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Nagoya University Training System for Neuroendovascular Therapists

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Summary

It is very important to train more neuroendovascular therapists (NETists) in response to Japan's growing social needs. Since the supply of qualified NETists is still insufficient to cover Japanese institutions, therefore some emergency cases with indications for endovascular therapy may be overlooked, untreated or treated by other methods resulting in unfavorable outcomes. Thus, neuroendovascular therapies are situated as one of the important tratment modalities for neurosurgical diseases [1,2].

We studied our present states of the endovascular neurosurgery and introduce our training system.

Training Curriculum

Basic Training Curriculum of Neurosurgeons

Our university adopted the "super-rotation system" 30 years ago. This system obliges the interns to rotate among basic clinical departments such as internal medicine, general surgery, obstetrics, pediatrics, orthopedics, emergency, etc., every one or two months, and to permit them to volunteer for other departments depending on each intern's chosen career path. After this two year postgraduate rotation course, they are free to select their own courses and start their training as specialists. Trainees who select neurosurgery learn emergency neurosurgical treatments, surgical techniques, perioperative patient care, neurooncology, neuroradiology and become familiar with various investigative tools including cerebral angiography. During this period all neurosurgical residents usually master transfemoral and transbrachial angiography in the course of exposure to more than 100 practical experiences. After their neurosurgical training, they must pass the neurosurgical board examination while at the same time deciding on their choice of subspecialty courses such as vascular neurosurgery, skull base surgery, pediatric neurosurgery, functional neurosurgery, neurooncology, spinal surgery, and so on. One of their alternatives is endovascular neurosurgery, a division included in the neurosurgical department of our university. Because most endovascular neurosurgeons belong to the neurosurgical department in Japan, and since the National Society of Endovascular Neurosurgery was first organized in our university in 1981, the NETists have been nurtured among neurosurgeons, a tradition that continues even now.

Training program for NETist

Our NETist clinical training program basically runs for three years. The items to be mastered include four categories; 1) preoperative check, 2) planning of strategies, 3) operative

technique, and 4) postoperative care (table 1). The clinical entities and endovascular treatments that must be learned involve three stages (table 2), and trainees are usually expected to complete one stage a year. However, we allow for the fact that not all the trainees can complete the program within the allotted three years because individual talent, effort, and learning abilities are different. During their training period, they should learn to gradually master the necessary strategies and techniques while working as assistants to senior NETists, and they will occasionally have the opprtunity to operate on easy cases under senior supervision. They must also practice microcatheterization techniques using synthetic materials such as glass or animal models in their off-duty hours. We use mid-sized animals such as dogs or rabbits to simulate the clinical maneuvers, and rats are employed for training in fine microcatheterization (figure 1). Once trainees reach a sufficient level of expertise and practical experience in actual cases, they are eligible to the board examination for NETists. The board examination system in Japan has been previously described in this journal[3].

Table 1 **Items to be Mastered by NETist Trainees**

1. Preoperative check
- Understanding symptoms due to lesions
- Other required diagnostic investigation and imaging
- Indications for endovascular treatment (w/o egoistic bias)
- Possible risk of complications
- Risk-benefit assessment
- Validity of treatments from economic and social points of view
- Informed consent

2. Planning of strategy
- Anatomical understanding of radiological images
- Approaches to simulation and design
- Selection of devices and materials
- Setting treatment goals
- Prediction of difficulties
- Risk management

3. Operative technique
- Gentle and meticulous catheterization
- Proper selection and handling of materials
- Adequate application of supplementary methods and images
- Alertness to changes in images
- Decision making as to the last point of procedure
- Troubleshooting
- Careful attention to the patient's condition

4. Postoperative care
- Neurological and vital checks
- Additional medical treatments (antiplatelet, BP control, etc.)
- Postoperative imaging to check for complications
- Treatment for delayed complications
- Psychosomatic care
- Follow-up schedule
- Possibility of recurrence
- Decision making for retreatment

Desirable qualification for NETists

In addition to the above-mentioned qualifications, other desirable abilities specific to neuroendovascular therapy are needed.

1) Attentiveness

Our surgical works are realized in the monitors, and all the procedure are evaluated and performed using fluoroscopic animation. We conscientiously monitor small deviations or danger signals which could show up as catastrophic complications on angiograms, e.g., branch occlusion, extravasation or haemodynamic changes. NETists must develop their powers of concentration to compare and evaluate each time of scenes as well as superior dynamic visual acuity to recognize impending mishaps in real time.

2) Perseverance

Endovascular manipulation of the microcatheter and guidewire is performed at 150 cm on the caudal side. Some tortuous and atherosclerotic arteries may momentarily escape trackability and maneuverability, making the approach difficult. Even in this situation, the operator must not panic but calmly continue to exert the maximum effort. However, in some cases, a timely switch to alternative methods or devices may be preferable to persisting in fruitless and time-consuming efforts. Of course we should take in considerations and timely decide the neurosurgical open surgery for some difficult cases.

3) Judgment

Endovascular treatments sometimes yield incomplete results. To insist on pursuing an an-

Figure 1 The scene of the cerebral angiography of rat.

giographic cure may occasionally cause complications resulting in patient morbidity. It is very important to know one's limitations and to recognize when to stop a procedure based on signs of a possible unfortunate outcome. As mentioned above, although diligent efforts usually result in eventual success, we should always be aware that excessive persistence or stubbornness may do more harm than an incomplete treatments. Since such a talent for risk management is developed from repeated practical experience, trainees should be diligent in learning "empirical decision-making" from experts.

4) Strong will

Because it is not so long since neuroendovascular therapies were first introduced to Japan, they have not yet achieved universal acceptance in neurosurgical circles. Some vascular neurosurgeons who still do not accept the beneficial effect of these treatments tend to find fault with everything, basing their objections on the lack of long-term results. It is up to NETists to show our determination to persuade them based on the wealth of empirical evidence. Furthermore, when complications do occur, NETists should have the courage to investigate and analyze the cause of problems[4].

Table 2 **Training Stages**

1st stage:
- Occlusion test, fibrinolysis, particle embolization of ECA(tumors)

2nd stage:
- Coiling for dissecting aneurysms (trapping) or for small-necked, unruptured aneurysms
- Coil packing of sinuses (DAVF)
- Carotid stenting

3rd stage:
- Coiling for ruptured aneurysm or for unruptured aneurysm with advanced technique
- Embolization of AVM/AVF

The Need for NETists

Since there are not enough NETists in Japan, they cannot hope to meet the growing number of demands for the timely treatment of surgically untreatable lesions. Therefore, the status of some patients has deteriorated due to lack of endovascular therapy. Our data shows that the conditions of at least four patients worsened because of a delay in early treatment. The aneurysms of three patients have reruptured during the wait for NETists; two of them died and one had to be surgically treated. Due to a delay, one patient with carotid stenosis suffered a progressive stroke, thus losing the opportunity to undergo angioplasty with stenting because of a complete stroke caused by a carotid occlusion. These tragic events were possibly attributable to the lack of NETists in the institutes concerned. Furthermore, the results of a local fibrinolysis for a thromboembolism were compared between 26 patients treated in the institutes with a NETist and 19 in those without a NETist over five years. Favorable outcomes (mRS 1 or 2) were obtained in 15 patients (58%) in the former category vs, while in only three patients (19%) in the latter. This fact may suggest that fibrinolysis by non-NETists cannot achieved the usual good results because of the violation of the indications or their unskilled technique. Therefore, stationing NETists in each institute is the ideal to improve the overall prognosis, but so far, the equipment for consultation system is the first consideration. One solution is to use the telemedicine network for technical support, advise particularly its capabilities of telephotographic real-time transmission of animation. We have established connections between our university hospital and 11 affiliated hospitals via a broad-band network. An endovascular neurosurgeon in a hospital 50 km from our university could successfully perform the embolization of a vertebral aneurysm using the real-time communication system of animation and sound while operating under the guidance of one of our specialits. It is also important to pass on the accumulation of valuable knowledge, including negative experiences, so as not to repeat the same errors by other operators. We have held an educational seminar (The Neuroendovascular Treatment Seminar in Nagoya) every autumn as well as two regional meetings and two case conferences at our university and affiliated hospitals each year, at which difficult cases are always discussed. Such educational seminars and conferences for complications cases are a valuable supplement to textbooks and technical manuals in the education of young or pre-board NETists.

Conclusions

In order to train independent NETists and to maintain the quality of the average treatment level, it is essential to establish a comprehensive educational program [2,5-7]. Such a program should produce totally well-balanced NETists with sufficient knowledge of each disease, highly skilled in the proper selection of treatment methods, reliable surgical techniques and the best perioperative management techniques in addition to the requisite humanity and personality characteristics. Furthermore, both trainers and trainees must display the attitude and motivation needed to raise the quality and level of endovascular treatment.

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