The Use of "Propranolol" to Treat Essential Tremor in Adults

By Amy K. Madzelan

An estimated 10 million Americans suffer from a condition known as Essential Tremor (ET). ET is a neurological condition that causes shaking in various parts of the body with the most noticeable shaking occurring in the hands. There is no known specific cause and no known cure. The most prevalent treatment is a medication called Propranolol.

ET is by no means a new condition. There is documentation of tremors in ancient textbooks and medical journals, some of which date back to ancient Greece and Egypt. The documentation of the symptoms of ET have not changed since the early documented cases. The most noticeable symptom of ET is a kinetic tremor in the hands - that is it is most pronounced when the patient is attempting fine motor skills such as writing or threading a needle. Tremors can also manifest themselves in other areas of the body. Many patients exhibit shaking in their head, arms, legs, and even in their voices. An informal online survey of 60 anonymous ET patients was conducted from November 9, 2011 to November 24, 2011 (full survey results included after the bibliography). The survey showed that 96.7% of patients exhibited tremors in their hands, 70.2% exhibited shaking of their arms, 44.6% exhibited shaking of their legs, 56.7% exhibited shaking of their head, and 50% reported shaking in their voice. A number of those surveyed also experienced some degree of balance issues. Each symptom can vary in severity from mild to debilitating. In addition, each symptom's severity can vary independently from one to another.

"Propanolol is a non-selective beta-blocker."

Although very noticeable, ET can often be undiagnosed or misdiagnosed. The impact of the disorder can go farther than just physical symptoms. There can also be a level of embarrassment with the physical symptoms of ET. In certain settings, not only can the symptoms cause embarrassment to the patient, but can cause also uneasiness in those around the patient. For example, a nurse with untreated ET can cause uneasiness with patients if her hands are shaking while attempting to do a blood draw. Embarrassment can cause reluctance in patients to seek diagnosis and treatment. Embarrassment can also cause patients to seek a diagnosis and treatment. For example, a 45-year-old woman having trouble holding a fork or spoon and having trouble feeding herself due to her tremors may try to hide the tremors from others, including family; however, because the tremors are causing problems with everyday functions, she sees her doctor who refers her to a neurologist and he makes the diagnosis of Essential Tremor.

Misdiagnosis can happen since there is no specific yes/no test for ET. One misdiagnosis is that of Parkinson's Disease. With Parkinson's, the patient will exhibit shaking in the body while at rest. The tremors associated with ET can occur while the patient is at rest; however, the majority of the tremors occur when the patient is attempting to do something such as feed themselves or write.

There is no specific set of tests to diagnose ET as with other disorders. Thediagnosis is made more with a process of elimination than any set blood test or exam like there would be for conditions, such as arthritis or high cholesterol. One factor that the physician will look at is family history although someone without a family history of ET can develop the disorder. Although there has been extensive genetics research done, researchers have been unable to replicate any results, so the family history relationship is still unknown. There are several common 'tests' done to determine a diagnosis of ET.

Fig-1

Fig-2

One of the common 'tests' done is called an Archimedes

Spiral. A patient is given a piece of paper and a pen and asked to draw a spiral starting from the inside and moving outward. A patient with untreated ET will have a very inconsistent and wavy line as shown in this first diagram (Oxford University Press, 2011). The fine motor skills needed to consciously draw the spiral are effected by the ET. In contrast, a patient that is currently being treated for ET will not have the exaggerated 'wobble' as in the first diagram. The second image is an Archimedes Spiral drawn by the author (currently being treated for ET with medication). There is little to no 'wobble' present in the spiral.

Among the other tests used to diagnose ET, one involves having the patient hold their arms out in front of them, eyes closed, with their palms facing up. Other tests can involve handwriting, examining the patient's gait, and electromyography. Once a diagnosis of ET is made, treatment options are discussed with the patient.

There are a number of treatment options available for patients diagnosed with ET. Although there are plenty of options for the ET patient, the most common of all of the treatment options are pharmacological. In the online survey completed by the author, patients indicated that they used a fairly wide variety of medications to treat their ET. Patients indicated that they use a range of benzodiazapines, beta-blockers, anti-convulsants, vitamins, and other 'natural' treatments. The most common of the medications used were: Valium, Ativan, Xanax, Metoprolol, Propranolol, Primidone, Gabapentin, Lemon Balm, Vitamin B, and Alcohol.

A fair number of the survey participants experienced "Breakthrough Tremors," or tremors that occur despite the patient currently being medicated. The most common medication used by the survey participants for breakthrough tremors was Valium. Valium falls into the Benzodiazepine class of medications. Where Valium is used for sedation for anxiety, pain management for some neck and back injuries, and to help control seizures once active, it is not a primary medication used for treating ET.

A primary medication is a medication that is used as a "first line" drug to treat something. For example, if someone has a headache, the first thing they may reach for is Acetaminophen. Doctors have several medications they can choose from for first line medications. Primidone and Propranolol are the two most common medications used.

Several factors go into deciding which medication is right for which patient. According to a neurologist in the York, Pennsylvania area, Jeffrey Mosser, MD, Primidone is generally used for older patients. Primidone falls into the "anti-convulsant" class of medications - it will raise the seizure threshold in patients. Use of Primidone to treat ET is an "unlabeled" use. Many medications have "unlabeled" uses. A drug that has a side effect of treating a different condition than it was intended is said to have an 'unlabeled use.' A large downside to the use of Primidone is its sedative effects. For those that have not had positive results using Propranolol or are unable to take a beta-blocker due to asthma or other condition, the sedative effects of Primidone may be a minor inconvenience.

The original intended use for Propranolol is actually as an anti-hypertensive agent. The exact mechanism for the drug effects as an anti-hypertensive medication is not fully known, nor is the mechanism as a treatment for ET. Propranolol is a non-selective beta-blocker. Nonselective beta-blockers are just that, non-selective. There are two types of beta receptors in the body that these drugs can react with. The beta 1 receptors are located in the heart, eyes, and kidneys. The beta 2 receptors are in the lungs, GI tract, liver, uterus, blood vessels, and skeletal muscles. Selective beta-blockers are designed to attach to only one type of receptor at a time whereas non-selective beta-blockers will bind to both the beta 1 and beta 2 receptors.

Beta-blockers work by binding to the beta receptor sites on the cells and prevent another molecule from binding to that particular site and preventing the cell from initiating the sequence to produce whatever hormone or protein it would otherwise have been told to do. Paramedics use a similar principle to wake up someone that has overdosed on a narcotic. The medication will bind to the narcotic receptor site and prevent the narcotic molecule from binding to that particular receptor site and thus blocking the effects of the narcotics. Along the same principle, asthmatic patients taking medications like albuterol (a beta-agonist) should not take betablockers as the two drugs will effectively cancel each other out. These are some of the many things that patients will need to speak with their physicians about when a diagnosis of Essential Tremor is made.

Propranolol does several things to the body. First, it will

reduce the patient's heart rate. It would not be out of the realm of possibility for a patient to have a resting heart rate in the low 50's. Second, the drug helps to dilate blood vessels in the body, thus lowering the blood pressure. Again, it would not be out of the realm of possibility for a patient to have a resting blood pressure below what the 'textbook' public perception is (120 mmHg / 80 mmHg). The benefits of beta-blocking medications can be negated, however (as stated above) by the use of certain beta-agonistic medications such as albuterol. This 'canceling out' could also (in the most extreme of cases) prove fatal as the albuterol should be helping to relax the smooth muscles in the airway, but is being blocked by the Propranolol. Once again, these are things that should be discussed between doctor and patient.

There has been no conclusive research results as to why propranolol works as an effective treatment for ET in some patients. Propranolol is an FDA approved medication that is effective in treating ET. In the online survey conducted, 29.8% of patients that responded stated that they currently take Propranolol for their tremors, 8.8% of patients are currently taking Propranolol in conjunction with another medication to treat their tremors, and 38.6% stated that they are aware that Propranolol is used to treat tremors. A small percentage, 10.8%, were not aware that Propranolol is used to treat ET.

Among the treatments for ET, there is an "unofficial" treatment that many people currently use to treat ET, as well as breakthrough tremors, is alcohol. As with other medications, the exact reasons as to why alcohol works is a mystery. Obviously there are some fairly standard problems with using alcohol to treat ET. Alcoholism is a possibility when other treatments fail. Small quantities of alcohol have been known to control tremors. The downside to treating ET with alcohol (other than the obvious alcoholism, risk of intoxication, and health risks) is the instances of rebound tremors. Rebound tremors are tremors that can occur after a treatment such as alcohol (usually the next day); however, the tremors come back worse than usual for a time. Treatment of breakthrough tremors with small amounts of alcohol (such as a glass of red wine) can be effective. A patient with ET may find that they have breakthrough tremors in the evening if they take their usual medication in the morning. A small glass of wine before going out to supper may help ease the breakthrough tremors and give the patient some self-confidence to be out in public.

In the online survey, 96.7% of ET patients are aware that alcohol can be used to treat ET (3.3% were not aware of alcohol's use for ET). 71.7% of patients stated that they have used alcohol to treat ET with positive results where 6.7% experienced negative results. 18.3% of patients (that were aware of alcohol's use) had never tried alcohol to treat their ET. A number of patients expressed that they use alcohol as a treatment for the breakthrough tremors.

Propranolol does not have the 'rebound' effect that is experienced when using alcohol to treat ET. Where missing a day of medication can cause the symptoms to emerge (and sometimes emerge stronger), the extent of the rebound is not as great. Also, propranolol lacks the intoxicating effects of alcohol.

Propranolol has been proven an effective treatment for ET for many years. Where it does not work for all patients, it is prescribed by physicians and approved by the FDA. Research is still going on to find the cause of ET as well as a cure. The National Institutes of Health currently sponsor research on Essential Tremor. Where Propranolol is currently an effective treatment for many patients diagnosed with ET, research may one day find a cause and a cure for the disorder.

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About the Author

Tremor Action Network's online support group Tremor received a friendly introduction from Amy Madzelan, sharing her interest in medicine and research. A college student at Penn State, Amy had worked as a Paramedic for 6 years. She chose to write about the use of Propanolol for ET after being assigned a technical writing project. Amy designed 9 questions, and asked the Tremor group members to help collect data for her paper by participating in an online survey at SurveyMonkey.com. Google noticed the survey after 10 days!

Essential Tremor – Symptoms and Treatments
Survey Results
Survey conducted online through SurveyMonkey.com
Target audience: Essential Tremor Patients
Number of Participants: 60

1. Have you been diagnosed with Essential Tremor by a HEALTHCARE PROFESSIONAL?

	Response Percent	Response Count
Yes	96.70%	58
No	3.30%	2

2. Who diagnosed you? (If you have seen more than one doctor/specialist, please select all that apply)

	Response Percent	Response Count
Family Doctor	46.70%	28
Movement Specialist	18.30%	11
Neurologist	71.70%	43
Physical Therapist	1.70%	1
I have not been diagnosed with ET by a HCP	3.30%	2
Other (Please Specify)	3.30%	2

Other responses: Allergist, Endocrinologist

3. When were you diagnosed?

	Response Percent	Count
This year	3.30%	2
1 – 2 Years Ago	6.70%	4
3 – 5 Years Ago	11.70%	7
6 – 10 Years Ago	21.70%	13
11 – 15 Years Ago	20.00%	12
16 – 20 Years Ago	3.30%	2
> 20 Years Ago	33.30%	17

4. If you have the symptom, please indicate the severity (1 – Mild, 5 – Severe) or 0 if you do not experience that symptom.

	N/A	Mild		Moderate		Severe	Count
Shaking in your Hands?	3.3% (2)	8.3% (5)	6.7% (4)	40% (24)	31.7% (19)	10% (6)	60
Shaking in your Arms?	29.8% (17)	24.6% (14)	19.3% (11)	19.3% (11)	5.3% (3)	1.8% (1)	57
Shaking in your Legs?	55.4% (31)	23.2% (13)	10.7% (6)	8.9% (5)	0.0% (0)	1.8% (1)	56
Shaking of your Head?	43.3% (26)	18.3% (11)	6.7% (4)	16.7% (10)	6.7% (4)	8.3% (5)	60
Shaking of your Voice?	50% (29)	19% (11)	8.6% (5)	10.3% (6)	6.9% (4)	5.2% (3)	58
Problems holding objects?	10.5% (6)	24.6% (14)	8.8% (5)	26.3% (15)	21.1% (12)	8.8% (5)	57
Problems doing fine tasks (ex. Threading a needle)?	6.7% (4)	3.3% (2)	11.7% (7)	25% (15)	23.3% (14)	30% (18)	60
Balance Issues?	27.1% (16)	28.8% (17)	13.6% (8)	13.6% (8)	10.2% (6)	6.8% (4)	59
Other							19

Other Responses: Internal Tremors, Jaw Tremor, Facial Tremors

5. Out of the following medications, please indicate if you: (Select all that apply)

	Am aware of the drug's use for ET	Am NOT aware of the drug's use for ET	Have taken the drug in the past for ET	Am currently taking the drug for ET	Am currently taking the drug in combination therapy with another drug for ET	Count
Primidone	43.6% (24)	18.2% (10)	40% (22)	10.9% (6)	5.5% (3)	55
Propranolol	38.6% (22)	10.5% (6)	36.8% (21)	29.8% (17)	8.8% (5)	57
Other Beta-Blockers	60.9% (28)	13% (6)	28.3% (13)	0.0% (0)	2.2% (1)	46
Ativan	29.2% (14)	62.5% (30)	6.3% (3)	4.2% (2)	0.0% (0)	48
Gabapentin	44.9% (22)	34.7% (17)	18.4% (9)	12.2% (6)	4.1% (2)	49
Other						19

Other responses: Effexor, Vallium, Ritalin, Topamax

6. Are you aware that alcohol can be used to control the symptoms of Essential Tremor?

	Response Percent	Count
Yes, but have NOT tried it	18.30%	11
Yes, and HAVE tried it with POSITIVE results	71.70%	43
Yes, and HAVE tried it with NEGATIVE results	6.70%	4
No	3.30%	2

7. How often do you experience Breakthrough Tremors? (Breakthrough Tremors are Tremors experienced despite being medicated for Tremors)

	Response Percent	Count
I have never experienced Breakthrough Tremors	46.70%	28
< Once per month	1.70%	1
1 or 2 times per month	8.30%	5
3 or 4 times per month	8.30%	5
1 or 2 times per week	5.00%	3
> Twice per week	30.00%	18

8. Are you...

	Response Percent	Count
Male	45.00%	27
Female	53.30%	32
I'd rather not say	1.70%	1

9. How old are you?

	Response Percent	Count
15 – 20	0.00%	0
21 – 30	3.30%	2
31 – 40	15.00%	9
41 – 50	16.70%	10
51 – 60	26.70%	16
61 – 70	25.00%	15
70	13.30%	8
I'd rather not say	0.00%	0