



Ictal biting injuries in the epilepsy monitoring unit, a cohort study of incidence and semiological significance



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ABSTRACT

Purpose: Oral biting injuries are widely recognized complications of seizures. Value in differentiating epileptic vs paroxysmal non-epileptic seizures is well demonstrated, but frequency and semiological value are poorly described. We aimed to evaluate frequency in an epilepsy monitoring unit setting as well as semiological value.

Material and methods: Systematic evaluation of ictal oral injuries was provided by the nursing staff on the Epilepsy Monitoring Unit. Cases were identified by chart review. Demographic, diagnostic and seizure-related data were collected from medical records and video-EEG recording, and correlated with location of tongue laceration. Lateralized oral lacerations while recumbent were further analyzed to eliminate contribution of body position.

Results: 89 events were reported in 52 individuals (5.6% of all admissions or 8.3% of patients with epileptic seizures). Lacerations occurred in 88 epileptic seizures (80 generalized, three focal, five undetermined) and one non-epileptic seizure. 87/88 had a tonic component and 86/88 had a clonic component. Lateralized tongue laceration occurred in 30 patients. This correlated with body position during the event but not with handedness or seizure characteristics.

Conclusions: Oral biting is a common complication in the epilepsy monitoring unit. Its presence suggests a tonic or clonic component but is of no help in localizing seizure onset.

1. Introduction

Oral lacerations are widely recognized as potential complications of seizures. These are mostly minor injuries requiring some degree of pain control, but occasionally require repair or result in more serious complications [1,2]. Diagnostic value of ictal tongue biting has been extensively evaluated, demonstrating good positive predictive value of lateralized tongue-biting for epileptic seizure versus paroxysmal non-epileptic seizures [3–5].

The usefulness of tongue biting in seizure characterization and localization, however, has received much less scrutiny. While injury can occur from serendipitous causes such as seizure-induced falls, it has been suggested that motor manifestations from the seizure itself could provoke tongue injury. Cortical stimulation studies suggest stimulation of the tongue motor cortex may produce tongue retraction or deviation to the contralateral side [6]. This is in line with studies demonstrating the specificity of lateral tongue injury for epileptic seizures, as tongue retraction would decrease the probability of a distal injury while also

increasing the width of the tongue and thus the probability of a lateral injury. It would also suggest that a lateral injury may be associated with a contralateral seizure focus. Only one original research paper evaluated this, with a small sample and only partial correlation (seven patients, injury ipsilateral to epileptogenic zone in five out of seven [7]. Little information is also known about the true incidence of such injuries, with reports ranging from 5% [8] to 60% [9] but coming from very dissimilar patient populations.

In this study we aimed therefore to evaluate the true frequency of oral lacerations in the epilepsy monitoring unit (EMU). Furthermore, we sought to evaluate seizure and patient characteristics associated with the occurrence of oral injury and its possible value in establishing seizure lateralization.

2. Methods

Chart review was performed for all adults who underwent seizure monitoring at the Cleveland Clinic epilepsy monitoring unit between

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February 2014 and February 2015. Oral biting events (number and location) were identified by reviewing nursing seizure evaluation note, as systematic, standardized evaluation of oral injuries has been part of nursing seizure assessment since February 2014. These notes describe the presence and location of oral lacerations, as well as seizure characteristics relevant to patient management and diagnosis.

Demographic data (age, sex, handedness), epilepsy characteristics (epilepsy vs non-epileptic seizures, primarily generalized vs focal), and seizure characteristics (EEG onset, clinical onset, semiology, ictal position), were collected via review of the medical record (Epic, Epic Systems Corporation) and through review of the video-EEG recording (NeuroWorkbench, Nihon Kohden Corporation). EEG and clinical seizure classifications were determined by the treating epilepsy team during the EMU admission.

Ictal and epilepsy characteristics of the patient population were described. Patients who sustained laceration to the side of the tongue, previously established as specific to epileptic seizures, were selected for analysis. For those patients, the side of oral laceration on the first event was correlated to handedness, ictal positioning, lateralization of the seizure onset and of clinical manifestations, using Fischer's exact test or χ^2 as appropriate (SPSS 20, IBM Corporation). Secondary analysis was performed on the subset of patients who sustained lateralized tongue laceration while remaining recumbent throughout the seizure to account for the effect of gravity.

This study was approved by the Cleveland Clinic Foundation's Institutional Review Board.

3. Results

3.1. Incidence

89 events of tongue or oral lacerations were reported, affecting 52 individual patients. Of those, 51 had a final diagnosis of epilepsy. Risk of tongue biting was evaluated at 5.6% per EMU admission, or 8.3% for those admissions with a final diagnosis of epilepsy. On average, patients who sustained oral injuries sustained 1.7 such injury per admission.

3.2. Epilepsy and seizure characteristics

Of 52 patients sustaining an oral biting injury, 46 had focal epilepsy, 5 had genetic generalized epilepsy and one was diagnosed with paroxysmal non-epileptic seizures. 80 of the 88 (91%) events occurring during epileptic seizures were associated with generalized onset (tonic or tonic-clonic) or focal onset seizures evolving to bilateral tonic-clonic seizure. Three (3.4%) were associated with seizures that remained focal, and five could not be classified, occurring within a cluster of focal-onset seizures with and without evolution to bilateral tonic-clonic seizure. Out of 88 epileptic seizures, one seizure was described as non-motor cognitive, but video of this specific seizure was not available for confirmation. All others included a unilateral or bilateral tonic component, and 86/87 seizures including a tonic component also included a clonic component. Seizure duration was on average 1.99 min (range 0.72–6.6 min).

3.3. Injury characteristics

No injury required laceration repair or intervention other than pain control. 58 events involved the tongue (49 unilateral, four bilateral, three at the tip), 12 involved the lip or cheek and 19 could not be localized by the nurse but were detected due to reported pain or presence of blood. Of patients with multiple lateral tongue biting, 13/16 had stable lateralization, two had bites on alternating sides and one had both a bilateral injury and a subsequent lateralized bite. The patient with non-epileptic seizures was found to have an injury to the tip of the tongue, as expected based on previous literature.

Table 1
Clinical characteristics of patients with lateralized laceration and focal epilepsy.

Side of laceration	Left	Right
Handedness		
Right	14	10
Left	2	3
Ambidextrous	1	0
EEG onset ¹		
Left hemisphere	8	5
Right hemisphere	5	8
Non localizable	2	1
Onset of tonic-clonic movements ²		
Left hemibody	6	4
Right hemibody	5	9

*No statistically significant differences.

¹ Excludes one patient with bi-temporal epilepsy, N = 29.

² Excludes patients with axial or bilateral onset, N = 24.

3.4. Localizing value

30 patients with focal epilepsy sustained lateralized tongue biting during their monitoring. There was no significant association with handedness, lateralization on EEG or side of tonic-clonic movement onset. See [Table 1](#)

3.5. Patient position

For those patients who, at some point during their seizure, were in a lateral decubitus position (excluding those who turned from one side to the other in the same seizure), side of tongue biting was strongly associated with the dependent side (N = 17, Fisher's exact test $p = 0.004$). See [Table 2](#).

Patients who remained recumbent throughout their seizure were evaluated to see if a localizing value could be found once the effect of gravity was eliminated. Again, handedness, EEG onset and tonic/clonic movement lateralization had no association with the side of injury. See [Table 3](#)

4. Discussion

This study sought to answer a few important points about biting injuries in seizures, namely incidence, associated seizure types and value in lateralizing the seizure focus. Incidence was found to be at the lower end of what was previously reported. It is conceivable, however, that patients in the monitoring unit are at a lower risk compared to the general population, as most seizure occur in a sitting or recumbent position, whereas seizures in the community may have additional injuries sustained from seizure-related falls. Per-seizure biting risk (as opposed to per-admission) was also not evaluated, as the boundary between clinical and electrographic-only seizure being sometimes uncertain makes it difficult to obtain a reliable denominator upon which to base our evaluation. While this study support that severe injuries are uncommon, tongue and oral injuries are often very unpleasant and should be considered in an informed consent discussion about medication withdrawal for seizure evaluation. Again, fall-associated injuries may very well prove to be more severe, and this study would likely underestimate this phenomenon and lacerations requiring surgical repair have been reported [10]. In our patient population, interventions

Table 2
Lateralization of biting vs ictal position (Fischer's exact test $p = 0.004$).

Side of laceration	Left	Right
Left lateral decubitus	9	1
Right lateral decubitus	1	6
Recumbent throughout	5	8

Table 3
Lateralization of biting in patients recumbent throughout the seizure.

Side of laceration	Left	Right
Handedness		
Right	5	2
Left	0	1
Ambidextrous	0	0
EEG onset ¹		
Left hemisphere	2	1
Right hemisphere	2	2
Non localizable	0	0
Onset of tonic-clonic movements ²		
Left hemibody	2	1
Right hemibody	1	2

No statistically significant difference.

¹ Excludes 1 patient with bitemporal epilepsy, N = 7.

² Excludes patients with axial or bilateral onset, N = 6.

for mouth lacerations were limited to pain control, which commonly is achieved with any combination of acetaminophen, non-steroidal anti-inflammatory drugs, and mixed medication mouthwash commonly known as “Magic Mouthwash”, the ingredient of which vary from one hospital to the next but generally containing a mixture of diphenhydramine, viscous lidocaine and magnesium/aluminium hydroxide or another antacid or mucosal coating agent. Mouth guards have been used in some centers to prevent tongue injuries during seizures. In our group, this has been a matter of debate regarding both efficacy and relative safety, as it was felt it could potentially impede proper oral clearance of saliva or vomitus. Nevertheless, it is a common-enough problem to wonder if mitigating measures might be possible.

According to our data, lateralized tongue biting is not only specific for epileptic seizures but furthermore strongly suggested the presence of a tonic or clonic component, and somewhat less strongly suggested a bilateral tonic-clonic seizure. This study, however, fails to demonstrate a lateralizing value to the side of the bite, instead demonstrating a relation to ictal position. This was further supported by the lack of association with the side of the seizure even in patients staying recumbent throughout the event, which should remove the influence of gravity on tongue deviation. This contradict previous report suggesting an association with the side of the EEG seizure [7], but as previously stated this previous study had found only a weak correlation using a small sample, and therefore its external validity was limited.

To date, this is the most comprehensive evaluation of the significance of tongue biting in epilepsy patients. As prospective, standardized data collection was carried for all patients admitted for seizure monitoring during the reference period, risk of bias was kept to a minimum and adequate internal validity was ensured. Patients in the epilepsy monitoring unit, however, may not be representative of the epileptic population as a whole. Being admitted to a specialized surgical center’s monitoring unit inherently bias the sample towards focal epilepsies, and furthermore towards drug-resistant epilepsies. This would not affect the validity of the results regarding localizing value (or lack thereof), as there would be none whatsoever in generalized epilepsies, but it may be a factor in why reported incidence was so low compared to previous reports and to so-called conventional wisdom about convulsions, which we based ourselves upon to teach trainees to seek oral

lacerations as an indicator of potential seizure. These results are, however, directly applicable to patients being admitted to the monitoring unit and could be used in a discussion regarding risk of injury during the evaluation or in a quality-improvement optic to find ways to minimize frequency or severity of seizure-associated oral lacerations.

5. Conclusion

While this study disproves previous impression that lateralization of tongue injury in a seizure may be useful in lateralizing a seizure focus, it supports the fact that this type of injury is relatively specific to motor tonic or tonic-clonic seizures and suggests a strong possibility that the seizure was generalized at some point during its course. This may be useful in discussing risk of sudden unexplained death in epilepsy (SUDEP) in patients with no witnessed generalized tonic-clonic convulsions, as tongue biting could be used as a relatively specific surrogate for such seizures.

Additionally, risk of tongue injury, while mostly a minor nuisance, may present as a question while discussing medication withdrawal in the EMU. This study supplies reliable prospective data upon which to base this discussion.

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Declarations of interest

None.

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