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First experiences with transcutaneous vagus nerve stimulation (t-VNS) in epilepsy treatment

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Content:

RATIONALE:
For patients suffering from pharmacoresistance which cannot be treated by resective epilepsy surgery further alternatives for treatment are invasive deep brain stimulation or vagus nerve stimulation. In the following feasability study t-VNS was applied in order to elucidate whether this noninvasive stimulation may be an alternative treatment option in pharmacoresistant epilepsies.

METHODS:
t-VNS was applied in 8 patients with focal and 2 patients with generalized epilepsies. Electrical stimulation of the left auricular branch of the vagus nerve was applied three hours a day for a period of nine months. Subjective patient report was documented by a patients` seizure diary. In addition a prolonged out-patient video EEG monitoring has been performed. Comfort of portable t-VNS stimulator and side effects as well as seizure frequency prior and during this nine months treatment were investigated.

RESULTS:
Overall practicability was reported as good and sufficient. No severe side effects occurred. According to patients` reports seizure frequency was reduced in 5 out of 7 patients who participated in the complete treatment phase. Results of computer assisted analysis of seizure frequency documented in the continuous long-term video EEG and cognitive as well as emotional testing were additonally analysed.

CONCLUSIONS:
Treatment by means of transcutaneous vagus nerve stimulator during a daily use of nine months from a technical point in most patients turned out as easily and safely to handle. First data point to an anticonvulsive effect of t-VNS in pharmacoresistant epilepsy. For further efficacy evaluation randomized controlled studies have to be performed.

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First experiences with transcutaneous vagus nerve stimulation (t-VNS) in epilepsy treatment

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Rationale

For patients suffering from pharmacoresistance which cannot be treated by resective epilepsy surgery further alternatives for treatment are invasive deep brain stimulation or vagus nerve stimulation. In the following feasability study t-VNS was applied in order to elucidate whether this noninvasive stimulation may be an alternative treatment option in pharmacoresistant epilepsies.

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Conclusion

Treatment by means of transcutaneous vagus nerve stimulator during a daily use of nine months from a technical point in most patients turned out as easily and safely to handle. First data point to an anticonvulsive effect of t-VNS in pharmacoresistant epilepsy. For further efficacy evaluation randomized controlled studies have to be performed.

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Pat	Age (y)	Sex	Epilepsy	Duration Epilepsy (y)	Seizure Types	SF (at start of study)	FD	FC	Previous Medication/ AEDs at start of study	Surgery / VNS
1	18	f	IGE with absences	10	absence	28-35 / w	no	no	7 AEDs / VPA+LEV+ZNS	no
2	43	f	symptomatic epilepsy due to periventricular nodular heterotopia l + r	10	CP with SG	2-3 / w	no	no	7 AEDs / ZNS +OXC-ER + CLB	no
3	29	f	IGE with absences	23	absence	~10 / w	brother	no	7 AEDs / LEV + LTG	no
4	44	m	cryptogenic extratemporal epilepsy	37	SP (aura), CP hypermotoric	~21 / w	no	no	10 AEDs / VPA + OXC-ER + LCM + CLB + LTG	no
5	31	m	cryptogenic focal epilepsy	9	SP, CP with SG	2-3 / w	no	yes	11 AEDs / LTG + OXC-ER + CLB	no
6	29	f	cryptogenic focal epilepsy	8	SP (aura), CP with SG, hypermotoric, psychomotoric	~50 / w	no	no	7 AEDs / LTG + ZNS	no
7	49	f	cryptogenic focal epilepsy	39	CP	2-3 / w	no	yes	10 AEDs / LEV + OXC-ER	no
8	32	m	symptomatic epilepsy after CNS radiation (lymphosarkoma)	22	CP	3-5 / w	no	no	9 AEDs / LTG + LCM	no
9	55	m	cryptogenic focal epilepsy	34	SP, CP with SG	1-2 / w	no	no	13 AEDs / LEV + OXC-ER + LCM	no
10	43	f	cryptogenic focal epilepsy	13	SP (aura), CP with SG	~3 / w	no	yes	13 AEDs / OXC-ER + LEV + LCM	surg. 02/2008
	mean 37.3			mean 20.5						

Table 1 Details of patients enrolled in the study. The following abbreviations have been used: SP simple partial, CP complex partial, SG secondary generalized, SF seizure frequency, FD family disposition, FC febrile convulsion, m male, f female, w week, AED antiepileptic drug, CLB clobazam, LCM lacosamide, LEV levetiracetam, LTG lamotrigine, OXC-ER oxcarbacepine, VPA valproic acid, ZNS zonisamide, VNS vagus nerve stimulato

Pat.	Tolerance	Cognition/Affect: Quality of life ①/②/④ improved/stable/deteriorated	Cognition	Depression
2	good, stimulation sometimes painful	③ ↑ ⑥ ↑ ⑨ =	③ 2/4/1 ⑥ 0/6/1 ⑨ 1/5/1	③ = ⑥ = ⑨ =
3	very good, no side effects	③ = ⑥ = ⑨ =	③ 1/4/2 ⑥ 1/5/1 ⑨ 1/5/1	③ = ⑥ = ⑨ =
4	acceptable	③ = ⑥ = ⑨ =	③ 1/5/1 ⑥ 1/6/0 ⑨ 0/7/0	③ ↓ ⑥ = ⑨ ↑
7	good after getting used to	③ ↓ ⑥ = ⑨ =	③ 0/7/0 ⑥ 1/6/0 ⑨ 3/4/0	③ = ⑥ = ⑨ =
8	very good, no side effects	③ = ⑥ = ⑨ =	③ 0/7/0 ⑥ 0/7/0 ⑨ 1/6/0	③ = ⑥ = ⑨ =
9*	good	③ ↑ ⑥ = ⑨ =	③ 1/6/0 ⑥ 0/7/0 ⑨ 0/7/0	③ = ⑥ = ⑨ =
10	very good, no side effects	③ = ⑥ ↑ ⑨ =	③ 2/4/1 ⑥ 4/3/0 ⑨ 2/5/0	③ ↑ ⑥ ↑ ⑨ =

* no verifyable events in EEG or video; seeks to acquire disability status
1/2/3 = number of cognitive subtests (out of 7) which were improved/stable/deteriorated compared to baseline
③/⑥/⑨ = change compared to baseline after 3/6/9 months

Table 2: A summary of findings of the 7 patients investigated in the tVNS study during the different outpatient video-EEG monitoring sessions. Pat. 1, 5 and 6 aborted the study. ③/⑥/⑨ indicates the results found in month 3, 6 and 9, respectively. Measures of cognition, depression and quality of life were stable for a greater part.

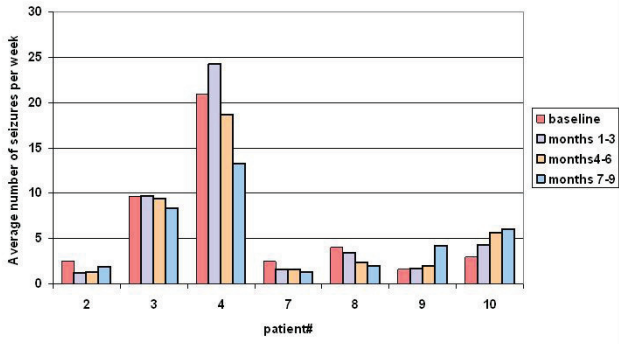

Figure 1: Average number of seizures per week according to the patient's seizure diary. The average of three consecutive months is shown, respectively.

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