Audit on first seizure presentation to Taranaki Base Hospital: a secondary centre experience

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ABSTRACT

BACKGROUND: Management of first seizure should be based on treating the underlying cause and tailoring investigations to identify those patients at high risk of recurrence.

AIM: To establish the incidence of first seizure presentation to Taranaki Base Hospital and investigate the management of these patients.

METHOD: A retrospective audit was performed identifying patients presenting to Taranaki Base Hospital from 1 January 2015 to 31 December 2015 with a first seizure.

RESULTS: Thirty-seven patients presented with their first seizure with 50% found to have an easily reversible precipitant. Forty-three percent had a history of previous brain insult and 52% had an abnormality identified on neuroimaging. Only 14% received formal neurology follow-up and only 8% had electroencephalography. Forty-three percent received chronic antiepileptic drug therapy and 27% had a recurrent seizure within 12 months. Only 43% had documented driving advice.

CONCLUSIONS: The incidence of first seizure presentation to Taranaki Base Hospital is similar to worldwide data. In general, patients receive basic investigations in keeping with international guidelines. This audit has helped to identify a number of areas to address with the current service provision, including ways to improve access to important investigations and ways to develop a guideline to standardise care.

Seizures are a common symptom encountered in emergency departments regularly. Seizures may represent a diagnosis of epilepsy but can also be a symptom of a wide range of medical illnesses, along with medication or substance effects.

Traditionally, the diagnosis of epilepsy relied on the patient having at least two unprovoked seizures more than 24 hours apart. This definition was revised in 2014 by the International League against Epilepsy (ILAE) to include:

- those patients with a single unprovoked seizure and a probability of further seizures similar to the general recurrence risk after two unprovoked seizures (ie, at least 60%) occurring over the next 10 years;
- and those patients with a diagnosis of an epilepsy syndrome.¹

Seizures are dangerous and life-threatening so establishing the cause or making a diagnosis of epilepsy with the appropriate management thereafter is essential. There are also significant ongoing social and occupational implications associated with the diagnosis (or lack thereof).

Worldwide incidence of a single unprovoked seizure is approximately 23 to 61 per 100,000 per year.² Approximately 8–10% of the population will have a seizure in their lifetime with 2–3% of them developing epilepsy.³

After an unprovoked first seizure, recurrence (without treatment) is estimated to be 21–45% after two years with the highest risk being immediately after the initial seizure.⁴ A variety of factors increase this risk, including electroencephalography (EEG) with epileptiform abnormalities,
previous central nervous system (CNS) insult (eg, stroke, brain tumour, head injury) or abnormal CNS imaging.4

A guideline from the American Academy of Neurology (AAN) from 2007 outlines the standard of care for investigating a patient with an unprovoked first seizure. This is also reviewed in the Journal of the American Medical Association in 2016. They recommend:

- All patients should have neuroimaging—up to 30% have potentially significant abnormalities detected3,5
- Outpatient EEG has a yield for epileptiform abnormalities of 29%3,5
- Routine screening for metabolic abnormalities (eg, hyponatraemia) and drug intoxication has been proposed and invariably occurs, but there is a lack of evidence as to its utility. Likewise, lumbar puncture is not recommended as a routine investigation.3,5

Following a subsequent unprovoked seizure, the risk of recurrence is substantially higher (57% by one year and 73% by four years).4 In these patients, it is well established that antiepileptic drug (AED) therapy is beneficial in terms of reducing seizure recurrence, inducing remission and improving quality of life.4

Management following a first unprovoked seizure is somewhat less clear.

The AAN guidelines on management of an unprovoked first seizure in adults from 2015 reflect this. These guidelines identified a number of patient groups at higher risk of recurrence after an unprovoked first seizure compared to those without:

- prior brain insult RR 2.55 (95% CI 1.44–4.51)
- patients with epileptiform EEG abnormalities RR 2.16 (95% CI 1.07–4.38)
- patients with abnormal brain imaging RR 2.44 (95% CI 1.09–5.44)

The guidelines highlight that immediate AED therapy significantly reduces the risk of recurrent seizure; however, this is not accompanied by improved rate of seizure remission in the long term (>3 years) or an improvement in quality of life. Additionally, 7–31% of patients experience side effects from AEDs.4

These guidelines mirror the shift in focus of epilepsy diagnosis to the more practical definition from the ILAE where those patients with unprovoked first seizures who are judged to have a risk of recurrence of more than 60% (ie, similar to the 57% recurrence risk after a second seizure) warrant upfront and immediate AEDs.1,4

Additional recommendation made from the National Institute of Clinical Excellence (NICE) guidelines from 2012 state that all adults presenting with a first seizure should be seen by a specialist in epilepsy as soon as possible.6

In New Zealand, a recent study by Joshi et al in 2015 identified a disparity in the access to care between patients in the Wellington region attributed to the hospital they presented to—either Wellington hospital with an established tertiary level neurology department, or Hutt hospital, which has neurology care provided by visiting neurologists from Wellington.7 They found that patients presenting with seizures were much more likely to be referred to the neurology service if they presented to Wellington hospital (52%) compared to Hutt hospital (13.4%). This difference was even more marked when examining for first seizure presentation where 63% were referred to neurology from Wellington, whereas only 9.8% were referred from Hutt hospital.7

Taranaki DHB (Taranaki Base Hospital (TBH) and Hawera Hospital), serves a population of 118,110 over a very wide area (7,948 km²). The Taranaki population is slightly older than the New Zealand population as a whole (36.9% over age 50 compared to 33.9%) with a higher proportion of Māori and lower proportion of Pacific Islanders compared to the rest of New Zealand (see Table 1).8 Taranaki Base Hospital is a secondary level hospital in New Plymouth with tertiary care being provided by a number of different DHBs dependent on the specialty. Tertiary level neurology care is provided by Auckland DHB with visiting neurologists from attending approximately once per month, usually for two days of clinics which tend to be severely overbooked. There is no EEG service in Taranaki and patients travel to either Waikato or Manawatu for this. Acute inpatient care is provided by general physicians.
Anecdotal experience indicates that the management of patients presenting with first seizure to Taranaki DHB is inconsistent and not in keeping with international guidelines. With ever-increasing modernisation of healthcare delivery by ways such as telemedicine, geographical constraints should no longer detriment patients’ care.

This audit will establish a baseline set of data to identify problematic areas and ways in which to bring the care of patients presenting with first seizures into line with international guidelines.

**Aims**

The aim of this audit was to investigate the current incidence of first seizures presenting to Taranaki Base Hospital (TBH). Additionally, the audit aimed to investigate the management of these patients and compare to current guidelines. We also assessed the rates of documentation of safety advice and events and suggest areas for improvement and development.

**Methods**

This study was designed as a retrospective audit over a 12-month period from 1 January 2015 to 31 December 2015.

A list of NHI numbers were obtained from patients over this period who presented to TBH with the diagnosis of “seizure”, “convulsion” or “epilepsy”.

Following this, the investigator examined the electronic records (discharge summaries, admission notes, results) and the hard copy referral letters and medical records. Data were collected on a standard Excel spreadsheet.

Inclusion and exclusion criteria were defined:

- **Inclusion**
  - Age >16
  - Documented history consistent with seizure—as determined by the primary investigator

- **Exclusion**
  - Age <16
  - Previous seizure
  - Non seizure

**Results**

One hundred and twenty-five patients were included in the initial data collection. Twenty-two patients (18%) were excluded as they were <16 years old, 31 (25%) excluded because it was deemed not to be a seizure (most commonly syncope), and 35 (28%) were excluded because it was not a first seizure. This left 37 patients (30%) included for further investigation.

![Selection process](image-url)
There was a roughly 2:1 split between males (62%, n=23) and females (38%, n=14). Mean age was 57.5 years, median was 58 years, with a standard deviation of 23.5 and interquartile range of 38.

Forty-three percent (n=16) had documented evidence of prior brain insult, including stroke (n=5), dementia (n=4), intracranial lesions (n=3), head injury (n=3) and previous encephalitis (n=1).

Potential reversible precipitants for seizures were found in 50% of patients:
- 11% (n=4) had seizures after exposure to drugs known to lower seizure threshold either in overdose or newly prescribed
- 14% (n=5) had seizures caused by illicit substances
- 22% (n=8) had seizures related to alcohol (five intoxicated and three in withdrawal)
- 3% (n=1) had a seizure associated with fever (negative lumbar puncture)

Most patients were recorded to have had generalised convulsive seizures (71%). Eighteen percent had focal seizures and in 11% the seizure type was unknown.

All patients received basic bloods including full blood count, renal function and electrolytes.

Neuroimaging was performed in the majority (97%) of patients. Most (92%) had CT; all were performed acutely on the day of presentation. MRI was done 32% of patients: in two cases instead of CT, and in addition to CT in 10 patients. Ten were done as inpatients with the average wait for MRI of 2.4 days (range 0–7 days), and two were as outpatients with the average wait of 12.5 days (range 11–14 days).

Of those that had neuroimaging, 52% had abnormal scans. Strokes (43%), atrophy (29%) and masses (29%) made up the abnormalities seen on CT. Strokes (38%) and masses (38%) were the most common abnormality on MRI. In those patients that had both modalities, 30% had their findings only demonstrated with MRI.

Thirty-eight percent (n=14) of patients did not receive any medical therapy for their seizures. Table 2 details the treatments received by those patients that did.

Management was predominantly inpatient-based with 78% admitted under general medicine.

Fourteen percent (n=5) of patients had formal neurology follow-up. The mean wait time for follow-up was four months. Only 8% (n=3) were referred for EEG, of which one was abnormal.

Less than half (48%) of the total study population had specific driving advice documented.

Table 1: Demographic data.

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>N (%)</th>
<th>DHB data (%)</th>
<th>NZ data (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZ European and other</td>
<td>26 (70.3)</td>
<td>79.9</td>
<td>77.7</td>
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<tr>
<td>Māori</td>
<td>11 (29.7)</td>
<td>18.9</td>
<td>15.8</td>
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<tr>
<td>Pacific Island</td>
<td>0 (0)</td>
<td>1.2</td>
<td>6.5</td>
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</table>

Table 2: Management N (%)

<table>
<thead>
<tr>
<th>Management</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>14 (38)</td>
</tr>
<tr>
<td>Medical therapy</td>
<td></td>
</tr>
<tr>
<td>• Acute</td>
<td>23 (62)</td>
</tr>
<tr>
<td>• Benzodiazepines</td>
<td>16 (70)</td>
</tr>
<tr>
<td>• IV antiepileptic</td>
<td>10</td>
</tr>
<tr>
<td>• Phenytoin</td>
<td>6</td>
</tr>
<tr>
<td>• Sodium Valproate</td>
<td>4</td>
</tr>
<tr>
<td>• Chronic antiepileptic therapy</td>
<td>2</td>
</tr>
<tr>
<td>• Phenytoin</td>
<td>16 (70)</td>
</tr>
<tr>
<td>• Sodium Valproate</td>
<td>4 (25)</td>
</tr>
<tr>
<td>• Levetiracetam</td>
<td>3 (19)</td>
</tr>
<tr>
<td>• Lamotrigine</td>
<td>2 (13)</td>
</tr>
<tr>
<td>• Carbamazepine</td>
<td>1 (6)</td>
</tr>
<tr>
<td>• Levetiracetam + Lamotrigine</td>
<td>2 (13)</td>
</tr>
<tr>
<td>Acute medical admission</td>
<td>29 (78)</td>
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<tr>
<td>Neurology follow-up</td>
<td>5 (14)</td>
</tr>
<tr>
<td>EEG</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Driving advice</td>
<td>16 (43)</td>
</tr>
<tr>
<td>Recurrent presentation with seizure &lt;12m</td>
<td>10 (27)</td>
</tr>
</tbody>
</table>
Discussion

This audit was designed to investigate the incidence of first seizure presentation to the emergency department at Taranaki Base Hospital and to establish how these patients are managed.

The incidence is similar to worldwide data: approximately three per 10,000 per year.

The population group is small and also only captures those patients who present to ED, therefore missing those not presenting through this pathway.

The approach to these patients by medical staff was fairly standard. Although not endorsed by guidelines, all patients had routine bloods.

Most patients (97%) had neuroimaging with the majority having CT. This is close to the goal of neuroimaging of all patients with first seizure as suggested by the AAN guidelines. Fifty-two percent had abnormal neuroimaging, which is in keeping with the findings from the AAN guidelines, which comment on an average yield for an abnormal finding of 15%, but with a wide range from 1–57%. The wide range would be expected given the significant potential for difference in interpretation of the imaging and findings. MRI was used more sparingly and not surprisingly had a higher sensitivity with 30% of patients having significant findings only identified on MRI. All CTs were completed acutely via the ED. The wait time to MRI for these patients is excellent (2.4 days for inpatient and 12.5 days for outpatient). Given that most of the patients were admitted, it is promising that these patients receive their investigations promptly. 12.5 days for an outpatient MRI is also impressive, but note must be made of the small sample size (n=2) very likely resulting in an underestimate of the true time period.

The majority (78%) were admitted to the general medical service for further investigation and management; however, 30% did not require any acute medical therapy and so may be more appropriate for outpatient management, which could be facilitated by development of a clear guideline.

Forty-three percent of patients (n=16) received ongoing medical therapy with AEDs. Most (88%) were with single agents. Phenytoin was the equal most commonly prescribed antiepileptic for ongoing medical therapy. This may reflect the high use of phenytoin in the acute setting (two-thirds of patients being treated with IV antiepileptics received IV phenytoin), which arguably is even more concerning with the increased risk of side effects and safer alternatives.

This likely also reflects clinicians’ familiarity with the drug given its long history of use and non-epilepsy specialists providing the bulk of the care.

The percentage that received ongoing AEDs is similar to both the percentages of patients with previous brain insults (43%) and abnormal imaging (52%), which suggests that there is an appropriate assessment of seizure recurrence risk with the resources available. Additionally, of those with abnormal neuroimaging, 76% (n=13) went on to receive chronic AED therapy, highlighting the influence and importance of this investigation.

Of the 19% (n=7) of patients identified as having unprovoked seizures with no significant history and normal neuroimaging, only one went on to have an EEG. AAN guidelines suggest EEG as a routine investigation following a first seizure as it can provide additional prognostic information to justify further AED therapy. The lack of a local EEG facility presents a significant barrier for these patients and clinicians may be less inclined to request the investigation due to these resource constraints. Additionally, only 14% of patients received any follow-up through the neurology service. Again, this represents a significant barrier related to the service in Taranaki as there are only visiting neurologists who are already overbooked. Clearly a local epilepsy specialist would help to address this problem, but other considerations should be made for novel ways to address this problem such as telemedicine and virtual clinics from the already established visiting neurologists.

The New Zealand Transport Associations guidelines state that patients with a solitary seizure should be managed in the same manner as those with established epilepsy with a stand-down period for 12 months (that can be reduced to six months if endorsed by specialist) unless there is exceptional circumstances such as a clearly identified provoking cause for the seizure. Regardless of seizure aetiology, only 48%
had documented advice regarding driving either in the clinical notes or the discharge summary. Documentation of premorbid driving status was globally absent. When excluding those patients who died in hospital and those presumed not to drive (ie, were rest home residents), 35% of the total still lacked driving documentation.

There are a number of limitations to this audit. A retrospective design means that collection of data relies solely on adequate documentation introducing information bias. There is potential for investigator error and bias when collecting the data, which was done by examination of old written and electronic records. Inclusion/exclusion of patients was especially vulnerable to error—both from the initial treating clinician and also the interpretation of the information in the notes as determined by a single investigator. Of those excluded, they had alternative diagnoses but it is very difficult to corroborate and confirm these retrospectively. Importantly, none of these patients were subsequently diagnosed with seizures in the next 12 months in Taranaki. Another example is with regard to driving advice and its documentation—the findings may reflect poor documentation by clinical staff rather than a true finding.

Conclusions and recommendations

First seizure presentations to Taranaki Base Hospital occur at a similar rate to worldwide data. Initial investigation and management is broadly in keeping with current guidelines, but there are areas in which to improve patient care.

This audit can help in the development of a specific pathway for management of a patient with a first seizure with clear guidelines on investigations both in the acute phase and following discharge from hospital. Dedicated education sessions to promote this proposed pathway will help to familiarise staff with its use and serve as a forum to troubleshoot any initial or ongoing issues.

Specific aspects to address would be to ensure all patients have neuroimaging and particularly important is identification of those high-risk patients and consideration of commencing antiepileptic therapy when appropriate. Generating an evidence-based guideline for choice of antiepileptic therapy would also be an easy way to simplify management and ensure appropriate care.

Streamlining of the referral process for EEG and aiming to remove the perceived barriers to its request is important going forward, as is referral to the neurology service. This may come in the form of virtual clinics or consideration of other alternatives such as combining their neurological consultation with their EEG consultation in another hospital. Development of a subspecialty interest in epilepsy (ideally in general neurology) by a general physician should also be encouraged and facilitated in order to further reduce the load on the visiting specialists.

Improvement of documentation of driving advice is very important going forward, with the recommendation for an information sheet detailing safety factors and other information about seizures to be developed along with a way to document its receipt by the patient (one option is to have a removable sticker on the information sheets that is then transferred to the patient's notes).

Further audit following the implementation of these changes is essential. Ideally this would be best done in a prospective manner in order to improve and eliminate some of the aforementioned limitations involved.
REFERENCES: