]. Quick and accurate diagnosis and treatment are crucial for improving the prognosis of acute neurological diseases [7]. The main purpose of urgent consultation in neurology departments is to help the other departments deal with life-threatening symptoms in a timely manner. With timely responses, curative rates and quality of life are improved while morbidity and mortality rates are reduced. However, the current shortage of neurological physicians could be further exacerbated in the future [6]. As it stands, performing consultations poses a huge burden for neurological physicians. Despite the importance of this issue, few previous studies have investigated urgent neurological consultation.

## 2 Methods

### 2.1 Subjects

This study included clinical cases of non-neurologic inpatients who applied for urgent consultation in the neurology department of a 3200-bed tertiary university hospital center in China (First Affiliated Hospital of XXX) between Jan. 1, 2014 and Dec. 31, 2017.

### 2.2 Methods

Urgent consultation requires a doctor to first contact the consultation physician in the neurology department by phone and then fill out the electronic case application, which includes the patient's name, age, and gender; the hospital admission number; bed number; consultation specialty; and reason for consultation. The consultant should arrive at the applicant ward within 10 minutes after receiving the phone call. Urgent consultation is often conducted by the Chief resident in the neurology department from Monday to Friday and by attending physicians on weekends and holidays. For difficult cases, young physicians are expected to consult with the senior attending physician on duty.

After reviewing the patient's data, the neurological physician conducted neurological examination, clinical diagnosis and suggested further examination and treatment. For patients who had multiple consultations, this study regarded the conclusion of the last consultation as the final diagnosis. Diagnoses of non-neurological diseases were obtained from the patient's hospital discharge records. If the same case was referred for consultation more than twice, it was still regarded as only 1 case. This study analyzed the following parameters: the purpose of consultation, the disease spectrum of consultation, the Department distribution of non-neurological diseases and the consistency rate with the emergency consultation criteria.

There were no reported criteria for urgent neurologic consultation. Therefore, we defined the following criteria for urgent consultation in the department of neurology [1,8]: (1) stroke within 24 hours; (2) cases of critical illness requiring the assistance of neurological physicians; (3) acute gas poisoning within 24 hours requiring emergency hyperbaric oxygen treatment; (4) other newly emerging neurological disease symptoms, neurological signs, or imaging abnormalities; (5) recurrent symptoms with poor therapeutic effects; (6) patients to receive emergency surgery who had had neurological diseases previously for preoperative evaluation; and (7) cases with medical disputes.

### 2.3 Statistical analysis

Microsoft Excel was used for data collection and to create tables. Countable data values were presented as the mean  $\pm$  SD. Data processing was done using SPSS version 23.0.

## 3. Results

### 3.1 General information

There were 1618 cases of urgent neurological in-hospital consultations in the 4-year period: 573 cases in 2014, 406 in 2015, 382 in 2016, and 257 in 2017. Among them, 136 cases had been consulted at least twice; these were regarded as 1 case in the data. Thus, 1437 cases were included in the final analysis, among which 54.6% were male and 45.4% were female. The average age was 60.3 years (range: 9–103).

### 3.2 Consultation department involved

Urgent neurologic consultation involved 29 clinical departments(Fig1): 990 cases in the general ward and 447 cases in the intensive care unit (ICU). A total of 68.3% cases were from the department of internal medicine and the surgical departments. The departments within the department of internal medicine that most commonly applied for urgent consultation were emergency (12%), respiration (11.9%), cardiology (11%), hematology (7%), and nephrology (6%). The departments within the surgical department that most commonly applied for urgent consultation were thoracic surgery (13%), orthopedics (12%), vascular surgery (11%), hepatobiliary surgery (10%), and ICU surgery (10%).

Fig.1 Urgent neurological consultation involving clinical departments.

### 3.3 Diseases and the purpose of consultation

The common purposes for inviting urgent neurologic in-hospital consultations were as follows: diagnosis unknown (80%), assisted treatment (14%), and disputed cases (6%) (Table 1). Table 1 shows other, less common reasons for applying for urgent consultation.

[Table 1 here]

The diseases in urgent neurologic in-hospital consultation can be divided into three categories: nervous system diseases, nonnervous system diseases, and unknown diseases. Diseases frequently requiring neurologic consultation included acute cerebrovascular disease, epilepsy, intracranial infection, metabolic encephalopathy, infectious toxic encephalopathy, ischemic and hypoxic encephalopathy; these accounted for 58.4% of the total urgent consultations. The older the age, the more frequent the application for urgent consultation. Non-neurological diseases accounted for 10.4% of the total number of emergency cases, in which the internal environment was disordered and the basic diseases were poor, and anxiety states were the most common. Unknown diseases accounted for 11.8%. There are many reasons for these conditions, including highly complex diseases and patients' refusal to further examination.(Fig2)

Fig.2 Departments with non neurologic diseases in urgent neurologic consultation

### 4. Discussion

For most physicians, neurology is a complicated subject that encompasses many critical diseases. It also presents a difficult area with many blind spots in medical diagnosis and treatment. Therefore, urgent consultation in neurology departments is very common in tertiary hospital centers. This study obtained two main findings. First, neurological diseases accounted for 77.8% of the total cases of urgent consultation diseases, 57.5% of which were in line with urgent consultation criteria. Second, the most common reasons for urgent consultation were disturbances of consciousness, tics/stiffness, limb weakness, and mental disorders. Common neurological disorders were acute cerebrovascular disease (33.6%), epilepsy/status epilepticus, and metabolic or infectious toxic encephalopathy.

Among the 1437 cases of urgent consultation, the actual number of cases decreased year by year, from 573 in 2014 to 257 in 2017. This may be attributable to improvements in the clinical skills of non-neurologists at the hospital as well as effective management by the hospital's medical services section. The data shown show that most urgent consultations have been adjusted reasonably and appropriately according to predefined criteria. There are many reasons for this. First, the hospital's management has placed greater emphasis on the importance of basic medical knowledge and skills. A great deal of training for continuing medical education has been conducted. Second, there is a standardized clinical pathway for physicians to reference regarding several neurological diseases. However, non neurologists should enhance their understanding of nervous system diseases, so as to make better judgment on the conditions related to emergency neurology consultation. Further, medical management bodies should adopt appropriate measures to enhance the effectiveness of urgent consultation.

In urgent consultation, acute cerebrovascular diseases accounted for 33.6% of cases, including cerebral infarction, cerebral hemorrhage, and transient ischemic attack; this is similar to previous findings [9]. In the study hospital, the average age of urgent consultation patients was 60.3 years old; this could be related to the increased incidence of stroke with age [6]. Most consultations were in line with the guidelines for urgent consultation because the hospital's physicians were more skilled now at diagnosing and treating acute cerebrovascular diseases. There were 177 cases of epilepsy/epileptic-persistent states, which differs from the common urgent consultation diseases reported in domestic emergency consultation studies. The main reason could be that the study hospital has an epileptic center that is, in fact, one of China's well-known epilepsy centers. The center has several epilepsy experts and a large number of regular follow-up patients who come from neighboring areas with poor treatment managed by non-specialists. Cases of metabolic or infective

toxic encephalopathy and encephalitis comprised the third-largest group for urgent neurological consultation. Many patients with encephalopathy and encephalitis are treated for longer periods of time. The study hospital houses the XX Key Laboratory of Neurology, which is operated by full-time specialists who can detect acid-fast bacillus with more than 80% positive results and abscissa cells. They can also detect more than 10 antibodies related to autoimmune encephalitis, which are highly specific and sensitive. Thus, the neurological physicians at the hospital can better manage the diagnosis and treatment of encephalitis.

Departments that frequently applied for urgent neurological consultation included the intensive care unit (ICU), respiratory medicine, cardiovascular medicine, hematology, and nephrology. At present, it is estimated that about 10% of patients present some neurological manifestations in the previous reports[10–13]. It has been reported that neurological consultation in the ICU is often urgent consultation, which also suggests that patients have more severe diseases to be managed. At the same time, some ICU doctors lack relevant knowledge about critical neurological illnesses. It is advised that internal medicine residents should be trained in neurological areas for at least 6 months of the 3-year standardized resident training in China. In addition, ICU physicians at the study hospital should attend more lectures on emergency neurology. Most patients in cardiovascular and nephrology department have risk factors of angiosclerosis, often accompanied by cerebrovascular disease. Patients with renal failure are consulted by neurology because of their impaired consciousness or convulsions during dialysis, which are due to internal environment dysfunction, renal encephalopathy, and dialysis encephalopathy.

The common reasons for applications for consultation in the respiratory medicine department included convulsions and disturbances of consciousness; the etiology was mostly pulmonary encephalopathy or ischemic and hypoxic encephalopathy. First, it is very important for them to control the primary disease. If patients with lung tuberculosis present with headaches, disturbances of consciousness, convulsions, or hyponatremia, tuberculosis meningitis should be considered. Then, patients should be prescribed a routine with lumbar puncture for cerebrospinal fluid analysis, dynamic electroencephalogram, and MRI. Once a patient is diagnosed with tuberculosis meningitis, antituberculosis drugs should be prescribed as soon as possible.

The main reason for applying for urgent consultation in the surgical department was impaired consciousness. Uncontrollable postoperative epilepsy is among the special cases for the neurosurgery department. However, the preoperative evaluation and secondary prevention of cerebrovascular disease often take place in the surgical department, which should be consulted regularly rather than through urgent consultation.

Accurate case histories and neurologic examinations may help physicians differentiate neurological diseases. There were 150 cases of nonneurological diseases, including restlessness, mental disorder, disturbances of consciousness, and headaches; these were considered to be related to internal environmental disorders, primary diseases, hypertension, anxiety, and vagal reflex syncope. Some physicians confuse aphasia with unclear utterances in mental disturbance. Therefore, to reduce unnecessary urgent neurological consultations, physicians should rule out the above diseases before applying for an urgent neurological consultation. Acute encephalopathy is often secondary to infection after cardiopulmonary resuscitation or metabolic disease. To control the primary causes is the main measure. Before applying for consultation, it is suggested that physicians perform blood gas analysis, electroencephalogram, blood glucose and electrolyte analysis, and skull CT, and take a detailed history of drug use, including sedatives and antidepressants. In the case of urgent consciousness disorders and cognitive impairment after surgery, drugs with adverse effects should be considered first. Thus, physicians should be familiar with the adverse effects of anesthetic drugs. For tetanus/convulsion, as one common reason for urgent consultation, physicians should be familiar with the possible causes of convulsion, including diseases related to respiratory medicine, cardiology, and other types of internal medicine. Only some of these cases of convulsion are diagnosed as epilepsy, which should apply for neurological consultation.

Nonneurological diseases accounted for 10.4% of cases. Internal medicine and surgical departments accounted for half, including respiratory, cardiology, orthopedics, obstetrics and gynecology, and digestive departments. Nonneurologic diseases presenting with irritability and delirium but with no focal nervous system signs can be regarded as differential criteria for neurological diseases. Most consultation patients with nonneurologic

diseases had no new structural damage in their central nervous systems [14], and treatment was mainly intended to maintain the stability of the internal environment for the treatment of primary diseases. Pain has also been a common cause of consultation in previous studies [15]. Some cases should involve consultation with a neurosurgical physician rather than a neurological physician. These include cerebral contusion and laceration, skull base fracture, diffuse axonal injury, intracranial tumor, hydrocephalus, and subdural hematoma. Physicians should therefore improve their neurosurgical knowledge.

In addition, some consultations should be ordinary rather than urgent. For example, one patient with Parkinson's disease applied for urgent consultation because of treatment with the intravenous infusion of ganglioside. There were 169 cases that could not be diagnosed because of severe disease, failure to complete relevant examinations, or poor recording by physicians.

To conclude, medical staff in non-neurologic departments should strengthen their knowledge of common urgent and critical diseases, while neurological physicians should provide more in-service training for young physicians.

#### 4.1 Limitations

This research examined all urgent consultation cases in a 4-year period in the study hospital; the emergency department was excluded because of its special case recording system. While this study is the first large retrospective sample survey of inpatients applying for urgent neurologic consultation, it was limited by the discipline distribution of the study hospital. Thus, the results might not be applicable to other hospitals. To fully grasp the current state of urgent neurologic consultation, large-scale cases and multicenter studies should be undertaken in the future.

#### Acknowledgements

see in Title page

#### Conflict of interests

see in Title page

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