

PAPER

Provision of 24 hour acute neurology care by neurologists: manpower requirements in the UK

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Objectives: The ABN has published standards of care for patients with acute neurological disease. Derriford Hospital provides a 24 hour neurology intake service to a population of 500 000 with the equivalent of four consultants, three specialist registrars (SpRs), and four senior house officers (SHOs) with a 37 bed ward. The authors undertook a prospective study of all neurology admissions to enable calculation of manpower necessary to meet the ABN guidelines.

Methods: All admissions to the neurology department were analysed prospectively for a three month period (March to May 2002).

Results: There were 629 admissions (equating to 2500 per year); data were collected for 93%. 78% of admissions were emergency, 16% elective. The mean number of neurology inpatients at any time was 76, with three (4%) being elective. The main diagnostic categories were stroke (29%), headache syndrome (13%), and epilepsy or seizures (12%). With regard to emergency admissions, 94% were seen by a neurology SHO within 6 hours and 81% by an SpR or consultant within 24 hours. Twenty five percent of emergency admissions were not seen by a consultant. 55% of patients were cared for on non-neurological wards for their entire admission. Median length of stay for stroke patients was 9.5 days, compared with 4 days for other patients. 37% of patients received a neurology follow up appointment. Currently each SpR spends 18 hours per week involved in the care of acute neurology admissions.

Conclusion: Meeting the ABN guidelines will require an increase in total neurology bed provision to at least 15 per 100 000 population, with the equivalent of 3 consultant sessions (11 hours/week). Meeting the European Working Time Directive will require a minimum of 8–10 SpRs working a full shift system, which will have a significant impact on training and other aspects of service delivery.

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The Association of British Neurologists (ABN) proposes that "a 24-hour neurological service should be available to all patients admitted with acute neurological illness and that all those who do not require immediate intervention should be seen within 24 hours".¹ Currently, most patients with neurological disease are cared for by general physicians or geriatricians. It has been argued that care of these patients by neurologists would result in better outcome and more efficient use of resources.²

There are currently 358 consultant neurologists in the United Kingdom (equating to approximately 1:177 000 population). The ABN has calculated that the number of consultants required to provide 24 hour on-site neurology cover in every district general hospital is 1:43 000 (an additional 1403 consultants).¹ In addition, the ABN has outlined the essential requirements for acute care provision and suggested standards of care.¹

The data on which these calculations are based are derived from studies of neurological presentation to accident and emergency departments^{3,4} and prevalence studies of neurological disease in inpatients.⁵ There has been no prospective study of all neurology admissions to a department providing a 24 hour acute service.

Derriford Hospital in Plymouth in the south of England provides a 24 hour neurology intake service (including stroke) to a population of 500 000 with the equivalent of four consultants, three specialist registrars (SpRs), and four senior house officers (SHOs) with a 37 bed ward. Patients in excess of this number are admitted as "outliers" to other wards, which may be either medical or surgical. These patients are looked after by the neurology medical team, but not by neurology nurses and do not have access to neurology therapists. All admissions to the neurology department were

analysed prospectively to allow calculation of the resources required to meet the suggested standards of care.

METHODS

A prospective study was carried out for a period of three months, from March to May 2002. These three months were chosen to minimise seasonal pressures that may have distorted the data. All admissions to neurology care were identified by the author, whether emergency, elective, or transfer from other medical specialty or hospital. Admissions were identified from admission lists generated by the SHOs and SpRs on a daily basis. These lists were cross checked with admission books in both the emergency and elective admission areas. A further check was performed with the hospital computer based patient management system. Finally, all notes arriving in the neurology department for discharge summary were reviewed. During the process of case identification, it became apparent that approximately ten patients with a neurological presentation (either seizure or headache) had been admitted and cared for throughout their stay by the general physicians during the study period. The data from these patients are not included in the study.

Data were collected in each case regarding age, sex, mode of referral, presenting symptoms, diagnosis at discharge, wait for clerking and senior review, length of stay, ward placement, investigations requested, outcome, and follow up.

Abbreviations: ABN, Association of British Neurologists; SHO, Senior house officer; SpR, specialist registrar

RESULTS

During the three month period there were 629 admissions, equating to 2500 per year. Data forms were completed for 586 (93%) of the identified admissions. Forms were not completed if the notes could not be retrieved within the study period (for example if the patient was admitted elsewhere) or if the admission notes had been lost. There were approximately 76 neurology inpatients at any one time, of which 4% were elective admissions.

Demographics

Forty five percent of the patients were male, fifty six percent female. The age ranged from 16 to 102 years. The median age overall was 59 years (mean 57.8 (SD 20.7) years). The average age of the main diagnostic categories is shown in table 1.

Source of referral

The majority (78%) of patients were admitted acutely: thirty one percent via the accident and emergency (A&E) department, 46% at the request of the general practitioner, and 1% as emergency from clinic. Sixteen percent of admissions were elective from clinic; 6% of admissions were referrals from other specialities or hospitals.

Presenting symptoms

The main neurological presenting symptoms were weakness (40%), headache (24%), and seizures (15%).

Diagnosis at discharge

The main diagnostic categories are listed in table 1. Cerebrovascular disease was the most common diagnostic category, accounting for 29% of all admissions. However, because of their greater length of stay, patients with stroke accounted for around 50% of neurology inpatients. Of the patients with a diagnosis of multiple sclerosis, approximately half were elective admissions for investigation, and half were acute relapses or admissions for immunomodulatory therapy.

The number of patients with subarachnoid haemorrhage quoted in table 1 does not include four patients who presented directly to the neurosurgeons during the three month study period. Were neurosurgery not on site, these patients would also have been referred to neurology in the first instance.

Of the 47 patients with a primarily medical diagnosis, 13 (28%) had systemic infection such as a urinary tract infection

or chest infection complicating a previous stroke or resulting in reduced conscious level or confusion, eight (17%) had alcohol related problems (despite a Trust policy for alcohol related confusion and seizures to be admitted under the care of the general physicians), six (13%) had metabolic derangement (such as hyponatraemia, hypoglycaemia, or acute renal failure) and five (11%) were found to have a non-neurological cause of loss of consciousness, usually syncope. The remaining non-neurological diagnoses included back pain, anxiety, psychosis, and other viral infections such as tonsillitis.

Wait for clerking and senior review

The delay prior to clerking and senior review for all admissions is outlined in table 2. With regard to emergency admissions, 94% were seen by a neurology SHO within six hours and 81% by an SpR or consultant within 24 hours, reflecting prioritisation of emergency admissions over elective admissions, and greater delay in review of the latter. Overall, 107 out of 586 patients (18%) were not seen during their admission by either an SpR or consultant; these were mainly patients admitted electively for planned investigations or treatments, patients transferred to the care of other specialities, or who could have appropriate investigations performed as an outpatient, for example transient ischaemic attack or single seizure. Fifty six percent of elective admissions and 25% of emergency admissions were not seen by a consultant.

Length of stay

The length of stay was documented in 579 of the 586 forms and ranged from 1 to 105 days (median 5). The length of stay varied according to diagnosis (table 3). Median length of stay for stroke patients was 9.5 days, compared with 4 days for non-stroke patients. The median length of stay for emergency admissions was 6 days compared with 3 days for elective admissions.

Ward placement

Ward placement was documented in 581 of the 586 forms. Two hundred and sixty six patients (45%) were admitted to the neurology ward at some point during their hospital stay—that is, 55% of patients were cared for on non-neurological wards for their entire admission. The percentage admitted to the neurology ward varied from 18 out of 32 (56%) of patients with central nervous system malignancy to 16 out of 51 (31%) patients with multiple sclerosis (mainly because these patients were admitted electively to a planned investigation unit).

Table 1 Number and percentage of admissions in each diagnostic category, with median age by diagnosis

	Number (%) of patients with diagnosis	Median age
Stroke or TIA	162 (29%)	76.5
Headache syndrome	73 (13%)	41
Seizures/epilepsy	69 (12%)	49
Multiple sclerosis	51 (9%)	41.5
Primarily medical condition	55 (9.5%)	62
CNS malignancy	32 (6%)	65
Neuropathies	24 (4%)	59
CNS infection	14 (2.5%)	29
Myasthenia	8 (1.5%)	
Extrapyramidal syndrome	8 (1.5%)	
Subdural haematoma	6 (1%)	
Motor neurone disease	5 (1%)	
Undiagnosed weakness	5 (1%)	
Undiagnosed sensory disturbance	4 (0.7%)	
Subarachnoid haemorrhage	4 (0.7%)	
Bell's palsy	4 (0.7%)	
Dementia	1 (0.2%)	
Head injury	1 (0.2%)	

TIA, transient ischaemic attack.

Table 2 Time delay for clerking and senior review of emergency admissions

Wait to be seen	By SHO (documented in 430 of the 456 emergency admissions)	By SpR or consultant (documented in 456)	By consultant (documented in 456)
<3 hrs	289 (67%)		
3–6 hrs	118 (27%)		
>6 hrs	23 (5%)		
<12 hrs		111 (24%)	
12–24 hrs		259 (57%)	191 (42%)
24–48 hrs		47 (10%)	78 (17%)
>48 hrs			73 (16%)
Total reviewed	430 (100%)	417 (91%)	342 (75%)

Table 3 Length of stay by diagnosis (days)

	Median
CNS malignancy	11
Stroke	9.5
CNS infection	6.5
Seizures/epilepsy	5.5
Peripheral neuropathy	3.5
Multiple sclerosis	3
Non-neurological	3
Headache syndrome	3

Investigations requested

The number of investigations requested is detailed in table 4. Repeat investigations were not documented in this study. Therefore the total number of computed tomography and magnetic resonance imaging scans is likely to be higher.

Outcome and follow up

Of the 580 neurology admissions for whom outcome was documented, 394 (68%) were discharged home, 62 (11%) were transferred to the care of another speciality, 50 (9%) were transferred to a rehabilitation unit, and 28 (5%) to a permanent care facility. Thirty seven percent of all patients and 23% of emergency patients received a neurology follow up appointment following their admission.

There were 46 deaths (8%), of which seven were unexpected. The mean age of patients who died was 77.5 (SD 11.6) years. The main diagnostic categories in patients who died were stroke (52%), including 13% with brainstem stroke, and intracranial haemorrhage (20%), admission being complicated by either pneumonia (30%), or gastrointestinal haemorrhage (7%). There was one case each of brain abscess, motor neurone disease, and glioblastoma. Five of the seven unexpected deaths represented rapid decline secondary to sepsis following stroke, or in the setting of dementia or subdural haematoma. In two cases the cause of death was not clear, and the patients were referred to the coroner for postmortem examination.

DISCUSSION

This study shows that from a population of 500 000 an acute neurology unit can expect to admit 2500 patients per year (500 per 100 000), of which 78% will be emergency admissions. The average number of inpatients at any given time was 76, of which three (4%) were elective admissions, due to their shorter length of stay. Approximately 30% of admissions were patients with stroke. This figure is similar to that found by Morrow and Patterson,³ suggesting that our data do not reflect a regional difference in referral pattern for stroke. However, we found that because of the increased length of stay (median 9.5 days), stroke patients accounted for half of all neurology inpatients at any one time. This figure is higher than the 36% quoted by Playford *et al*⁵ and

may well reflect local differences in discharge planning and facilitation.

One of the essential elements of care of patients with acute neurological disease outlined by Warlow *et al* is that patients are cared for by a team of nursing staff with appropriate training and expertise.² Currently half of all neurology admissions are cared for on non-neurological wards. There is a limited system in place to identify those patients who are most in need of specialist nursing and therapist input to enable transfer to the neurology ward, though this inevitably fails a significant number of patients. The number of total neurological beds required is therefore 15 per 100 000 which is more than double the current level of provision in Derriford Hospital. Bed requirement calculations performed previously⁶ and in other countries⁷ vary widely, reflecting differences in admission rate and length of stay. These factors would need to be determined locally to enable calculation of local bed requirement.

Further requirements endorsed by the ABN are for a prompt and correct diagnosis and 24 hour availability of appropriate medical staff.² In addition, the ABN has recommended that critically ill adult patients with neurological disorders should be seen immediately by a neurologist, and within 24 hours if less seriously ill.¹ This is in keeping with the Royal College guideline that an effective post-take ward round should be carried out by the consultant immediately after a 24 hour intake period.⁸ The ABN specifies that “adequate clinical time needs to be identified to allow [acute neurological admissions] to be seen promptly”.¹ Consultant neurologists in Derriford are allocated 1.5 three and a half hour sessions per week for work related to acute admissions and currently see 75% of acute admissions. Those not reviewed by a consultant are almost always seen by, or at least discussed with, the SpR, and are generally patients with a short length of stay (median 2 days) with a diagnosis of non-neurological condition (17%), headache syndrome (16%), multiple sclerosis (MS) relapse or possible MS (16%), migraine (7%), and epilepsy (7%). Delay in being seen by the neurology SpR (that is, the 10% of emergency admissions that were seen between 24 hrs and 48 hrs) reflects a combination of factors such as the patient not being on the ward at the time of the post-take ward round and inadequate time allocation for the post-take ward round, given other service commitments.

Delay to consultant review reflects timing of admissions in relation to the consultant’s weekly ward round. Inadequate session allocation has meant that it has not been possible to institute a daily consultant-led post-take ward round, although the consultant is always readily available for telephone advice. It has also been recognised that an SpR-led post-take ward round is a valuable educational opportunity for the registrar. A system of post-ward round review is being implemented to maximise this potential.

It could be argued that the level of consultant supervision currently provided in Derriford is appropriate, and that the ABN and Royal College guidelines impose an unnecessary burden on consultants. We calculate that in order to meet the ABN guidelines, each consultant requires at least three consultant sessions per week per 100 000.

This study has shown that a significant proportion of admissions to neurology care did not have a neurological diagnosis (8%). In addition, 37% of deaths were attributable to a medical complication of acute neurological disease—either pneumonia or gastrointestinal bleed. Although many of these complications occurred in critically ill patients in whom a decision not to intervene had been made following consultation with relatives, there must always be a close relationship between general internal medicine and

Table 4 Investigations requested

Investigation	Number requested	Percentage of patients for whom requested
CT	291	42%
Plain x ray	153	22%
MRI	106	15%
LP	94	14%
EEG	46	6.6%
EMG/NCS	15	2%

neurology. This must be considered when training schemes and accreditation are being planned.

Currently each SpR spends 18 hours per week involved in the care of acute neurology admissions (four hours each for post-take round, consultant ward round, further registrar ward round and discussion and administration, with further time required after every fourth weekend). This equates to 54 SpR hours per week, or 10.8 hours per 100 000 population. The ABN has calculated that the minimum number of neurological specialist registrars to provide a 24 hour registrar on-call service is five. However, a one in five on-call rota is non-compliant with the UK Government New Deal working arrangements, with the current workload. In addition, the implementation of the European Working Time Directive will impose a 48 hour working week by 2009. This will require a minimum of 8–10 SpRs working a full shift system, which will have a significant impact on training and other aspects of service delivery.

Although providing extensive acute neurology experience for registrars, the current system leaves little time for attendance of subspecialty clinics, neurophysiology sessions, neurosurgical procedures, or structured consultant-led teaching. Since this study was carried out, there has been an increase in the number of SpRs (to five) that will help address this issue, although as the number of junior doctors is increased to meet legal restrictions there is a danger that training experience will be diluted. The same considerations apply to the SHO grade; although current numbers are adequate to maintain service, SHOs sometimes find it difficult to attend outpatient clinics and teaching sessions. The development of nurse practitioners to assist with the care of acute neurology patients should help in this regard, and these changes are currently being piloted.

Clearly there are many potential models to care for patients with acute neurological conditions, often varying in the method of triaging symptoms. Different individual physicians will have varying degrees of confidence in their ability to deal with acute neurological problems. Many acute medical admission units will only refer patients to the neurological service if the patient's problems are more esoteric or unusual. We have worked on the assumption that all patients with any neurological symptoms are best cared for by specialist teams who routinely look after such problems and are able to understand both common and less common clinical presentations. We accept that other models may be appropriate, such as daily specialist neurology ward rounds on the medical admissions unit, although this may introduce significant delay in access to more specialist opinion, which may have consequences in sicker patients.

Availability of appropriate investigations is an essential requirement for an acute service. In this study, 57% of patients underwent imaging investigation at least once with either CT or MRI scanning. 6.5% had an EEG, and 14% lumbar puncture examination. There are no comparable studies to determine whether care of acutely ill neurology patients by neurologists results in more or less use of

investigative techniques. Morrow and Patterson's study of acute neurology under general medical care found that a similar proportion of patients had a lumbar puncture (16%).³ However, there was a greater use of EEG (17%) and much less imaging (1%), reflecting the local availability of the investigations at the time. Nevertheless, the investigative burden needs to be taken into account when calculating resources required for provision of an acute neurology service.

Thirty seven percent of all patients and 23% of emergency admissions received a neurology follow up appointment following discharge. Some of these patients (for example those with epilepsy or multiple sclerosis) would have had pre-existing appointments and would therefore not be "new follow ups". It is not possible to ascertain from the present study which patients fell into that category. However, there is undoubtedly a large outpatient workload associated with running an acute service (at least 90 follow up appointments per year per 100 000 population), which requires appropriate resources.

In conclusion, our figures allow departments considering an acute neurology service to predict resource requirements per 100 000 population. The expected annual emergency admission rate would be 390 patients, with an acute bed requirement of 15 and generation of 90 outpatient appointments per year. If elective admissions were included in the calculations, the figures would be 500 admissions per year, with the generation of 185 outpatient appointments per year. Sufficient junior staff are required to provide both adequate ward cover (including elective admissions) and a 24 hour acute admission service, representing a significant expansion from that currently available. Meeting the ABN guidelines will require three consultant sessions per week per 100 000 (or one consultant per 50 000 population).

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