

Ethics of Memory Dampening Using Propranolol as a Treatment for Post Traumatic Stress Disorder in the Field of Emergency Medicine

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ABSTRACT

Imagine a world in which one could selectively recall memories - the undesirable memories would not be retrievable, leaving us with only pleasant remains to be remembered. In this world, an emergency medical technician (EMT) forced to witness a violent mutilation following a severe car accident could forget every detail of what they'd observed and avoid the emotional aftermath. In many emergency situations worldwide, emergency medical personnel, such as first responders, EMT-B's, or paramedics are relied on to provide critical pre-hospital care. While this pre-hospital care is often necessary to save citizens' lives, those providing the care are consistently exposed to cognitively corrosive events. The nature of the field of emergency medicine causes the incidence of mental disorders to be incredibly high in this profession compared to other healthcare professions. Post-Traumatic Stress Disorder (PTSD) is particularly common amongst emergency medical personnel. This mental disorder, often characterized by reiterations of the trauma through intrusive and distressing recollections of the event, flashbacks or nightmares, affects approximately 20 percent of those employed in emergency medicine (Slaymaker 1999). In part, this has caused the average career of an emergency medical professional to last only 4-7 years. One potential solution to the high prevalence of PTSD and the elevated personnel turnover rate involves neurocognitive enhancement, one of the fundamental issues raised in neuroethics. Administration of propranolol prior to or immediately following traumatic situations to prevent emotional memory consolidation may ensure that no traumatic experience becomes embedded in the amygdala as a non-conscious emotional memory. Pre-hospital workers could take advantage of this effect and use propranolol, a sympatholytic non-selective beta-blocker, as a preventative measure. Specifically, propranolol administration could help emergency personnel to avoid the chronic hyperactive fear response triggered by certain stimuli that is the basis of PTSD (Glannon 2006). For example, the EMT from earlier would be administered propranolol either before or immediately after treating the victims of the violent car accident to help prevent emotional memory consolidation. Without the emotional component of the memory, the EMT would be far less likely to develop symptoms of PTSD. However, this must be weighed against the potential negative consequences. Because propranolol works to prevent aspects of memory consolidation via reduction of emotion, moral judgments that might arise during such traumatic situations could be affected, thus compromising the quality of patient care. In this paper, I will examine the ethical implications

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of alteration of memory consolidation through emotional dampening and moreover, the inability to make sound moral judgments as a result. Utilizing the current literature from various disciplines on the subject, I demonstrate that the disadvantages and potential risks of propranolol administration significantly outweigh the potential benefits, especially for the 80 percent of emergency medical personnel who will not develop PTSD. Therefore, treatment with propranolol to prevent emotional memory consolidation in emergency medical personnel is unethical and should be prohibited.

KEYWORDS

Pharmacological Enhancement, Post-Traumatic Stress Disorder, Emotional Memory Consolidation, Propranolol, Moral Decision-Making, Personal Identity, Value of a Life

INTRODUCTION

A world where one could selectively remember events—the memories we no longer wanted would be erased and we would be left with only pleasant remains. In this world, a witness to a violent assault would be able to forget every detail of what they'd observed and avoid the emotional aftermath of the horrible scene they'd been forced to witness.

Recent research supports the idea that memory dampening using a drug called propranolol immediately following traumatic events has the potential to manipulate memory and change our world to resemble the one described above. This method of memory dampening with propranolol is now being explored as a method of treatment for victims of post-traumatic stress disorder (PTSD). Reduction of the incidence of PTSD could be especially useful in the field of emergency medicine in which approximately 20 percent more people in the field than in the general population will develop PTSD. However, many things remain to be seen with regard to the drug's long-term effects and the mechanisms by which it works. Moreover, a myriad of ethical implications inevitably arise when discussing memory manipulation, regardless of the intentions of the manipulation.

AN OVERVIEW OF EMERGENCY MEDICINE

The field of emergency medicine is crucial to the successful functioning of our current society in the United States. Every year, thousands of lives are saved by the Emergency Medical Services (EMS). The primary occupations within EMS include certified first responders (CFR), Basic Emergency Medical Technicians (EMT-B), Advanced Emergency Medical Technicians—Intermediate (AEMT-Intermediate)

and EMT-paramedics, each of whom retain a unique role in emergency situations (NY Health 2013).

The primary role of the CFR is essentially what is indicated by their title—he or she “answers emergency calls to provide efficient and immediate care to ill and injured patients... and safely responds to the address or location given, using the most expeditious... route, depending on traffic and weather conditions” (NY Health 2013, 2–1). Once on the scene, a CFR may be required to assist the EMT-B or paramedic with various tasks including caring for the patient(s) in a variety of ways. After each call, the CFR is responsible for returning the emergency vehicle to its initial state, as to be prepared for the next call.

The EMT-B is primarily responsible for immediate care of the patient. This care may include (but is not limited to) “opening and maintaining an airway, ventilating patients, administering cardiopulmonary resuscitation, (including use of automated external defibrillators), [and] providing pre-hospital emergency medical care of simple and multiple system trauma such as controlling hemorrhage, treatment of shock (hypoperfusion), bandaging wounds, [or] immobilization of painful, swollen, or deformed extremities, immobilization of painful, swollen, or deformed neck or spine” (NY Health 2013, 2–3). Additionally, an EMT-B is expected to “[provide] emergency medical care to assist in emergency childbirth, or manage general medical complaints of altered mental status, respiratory, cardiac, diabetic, allergic reaction, seizures, poisoning behavioral emergencies, environmental emergencies, and psychological crises” (NY Health 2013, 2–3). Once en route to the hospital, the EMT serves as the link between the EMS staff and the staff at the hospital. Other duties might include assisting in restocking supplies in the emergency vehicle or ensuring maintenance of the vehicle.

The role of the AEMT-Intermediate is essentially that of the EMT-B, but the AEMT must also “be able to provide Advanced Life Support using intravenous therapy, defibrillator and advanced airway adjuncts to control the airway in cases of respiratory and cardiac arrest” (Wronski 2013, 1). Similarly, the EMT-paramedic must be able to perform all basic skills of the EMT-B and the AEMT-Intermediate, as well as “be able to perform under Advanced Cardiac Life Support (ACLS) and Basic Trauma Life Support (BTLS) standards [and be] knowledgeable and competent in the use of a cardiac monitor/defibrillator and intravenous drugs and fluids” (Wronski 2013, 1).

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Each of these professions is unique, but collectively, those employed in medicine are commonly referred to as 'EMTs', as they will be in the remainder of this paper. While these occupations are essential to the survival of thousands of citizens every year and provide incredible gratification to those in the field, these jobs don't come without hindrances. Based on the descriptions of various professions in emergency medicine, it becomes clear that working in this field is incredibly taxing and stressful, not only as a result of the multitude of tasks that must be performed in high stress situations, but also because of the exceptionally gruesome situations to which one might be forced witness.

One of the major negative outcomes of working in EMS is the high level of stress that one must confront on a daily basis. Simply based on the job descriptions, it is easily understandable that a person working in emergency medicine would have to cope with great amounts of stress. Obviously, such high stress levels on a consistent basis can lead to a variety of physical problems in the long run. These problems include but are not limited to increased risk of heart disease, strokes, gastrointestinal problems, cancer, memory, concentration and learning deficits, poor eating habits, or even substance abuse (Simon 2009).

In addition to the variety of physical ailments one might experience as a result of such high levels of stress, psychological problems are also likely to arise. According to studies done at the University of Maryland, "the inability to adapt to stress is associated with the onset of depression or anxiety" (Simon 2009, 1). One specific type of anxiety disorder that is particularly common amongst emergency medical personnel is post-traumatic stress disorder (PTSD), with a rate of development of greater than 20 percent (Slaymaker 1999), whereas only about one percent of the general population will develop this disorder (Helzer et al. 1987).

As a result of the psychological (and physical) effects of such exorbitant amounts of stress - PTSD, specifically—the career-span of many emergency medical personnel tends to be quite short, approximately 4-7 years on average. Although there are other reasons for a shortened career in emergency medicine (such as pursuing higher educational opportunities or simple dislike for the work), the high levels of stress leading to higher risk for PTSD is a huge contributing factor. In a study conducted by Deborah Sirratt, approximately 115 emergency personnel responded to a survey investigating occupational stressors and the correlation with burnout rates in the field. "Results of the correlation indicated that there was

a significantly positive correlation between occupational stressors and the burnout subscales of Emotional Exhaustion and Cynicism... In the next analysis, results indicated that Emotional Exhaustion, Cynicism, and Professional Efficacy serve as predictors of severity of psychological distress. Results of the multiple regression indicated that Emotional Exhaustion and the overall occupational stressors score were predictors of the severity of PTSD symptoms," (Sirratt 2001, 1).

AN OVERVIEW OF PTSD

PTSD itself is a specific type of anxiety disorder whose name is rather self-explanatory. "PTSD is a serious, potentially debilitating condition that can occur in people who have experienced or witnessed a natural disaster, serious accident, terrorist incident, sudden death of a loved one, war, rape or other violent personal assault, and other life-threatening events" (ADAA 2010, 2), all of which would be characterized as 'traumatic events' in one's life.

It is not necessarily always triggered by a traumatic event (ADAA 2010, 2), but in emergency medicine, it seems that the high stress levels in combination with exposure to traumatic scenes trigger PTSD more frequently than anything else. Other factors that could be causal in the development of PTSD include "the type of traumatic event experienced, childhood adversity, biological markers, genes, and environmental and other influences" (ADAA 2010, 3).

The symptoms of this potentially debilitating disorder most commonly include "re-experiencing the trauma through intrusive distressing recollections of the event, flashbacks and nightmares, emotional numbness and avoidance of places, people, and activities that are reminders of the trauma, and/or increased arousal such as difficulty sleeping and concentrating, feeling jumpy, being easily irritated and angered," (ADAA 2010, 2). A diagnosis of PTSD is typically made when these symptoms are experienced for at least one month following a traumatic event, but the onset of these symptoms may not occur until months or even years after the event, (ADAA 2010).

Clearly, an effective treatment for PTSD in emergency medicine is necessary in order to retain some of our most respectable men and women in public service for more than 4 years. Such a treatment would most likely decrease the level of stress and incidence mental disorders and therefore allow a higher retention rate in the field. Some treatment options for PTSD already exist; among the most popular

are cognitive behavioral therapy (CBT) and medication, or some combination of the two.

Cognitive behavioral therapy involves talking through a mental illness such as PTSD with a mental health care professional using three different aspects—exposure therapy, cognitive restructuring, and stress inoculation training. Theoretically, exposure therapy allows the patient to face their fear and confront it, cognitive restructuring is geared toward allowing the patient to understand the traumatic event realistically, and stress inoculation training treats the symptoms in order to reduce feelings of anxiety (NIH 2013).

The two most common medications used for treatment of PTSD are sertraline (Zoloft) and paroxetine (Paxil), which are both selective serotonin reuptake inhibitors (SSRIs). Occasionally, other classes of drugs such as benzodiazepines or antipsychotics are used as well, but little is known about how these work to treat PTSD. (NIH 2013).

SSRI's are one of the most common types of antidepressants; they selectively block the reuptake of serotonin and seem to leave other neurotransmitters unaffected. When the levels of reabsorbed serotonin in the presynaptic neuron are reduced by SSRIs, mood tends to be positively affected (Dubuc 2002). While SSRIs (and in some cases, other drugs) can help to treat PTSD in some cases, their efficacy is far from exceptional.

Because PTSD is so difficult to treat, a variety of other treatments are currently being explored. Treatments under investigation include d-cycloserine, MDMA (commonly known as "ecstasy"), transcranial magnetic stimulation (TMS), and memory dampening drugs (Kolber 2006, 11), which are the focus of this paper. Recent experiments (the first of which took place in 2002 with Roger Pitman as the primary investigator) have suggested that administration of propranolol (a β -adrenergic blocker originally intended to treat hypertension) within a short period of time (i.e., less than six hours) after enduring a traumatic event can reduce emotional intensity as well as dampen factual components of the memory (Kolber 2006, 1-2). The majority of these studies have been executed using patients admitted to the emergency department (ED) following some sort of traumatic event after which the patient did not sustain physical harm.

It has long been understood (at least on a basic level) that heightened physiological responses can work to enhance memory consolidation. "The ability to remember an event is made possible by changes in neurons and in networks

of neurons—neural plasticity,” (Paller 2009, 1), and Larry Cahill has proven in a recent study that when physiological responses are heightened due to emotional arousal, one’s ability to remember specific details of a specific event is enhanced.

The six-hour period following a traumatic event is believed to be the time during which the memory of the event is being consolidated. Since the primary purpose of propranolol is to “block or diminish the cardiovascular excitatory response to the stress hormones adrenaline and noradrenaline,” (Glannon 2006, 2) during this period, it stands to reason that the emotional intensity and factual richness of the memory would be dampened by administration of the drug. Theoretically, a drug like propranolol could even be administered before a traumatic event if one is previously aware that the event is going to occur, as would be the case for EMTs.

POTENTIAL BENEFITS OF TREATMENT WITH PROPRANOLOL

Since “a substantial number of EMTs (over twenty percent) demonstrated clinically significant symptoms of work-related PTSD,” (Slaymaker 1999, 1), many emergency medical personnel could benefit monumentally if this technique of memory dampening were utilized as treatment. The most obvious advantage to permitting treatment of PTSD using propranolol in emergency medicine would be to reduce emotion during emergency situations.

Suppose that the emergency department receives a call from a bystander stating that they have just witnessed a tragic ten-car pile-up that occurred at high speeds on a major highway nearby. Now suppose that the EMTs, immediately prior to (or immediately following) the treatment of at least five mangled bodies, are administered propranolol in order to reduce their emotional response to the situation. “The aim would be to ensure that no traumatic experience would become embedded in the amygdala as non-conscious emotional memory. This memory could result in a chronic hyperactive fear response when triggered by certain stimuli long after [the event]. Administering the drug could modulate the fear” (Glannon 2006, 2). Theoretically, the EMTs could respond appropriately and do their job more efficiently without emotions interfering, and they would avoid forming pathological emotional memories of the tragedy.

Despite the fact that such treatment sounds good in theory, the reality of how propranolol would actually work within the human brain and body is unexplored and potentially dangerous. First of all, if the drug blunted the EMTs emotional response too much, he or she would have a decreased fight-or-flight response,

potentially resulting in his or her own serious injury or death if in a life-threatening situation. In this situation, "what was intended as a prophylactic intervention to prevent harm could unwittingly result in harm," (Glannon 2006, 2). Secondly, "although the amygdala regulates non-conscious emotional memory and the hippocampus regulates conscious episodic memory, it is unclear whether a drug aimed at altering the first type of memory would have any effect on the second... The action of the drug would have to be very specific, and it would be difficult to predict that the drug would not have any adverse effects on other memory systems. There is no guarantee that targeting negative emotional memories in the amygdala would not result in collateral damage to episodic memories in the hippocampus," (Glannon 2006, 2). Finally, if an EMT were to use propranolol on a daily basis to prevent development of PTSD, they could be taking this drug every day for years. Currently, the long-term effects of consistent treatment with propranolol have yet to be explored and could be potentially harmful in ways of which we are not yet aware.

On the other hand, this potential reduction in emotion could have numerous advantageous results for the mental health, well-being, and career-span of many people in the field of emergency medicine. It seems that if propranolol can reduce the physiological response to stress hormones, then the high levels of stress that are typically associated with an occupation in emergency medicine could be reduced. Reduction in stress could lead to decreased symptoms of chronic stress as well as decreased frequency and intensity of the distressing recollections, flashbacks and nightmares of the event. If EMTs have a lower chance of experiencing distressing flashbacks, they would therefore have a smaller probability of developing PTSD.

By way of contrast, it has not been proven that reducing physiological response (e.g. cardiovascular response) to stress hormones will decrease perception of stress. Even if the physiological stress response is decreased by the propranolol, what is important is whether or not the EMT perceives the same level of stress as he/she would without propranolol treatment. If the EMT still perceives the high level of stress, symptoms of chronic stress would seemingly remain unchanged. Furthermore, if chronic stress is not decreased, flashbacks could still occur exactly as they would without treatment with propranolol.

Another potential benefit of treatment with propranolol could be improved well-being and quality of life for EMTs. "Over 18% of the sample [of EMTs] admitted to the deliberate use of alcohol as a strategy for coping with the job," (Slaymaker

1999, 1) and a reduced incidence of PTSD could decrease the probability that EMTs feel the need to turn to alcohol or other drugs. However, the EMTs will still be exposed to the same gruesome events that caused so many of them to turn to drugs and alcohol in the first place. Therefore, there is an inherent risk that an EMT being treated with propranolol will simply be compounding alcohol abuse with consistent use of another drug.

Finally, as a result of the high levels of stress, the burnout rate in emergency medicine is exceptionally high, with an average career span of approximately 4–7 years. While the use of propranolol as a treatment could significantly lengthen the career-span of EMTs by decreasing incidence of PTSD and chronic stress, the burnout rate may remain unchanged for two reasons. Primarily, as discussed previously, symptoms of chronic stress and development of PTSD may be unaffected by treatment with propranolol. Secondly, careers in emergency medicine are shorter than other careers for reasons other than mental condition. It takes a unique and emotionally strong person to be able to function (and even enjoy) performing in high-stress situations and some people simply do not enjoy the profession. Outside of being unfit for the profession, others leave the career to pursue higher levels of education—medical or nursing school, for example.

ETHICAL ARGUMENTS AGAINST TREATMENT WITH PROPRANOLOL

Outside of the physical arguments against treatment with propranolol, there is an inordinate amount of ethical issues to take into consideration when considering memory dampening. The President's Council on Bioethics has reported several issues related to the ethics of simple memory dampening, specifically involving three issues. Firstly, "the Council claims that memory dampening, by offering us a solution in a bottle, allows us to avoid the difficult but important process of coming to terms with emotional pain," (Kolber 2006, 38). It seems as though the council believes that by providing an easy way to deal with the situation, those using propranolol will be less emotionally healthy in the long run. Secondly, "memory and identity are closely linked. We feel a special connection to our past selves largely because we remember having our past experiences... While memory is not the sole constituent of personal identity, it creates much of the psychological continuity that makes us aware of our continuing existence over time," (Kolber 2006, 41). If we lack memories of our personal experiences, what truly defines us as unique individuals? Finally, "according to the Council, 'we

might often be tempted to sacrifice the accuracy of our memories for the sake of easing our pain or expanding our control over our own psychic lives. But doing so means, ultimately, severing ourselves from reality and leaving our own identity behind.' This, according to the Council, 'risks making us false, small, or capable of great illusions.' It also risks making us 'capable of great decadence or great evil,'" (Kolber 2006, 45).

Relating specifically to treatment of EMTs with propranolol, the effect the drug may have on his or her ability to make sound moral judgments is of grave concern. "Both reason and emotion need to be integrated into the process of ethical decision making to ensure balanced outcomes," (Connelly 1990, 1), and from that it follows that decisions made without emotion would more often tend to be ethically wrong. As an EMT, one is faced with many ethical decisions every day, such as whether to save one patient over another or how to distribute limited resources if there is a large amount of injured people. If an EMT's ethical decision-making is impacted, this could cost one or more patients their lives.

Another concern when dampening emotions to such an extreme extent is the threat of diminution of factual memory capabilities. As discussed previously, heightened emotional states should allow for better memory consolidation; memories created in a heightened state will be remembered in more vivid detail and for a longer period of time than those created on an average day. In a 1994 study, this theory was supported by Cahill's conclusion that "propranolol significantly impaired memory of the emotionally arousing story but did not affect memory of the emotionally neutral story" (Cahill et al. 1994, 1).

The ethical implications of a decreased ability to remember emotional events as a result of propranolol treatment are rather profound. First of all, if an EMT is unable to remember the events as clearly, they might fail to remember a technique that had been successful at reviving a patient in the past. What is more is that the EMT may be unable to accurately report the events that occurred in the field to the doctors in the emergency room. As a result of diminished memory capabilities, the probability that one of the EMT's patients will not receive optimal care is increased significantly. In other words, an EMT under the influence of propranolol is not in an ideal state to provide optimal care to each patient, and his or her chances of saving a life could be severely diminished by the administration of propranolol.

Finally, the question of whether or not it is ethical to treat EMTs who are not actually at risk for developing PTSD arises. Because only about 20 percent

of people in emergency medicine will develop PTSD, that still leaves eighty percent, a rather large majority, un-afflicted by the disorder. It does not hold that potentially solving this problem for 20 percent of people is worth putting the other 80 percent at risk with no chance of benefit. Plus, for that 80 percent of people, there exists the possibility of 'over-correction' because treating those people with propranolol would be treating PTSD that doesn't exist; therefore, it is certainly plausible that this could result in severe emotional numbing of this fraction of the EMT population.

Some have suggested that an effective approach to using propranolol as a treatment for PTSD would be to identify those at a higher risk for developing PTSD and to only treat those people. However, PTSD has only been recognized as a disorder for a few decades, and currently not enough is known about how the genetics of the disease interact with the environment to be able to accurately predict who would or would not develop PTSD. So perhaps in the future, this could be explored as a solution, but first the disease itself needs to be further understood.

CONCLUSIONS

As a result of the magnitude of the problem of such high levels of PTSD in emergency medicine, the development of an effective treatment for PTSD in emergency medicine is absolutely necessary. For the time being, treatment with SSRIs and CBT is a moderately effective approach, but the risks and shortcomings of administration of propranolol are simply too extreme to consider it an ethically reasonable approach to treating PTSD.

While the benefits of PTSD could include reduction of emotional arousal, reduction of symptoms of chronic stress and PTSD, reduction of alcohol and drug abuse, and improvement of the characteristically short career-span in emergency medicine, these benefits are only potential. It has not been proven that incidences of chronic stress, PTSD, or alcohol and drug abuse would decrease with treatment of propranolol, and there are fundamental risks involved. First of all, every EMT who was treated with propranolol would have a reduced fight-or-flight response, which could be critical in an emergency situation, and the long-term effects as well as the side effects of treatment with propranolol are currently unknown. Secondly, there could be collateral damage to episodic memories in the hippocampus. Additionally, there is no guarantee that a person being treated with propranolol

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would not abuse drugs or alcohol, so the abuse could just be compounded and made more dangerous by the treatment. Finally, because the decrease in incidence of chronic stress and PTSD is not guaranteed by treatment with propranolol, the elongation of the average career-span is not guaranteed either.

In addition to these risks, there are also ethical concerns with regard to memory dampening. Specifically, the President's Council on Bioethics is concerned that using a propranolol to treat PTSD might result in overall decreased emotional health in the long run, a loss of connection with one's personal identity, or even a lack of connection to reality, potentially resulting in 'evil.' Additionally, the threat of diminution of factual memory capabilities is compounded by a potential lack of ability to make sound moral judgments and the risk of emotional numbing of the 80 percent of EMTs who would not have developed PTSD. Together, these ethical issues are of serious concern when considering treatment of PTSD with propranolol in EMTs.

As a result of the inherent risks, the great amount of unknown information about the effects and mechanisms of propranolol treatment, and the slew of ethical issues that arise when considering memory dampening, treatment of PTSD with propranolol is unethical and should not be practiced. Regardless, EMTs are still desperately in need of a solution to decrease the suffering caused by PTSD. Along with other aforementioned solutions that are currently being investigated, (i.e., d-cycloserine, MDMA, and TMS), there are two other solutions that seem to be worth exploration—firstly, utilization CBT prior to traumatic event exposure as a form of priming, and secondly, treatment with propranolol after a person has begun to develop symptoms of PTSD.

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