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Short communication

Reasons for prolonged length of stay in the epilepsy monitoring unit

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ABSTRACT

Epilepsy monitoring unit (EMU) admissions are essential for the classification/localization of epileptic seizures (ES) and psychogenic non-epileptic seizures (PNES). However, the duration of admissions is highly variable. Accordingly, we evaluated the duration of 596 EMU admissions and reasons for prolonged (>7 days) lengths of stay (LOS). The average LOS was longer for patients diagnosed with ES (8.0 days, SD 4.1 days) than all others (6.0 days, SD 3.9 days, $p < 0.001$). Of the 596 admissions, 231 (38.8%) had prolonged LOS. The most commonly reported reason for prolonged stay was need to record additional seizures (33%). Other contributors included complications such as seizure clusters (6.9%), status epilepticus (1.6%), test complications (3.7%), psychiatric concerns (4.3%), and medication side effects (1.6%). Our results suggest multiple factors produce prolonged LOS with no factor accounting for the majority. Recording an insufficient number of all habitual seizures was the leading cause, which was over twice the percentage of reported complications (17.6%). However, being able to prolong admissions when necessary resulted in only 14.9% of admissions being inconclusive, potentially justifying the extra expense. Efforts to shorten LOS may be best directed at faster recording of seizures, but this may increase LOS due to complications. Our results may be helpful when assessing whether efforts to shorten LOS are useful in improving the quality and cost of care.

1. Introduction

Evidence supporting the diagnostic value of video EEG monitoring (VEM) is well established (Nordli, 2006). VEM diagnosis serves to guide treatment of epileptic seizures and avoids unnecessary, costly, and potentially harmful treatments of non-epileptic spells (LaFrance et al., 2013; Smith, 2014). For patients with medically intractable focal onset seizures, VEM is essential for planning resective surgery. It is now accepted that medical intractability be defined as the failure of 2 or more appropriately chosen antiepileptic drugs (AEDs). Given the known physical, psychosocial, and mortality consequences of continued seizures (Laxer et al., 2014), it is recommended any patient with drug resistant focal epilepsy be referred for a comprehensive surgical evaluation. This includes patients with lower frequencies of seizures who may not have been referred for monitoring previously. Seizure freedom after surgery reduces subsequent epilepsy-related healthcare expenditures (Langfitt et al., 2007) and justifies the cost of EMU admissions.

Although the average length of stay (LOS) in adult EMUs is 3–4 days (Nordli, 2006), more prolonged monitoring may be necessary. We previously demonstrated that prolonged VEM was useful for the diagnosis/localization of ES. Such patients were just as likely to have diagnostic admissions regardless of whether their LOS was ≤5 days or more prolonged (Moseley et al., 2015).

Given the changing healthcare landscape and a desire to maximize utility, we evaluated LOS in our EMU. We identified admissions exceeding 7 days and identified contributory factors, with the goal of improving the efficiency and safety of monitoring.

2. Materials and methods

We reviewed the medical records of all patients admitted to the adult EMU at UCLA Medical Center from 2004 to 2008. All patients were monitored with continuous video and scalp EEG to classify/localize seizures. Data abstracted from the medical records included age, duration of seizures, reason for admission (presumed ES, PNES, or other non-epileptic events), LOS, and discharge diag-

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nosis. For patients with ES who were admitted for a presurgical workup, an admission was considered inconclusive if no seizures or an insufficient number of seizures were recorded. At our institution, we aim to record at least 3 nonclustered (>6 h apart) seizures in presurgical patients prior to discharge. For patients with presumed non-epileptic spells who were admitted for spell classification, inconclusive admissions included either recording no spells or not recording all habitual spell types. For patients with LOS >7 days, we recorded the reasons contributing to prolonged LOS.

Patients admitted to our EMU generally undergo maneuvers such as AED tapering to help capture seizures. Most patients with presumed ES admitted for a presurgical workup undergo a brain positron emission tomography (PET) scan on hospital day 2. In those cases, we generally do not start tapering AEDs until the PET is completed. The subsequent tapering of AEDs is individualized for each patient (based on factors such as baseline seizure frequency, history of status epilepticus, and medication half-life) and is not uniform.

All data entry and statistical analysis were performed using IBM SPSS Statistics Version 22 (IBM, Armonk, NY, U.S.A.). p-values <0.05 were considered statistically significant.

The protocol was approved by the UCLA Institutional Review Board.

3. Results

A total of 596 patients were admitted during the study period. The majority (333, 56%) were admitted with presumed ES for a presurgical workup. The remainder were admitted with presumed PNES (150, 25%) or other non-epileptic events (113, 19%) for the purpose of spell classification. At discharge, most patients (356, 59.7%) carried a diagnosis of ES. The remainder were diagnosed with non-epileptic spells only (137, 23.0%) or mixed disorders (both ES and PNES, 14, 2.3%). Eighty nine admissions (14.9%) were inconclusive. Of the 507 conclusive admissions, 9 patients with presumed ES were ultimately diagnosed with non-epileptic spells (1.8%) as a result of video EEG monitoring. Fifty patients with presumed non-epileptic spells had their diagnosis changed to ES (9.9%) as a result of monitoring.

The average LOS for all admissions was 7.2 days (standard deviation, SD 4.1 days). This was significantly longer for patients discharged with a diagnosis of ES (8.0 days, SD 4.1 days) versus all others (6.0 days, SD 3.9 days, independent samples T test, 2 tailed, equal variances not assumed, $p < 0.001$). A total of 231 patients (38.8%) had LOS >=7 days. Patients with discharge diagnoses of ES were significantly more likely to have prolonged LOS (173/356, 48.6%) versus all others (58/240, 24.2%, Fisher's Exact Test, 2 sided, $p < 0.001$). Patients with prolonged LOS had more prolonged durations of epilepsy/spells (17.7 years, SD 13.0 years) versus those with shorter stays (13.5 years, SD 12.2 years, independent samples T test $p < 0.001$). However, patients with prolonged LOS were not significantly older at the time of admission (36.4 years, SD 12.4 years versus 36.0 years, SD 14.1 years, independent samples T test $p = 0.69$).

There were 231 admissions (38.8%) with LOS >7 days. Of those 231 admissions, only 30 (13%) remained inconclusive at the conclusion of prolonged monitoring. Prolonging monitoring beyond 7 days in the majority (201, 87%) resulted in a definitive diagnosis being reached by the time of discharge. Of the 231 admissions lasting >7 days, 188 (81.4%) had adequate documentation to determine reasons for prolonged LOS. The most commonly reported reason was too few seizures recorded (62/188, 33%). Other contributors are listed in Table 1.

In the 62 patients in whom too few seizures recorded or prolonged time to first seizure was listed as a reason for prolonged LOS, the majority (49/62, 79%) ultimately had conclusive admissions. The same was true for the 8 patients with prolonged admissions and nonhabitual seizures/failure to capture all seizure types (5/8, 62.5% had conclusive admissions), 7 patients with testing complications (6/7, 85.7% had conclusive admissions), and 3 patients with medication side effects (2/3, 66.7% had conclusive admissions). All of the patients who were documented as having prolonged LOS secondary to clustered seizures (13), status epilepticus (3), unclear localization (23), and psychiatric concerns (8) went on to have conclusive admissions.

Twenty one patients were readmitted to our EMU for subsequent monitoring, with one admitted 3 times. The average LOS of the first admission (8.5+/−5.6 days) did not significantly differ from the second admission (7.5+/−7.2, $p = 0.47$). Patients requiring readmission were not significantly younger or older than patients who did not require a readmission ($p = 0.81$). Although readmitted patients tended to have more prolonged durations of epilepsy/spells (19.7+/−14.4 years) than patients who were admitted once (15.1+/−12.6 years), this did not reach statistical significance ($p = 0.24$). Only 1/21 readmissions (4.8%) was inconclusive.

4. Discussion

In our study, over a third of EMU admissions were associated with a LOS >7 days. This has been reported in other studies of VEM, with similar correlation between epilepsy duration and prolonged LOS (Alving and Beniczky, 2009; Lampe et al., 2014). The duration of epilepsy has also been correlated with increased adverse events in the EMU (Dobesberger et al., 2011). Overall, our results suggest that factors such as epilepsy duration should be taken into account when planning EMU admissions to maximize resource utilization.

At our institution we have resources to enable patients to stay >5 days when necessary. Other institutions are limited in their ability to extend LOS, with some forced to limit admissions to ≤3 days (Henning et al., 2014). Shorter stays have been associated with an increased risk of 30-day hospital readmission or ED visits (Caller et al., 2014). This suggests artificially limiting LOS may have consequences beyond not establishing a diagnosis. Inconclusive diagnosis rates at discharge have been reported to be 21.2–28% at other centers (Sauro et al., 2014; Spritzer et al., 2014), which is less than our rate of 14.9%. Given that 59 patients had their diagnoses changed as a result of VEM, there is clear value in obtaining a diagnostic stay. Our results suggest prolonging stay may be more cost effective and result in better resource utilization than cutting them short, only to repeat them (at greater overall length and cost) in the future.

One disadvantage to prolonging stay is the potential of payers to deny services. Many insurance providers limit covered LOS, with extensive measures needed to gain approval for admissions longer than a week. When attempting to find ways to shorten LOS, our data suggests reducing the time needed to record the first seizure would be helpful. Our institution's policy to record ≥3 non-clustered seizures for surgical evaluations and slow tapering of AEDs may contribute to longer stays. This contrasts with other institutions, where AED tapering may begin upon or even prior to admission (Scott et al., 2000; Henning et al., 2014). There is no standard AED tapering rate, with reported rates ranging from 16% to ≥30% per day (Zhou et al., 2002; Wang-Tilz et al., 2005; Di Gennaro et al., 2012).

The topic of AED tapering is controversial, with some studies reporting no significant difference in complications with more rapid tapering (Haut et al., 2002; Henning et al., 2014) and others reporting increased adverse events (Yen et al., 2001). A randomized, blinded study that compares outcomes from early and rapid