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Lethal Injection, Anesthesia, Medicine and Organ Donation - Ethical and Clinical Considerations Regarding the Pending Supreme Court Case: ***Baze vs Rees***

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Abstract: The recent deliberation by the United States Supreme Court regarding the use of lethal injection for executions has raised public awareness regarding the technique itself and any similarity with clinical anesthesia. This paper reviews the issues, with an emphasis in utilizing lay terms, to provide information and reference to professionals and lay persons interested in the subject of lethal injection. Anesthesiologists are most knowledgeable of the specific drugs involved in the process and may be called upon to provide information in this matter.

Keywords: Lethal injection, execution, medical ethics, ethics, anesthesia, organ transplantation, organ donation, end of life, physician assisted suicide.

INTRODUCTION

The United States Supreme Court is actively considering many issues pertaining to "state of the art anesthesia" regarding lethal injections (***Baze vs Rees***) [1]. The court case involves multiple questions, primarily questioning the possibility of infliction of unnecessary pain during the execution, the ability to insure unconsciousness until death occurs and the ability to reverse the execution process, should a stay of execution be issued after the process begins. The legality of capital punishment itself is not an issue before the courts. The reader is referred to reference #1 for legal details. It is pertinent to provide professional and informed clarification of the issues pertaining to use of anesthetics in this paper, having direct bearing on the controversy surrounding the use of "lethal injections" as a form of execution. Because the method of execution, rather than execution itself is at issue, analysis of these contemporary and common methods of anesthesia practice are important to understanding fully the concepts considered in the ongoing court review. Details of the specific crime leading to capital punishment are similarly irrelevant here, beyond the legal application of justice under the law. It suffices here to state both inmates were convicted of double homicides. As a practicing anesthesiologist, spending most of my career in the University setting, frequently treating patients who are unable to provide informed consent to anesthesia for a great variety of procedures and having trained a great number of individuals to practice anesthesia, I feel sufficiently qualified to present the following matters in plain language to allow understanding by lay persons. My current practice at the University of Pittsburgh, a level one trauma center and renown, central institution in transplant medicine world wide, has provided personal clinical involvement in the process of determination of death, as well as the ongoing care of the dead during organ procurement procedures from "brain dead" (heart-beating) and "just dead" (non-heart-beating) cadavers.

When asked by a lay person to define anesthesia, I typically indicate general anesthesia is a state of insensibility and unconsciousness-of "feeling nothing", easily induced by intravenous injection, whereby life is then sustained only by vigorous vigilance, resuscitative life support measures or, without these efforts, only great luck. Anyone can induce and sustain the anesthetic state (quite certainly for the short 10 minute period typical of an execution). The challenge in the administration of anesthesia is to *avoid death* and awaken afterwards unharmed, rather than to succumb to the effects of anesthesia in death. The "art of anesthetic practice" involves inducing this state of unconsciousness and non-reactivity, bringing the patient essentially to death's door, thus facilitating the ability of a third party professional to perform otherwise terrible (or terrific surgical) insults (including inducing a state of death), completely reversing this process and ideally sending the patient on their way homeward without detriment, pain from the procedure, nausea or any recall of the events.

ANESTHESIA METHODS AND RESULTS

The most frequently administered drugs (induction agents) used to induce anesthesia by intravenous (IV) injection include propofol, etomidate, thiopental and methohexital, all of which (except for thiopental) cause a severe "burning" sensation and significant pain on injection. As propofol is by far the leading intravenous drug used today to induce (and sustain for prolonged periods as well) anesthesia (because of the advantages it affords in the patient on awakening), many attempts to find ways to completely eliminate the pain of injection have occurred and are attempted daily with only variable success [2]. Clearly, given the extensive clinical utilization of propofol to maintain anesthesia for prolonged periods in contemporary clinical anesthesia (as opposed to the very uncommon utilization of thiopental to maintain anesthesia) a simple switch to propofol in executions would go far in eliminating uncertainty of effective

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anesthesia under the conditions of intravenous administration. The only sure way to grantee absence of pain, when injecting these induction agents, however, is to inject through a long IV catheter, which reaches into the very larger central veins within the chest cavity, avoiding contact with small limb veins. In this way, the drug is diluted by the very large amount of blood flowing in the chest. Many anesthetists will try to "numb up" the commonly utilized smaller hand and arm veins by first injecting a local anesthetic (again with only variable results), which typically only reduces the pain. Similarly, strong pain medications (opioids, i.e. similar to morphine or heroin, or benzodiazepines similar to diazepam = Valium^{R}), which do not "burn" on injection, can be given prior to induction to mitigate the injection pain or memory of the pain, respectively. As such, burning pain on injection is a commonplace and daily occurrence in the intravenous induction of anesthesia in many, of not most patients, during modern anesthesia. Thiopental is the standard induction drug in the "three drug mixture" for executions and typically does *not* irritate or burn the vein on injection anywhere near that of these other drugs. Thiopental has been displaced in modern anesthesia by the other drugs and specifically propofol, as they provide specific advantages (regarding awakening from anesthesia) not really applicable to executions. Thiopental will cause many other drugs to precipitate (turn from a liquid to a solid) when mixed in the IV line, which is a significant disadvantage in executions using pancuronium, as this solid precipitate can cause the IV line to become blocked.

As one example of clinical intravenous anesthesia: During electroconvulsive therapy (ECT) treatment, the use of medications to minimize the pain of injection from induction agents is counterproductive in producing effective therapeutic seizures or overall care. Patients are typically induced with either methohexital or etomidate, which both "burn" strongly during injection. While the vast majority of these depressed patients submit to the ECT "shock treatments" of their own free consent, because they WANT to get better, some patients do occasionally undergo these treatments repeatedly by court order. It is also possible, that awareness under anesthesia can occur in any patient during any surgery and especially during ECT, where the minimal effective "sleep" dose to cause amnesia, and not deep surgical anesthesia per se, is used to avoid inhibition of seizure activity and thus produce and allow effective treatment. Intravenous induction agents typically impair or stop seizures, hence only the minimal effective doses are sought. Muscle paralysis is typically induced with a short acting muscle relaxant, succinylcholine, to avoid patient injury from the intense muscle contractions occurring during seizures, and infrequently, this paralysis will outlast the "sleep" dose. Thus, patients can occasionally experience paralysis while conscious. I would question the belief that pain on injection would be somehow "cruel and unusual punishment", given this commonplace occurrence in modern anesthesia. The likelihood of awareness during a "botched" execution under intravenous anesthesia also appears difficult to conceive, given that gross, continual overmedication with thiopental is typical or otherwise quite possible during the execution (as no awakening is intended) and all drugs are given through the same IV line. Because of the problem with precipitation of drugs into solid form when mixing with thiopental, short interruptions of the thiopental must occur to "flush" the line. These interruptions are short and occur daily in routine clinical anesthesia practice and without patient awareness with proper dosing.

Pain is a conscious experience. As soon and long as anesthesia is induced, the phenomenon of any and all pain is ended as is inherent in the name: Anesthesia: from Greek αν- (an-) = "without" and αἴσθησις (aisthesis) = "sensation", has traditionally meant the condition eliminating the feeling of all pain and other conscious sensation. Total intravenous anesthesia (TIVA) is a commonplace contemporary technique in 2008. It is easy to identify a properly functioning intravenous line and the onset of unconsciousness by the patient's immobility and non-reactivity to verbal or painful stimulation after injection. Interrupting IV drug administration or injections occurring into non venous routes would make the effective administration of the pancuronium extremely delayed (allowing the awakening from the similarly terminated "sleep agent"/thiopental infusion). Similarly, potassium chloride infusion would be completely ineffective to stop the heart, when not administered directly into the vein. Clearly, thiopental and potassium in the doses used must be injected directly into the bloodstream to cause unconsciousness or stop the heart, respectively. Thus the successful termination of the heartbeat by the potassium infusion invariably documents correct intravenous administration of all prior drugs administered through that IV site. A swelling at the insertion site of the IV would be readily apparent, when the injection does not go directly into the vein, after only small, 1-2 tablespoon volumes. The injection into a free flowing IV placed directly under the skin thus ensures intravenous administration of all drugs. During clinical anesthesia for surgery, a single 300-500 mg dose of thiopental typically affords 5-7 minutes of anesthesia, during which period, an effective dose of muscle relaxant is administered, allowed to take full effect, while then a breathing tube, temperature probes and when needed, other tubes are inserted and without patient awareness or awakening.

During executions, addition of a muscle relaxant or potassium chloride to stop the heart is not at all necessary, if one is willing to administer a sufficiently large overdose amount of any modern anesthetic agent: without the vital support of breathing and circulation death would occur. Anesthetic drugs are well known to have very a low therapeutic index: this means the lethal dose (without supportive measures) is close to, or in the instance of muscle relaxants, actually below the clinical dose used to produce the desired clinical effect. The rapid administration of thiopental alone in overdose amount is readily possible and would insure anesthesia up to death, because anesthetic induced respiratory and circulatory depression is the cause of death during such overdose. Because thiopental suppresses brain activity, with sufficiently large amounts, seizures and all movement would become unlikely. The additional use of muscle relaxants becomes primarily aesthetically appealing, as no untoward movement of the patient becomes certain, insuring the appearance of a peaceful exit. The use of intravenous potassium is merely expedient, to rapidly and reliably stop contraction and all electrical activity of the heart at a predetermined moment. Completely stopping electrical activity of the heart is desirable, because electrical activity mimicking effective heartbeats can occur for a significant time after the mechanical pumping of the heart actually stops (and is

known clinically as electro-mechanical disassociation-EMD). As monitoring of the electrical activity is commonplace in the hospital (while not during executions), one may be misled by such monitoring of electrical activity to believe that the heart may still be producing blood flow. This event is often seen in clinical medicine (for example in arrest situations or during cadaver organ donor procedures, when the heart itself is not taken for transplant purposes), where arterial pressures are directly monitored (not during executions) and the lack of blood pressure and flow (and thus death) can be confirmed and patients pronounced dead, even with the continuing, ineffective electrical heart activity.

While the use of thiopental to induce anesthesia, pancuronium to ensure motionlessness, and potassium chloride to stop the heartbeat are the traditional "cocktail" to perform execution, this is by no means an exclusive methodology. Many viable alternatives are possible and without the negative aesthetics of guillotine decapitation, electrocution, hanging, firing squad or gas chamber. With large doses of heroin or similar opiate drugs administered alone by intravenous or intramuscular injection (and possibly by oral administration), death can be insured, as is evident by the large number of "drug overdose" deaths and emergency room resuscitations/admissions tabulated each year. While one might argue that an "opiate overdose" method is undesirable, because narcotics are known to not specifically eliminate consciousness and memory before the lack of oxygen and excess carbon dioxide levels do effect unconsciousness and then death, the euphoria or "high" caused by such drugs may also seem inappropriate to those desiring a "punishment" at execution. Indeed, the possibility to "experience" the end in a peaceful, pain free state, has been central in the clinical use of these pain relieving drugs to provide terminal comfort to cancer patients, while recognizing this may actually shorten overall residual periods of life.

If one considers the possibility, that the injection of potassium chloride might be somehow "severe and unusually" painful while under anesthesia, should one choose to administer thiopental and follow this with an overdose of local anesthetic agents (bupivacaine or lidocaine), these local anesthetics will also reliably stop the heart and will not cause *any pain*: Indeed, lidocaine is commonly used to prevent the pain of injection in the clinical setting of anesthesia! [2,3] Lidocaine is either given prior to painful injections or in the case of propofol anesthesia, many practitioners will simply mix it into the propofol to be injected as a mixture, as the two drugs are quite compatible in solution. Using propofol for anesthesia and lidocaine to stop the heart without muscle relaxant (pancuronium) would eliminate the problem of drugs crystallizing into solid material and blocking the IV line. Simultaneous and uninterrupted administration of generous doses of propofol with lidocaine insures deep anesthesia until the heart stops beating. It is possible, that a seizure from lidocaine may occur unless very large amounts (more than just standard anesthetic doses) of "sleep agent" (i.e. thiopental or propofol) are administered in advance or continually, especially in the absence of pancuronium paralysis. Any such movements due to seizures might seem disturbing to onlookers. There would be no awareness of the event to the individual receiving the drugs under thiopental or other anesthetics, however, quite like seizures during ECT sessions. Individuals are apparently typically strapped down during lethal injection and this would insure no injury could develop, whereby during this period, again, no pain exists by definition, due to anesthetic induced unconsciousness and insensibility.

It is possible to also induce anesthesia quite rapidly by breathing inhalational anesthetics at clinical concentrations. As few as one maximal or 5-10 normal breaths are typically adequate to induce unconsciousness in the clinical setting, when using the two most useful inhalational agents: halothane or sevoflurane [4]. Such inhalation inductions are performed daily in pediatric centers to spare children the experience of insertion of an IV infusion or to promote distention of superficial veins for easier IV insertion into non-moving anesthetized patients, should this be an issue. A mask is held tightly on the face and after only a few breaths, during a very short period, unconsciousness ensues. Use of a diver's or astronaut's type of suit/helmet during an execution would allow efficient administration of such inhalational anesthetic agents in anesthetic and/or overdose concentrations on demand, to thus insure unconsciousness and without the need for any intravenous drug administration. This may be preferable to death by cyanide, chlorine or carbon-monoxide alone in a "gas chamber" or one could also incorporate the administration of such deadly gas, after inducing anesthesia by inhalation. Alternately, very excessive amounts of anesthetic agents alone would invariably lead to death. The addition of another anesthetic agent, nitrous oxide (laughing gas) could allow the rapid elimination of oxygen from the inhaled mixture after anesthesia is clearly induced and maintained as overdose concentrations, to provide additional assurance of rapid demise from withdrawal of oxygen *under anesthesia* and while breathing *only* anesthetic agents. Breathing would continue to introduce more anesthetic, while failure to breath from profound anesthesia overdose would rapidly lead to hypoxic death under anesthesia. The removal of all oxygen from the anesthetic gasses only doubly insures death during the unconscious state. Switching to such an anesthetic gas mixture without oxygen could speed and insure death. Movement by the individual in the absence of muscle relaxants (pancuronium) is again possible should seizures occur. Again, restraints are typically employed and seizure's movement is not indicative of pain or awareness. As anesthesia gasses take effect, the subject becomes motionless except for breathing. The concentrations of all anesthetic gasses can be easily monitored to insure effective clinical anesthesia, at least as effectively as clinical brain wave monitoring (see below) [5]. The documentation of greatly excessive drug concentrations in the inspired gas makes the use of brain wave monitoring superfluous, as the goal of such brain wave monitoring is clinically used to insure *minimal* adequate anesthetic depth. Such inhalational executions may provide another particular legal advantage: Should a reprieve arrive during execution and prior to death by loss of heartbeat, resuscitation by actively breathing room air or oxygen alone, effectively removes the anesthetic, unlike the intravenous agents, which must be metabolized or otherwise actively compensated and effects corrected.

This introduces the question, whether clinical monitors of anesthesia might offer some advantage in eliminating pain, suffering or procedural failure during executions. The available monitors of brain activity are not infallible, but can be useful to help indicate that brain activity may be sufficiently

or minimally effectively depressed [5]. This can reflect, that the intravenous drug is reaching the brain in an effective concentration. These monitors are not 100% effective or equally effective for all anesthetic agents, ketamine in particular. Such monitors can be adversely influenced by muscle activity and other external factors and have never been (and probably never will be) tested for accuracy and use in human executions. These brain wave monitors (i.e. the BIS monitor- Aspect Medical Systems, Inc, One Upland Road Norwood, MA 02062) have also not been deemed essential monitors in clinical anesthetic monitoring by a recent practice advisory of the American Society of Anesthesiologists [6]. The utility of inhalational agents, on the other hand, allow continual monitoring of respiration and concentration of the gas itself, to insure delivery to the brain in anesthetic concentrations. Indeed, the loss of the ability to breath is inherent in the dangers of all forms of anesthesia and is itself indicative of significant clinical anesthetic effect in the brain.

It is also possible to reliably induce and maintain anesthesia by an intramuscular injection with the anesthetic agent ketamine. Another advantage here is the ability of the drug to maintain breathing over the other agents. Ketamine is a powerful pain medicine, which causes little pain during intravenous or other injection, and has found abuse as a street drug: Street terms for ketamine: jet, super acid, Special "K", green, K, cat Valium. Patients often become agitated, delusional, and irrational, while recovering from its clinical anesthetic effects, when used as the sole agent, which is of no consequence in the context of execution. This drug enables effective induction of anesthesia in combative patients and is clinically used commonly in uncooperative pediatric or psychotic individuals, who will not allow inhalational anesthesia or insertion of an intravenous line. The pain perceived in using ketamine is that of the intramuscular injection itself, again commonplace in clinical medicine, with rapid anesthetic induction within minutes and a duration proportional to the total dose administered, typically 10-20 minutes or longer, using typical clinical doses as a single injection. As soon as anesthesia becomes obvious by the ensuing nonreactive state of the patient, intramuscular injection of muscle relaxant (and an additional large dose of ketamine for good measure), would reliably insure death under anesthesia without the need for an intravenous line at all, as paralysis ensues. Again, given the powerful anesthetic and pain suppression of ketamine, no pain is produced with subsequent intramuscular injections or even surgery under anesthesia. As an example, ketamine is frequently used intravenously in burn clinics, where superficial wounds are surgically cleaned and skin cut off and transplanted- an otherwise rather painful event, like being skinned alive. This information is offered to verify the powerful analgesic and anesthetic effects of this single drug anesthetic to the lay reader.

Finally, it is not necessary to use solely one anesthetic agent as the means of execution. However, use of any other supplementary method under anesthesia provides alternatives to intravenous potassium infusion to stop the heart. The following is if particular interest to discussions below: The use of electrical current is clinically used to return heartbeat to normal rates while unconscious (cardiac arrest) and otherwise typically under anesthesia (heart rhythm disorders). It is commonly known that AC current applied across the heart can lead to death in household electrical accidents, as regular heartbeats are interrupted. Would the use of electricity to the chest to cause death be significantly different from the use to cause health (i.e. applied to the chest for cardio version/defibrillation, or the head for ECT)? Tasers are used by the police to subdue violent suspects. Is this "cruel or unusual punishment? Alternately, we have all had the blood pressure cuff placed on our arms or legs. We have experienced the discomfort of the tightness, when the machine cycles higher than the blood pressure during measurement. Could this be deemed cruel or unusual punishment? Many patients complain bitterly of this discomfort from clinical blood pressure measurement. Such a cuff could also be placed around the neck and inflated rapidly, and if quite rapid, the blood flow to the brain is interrupted and unconsciousness results in a remarkably short period, less than the time needed to clinically measure the blood pressure on the arm. Inflation of such a neck tourniquet while awake may be considered less than humane. Seizures and associated movement would be likely to occur with this method. However, unconsciousness becomes rapidly evident and causes the seizure, again preventing awareness or pain during the seizure itself. Were the condemned first to be anesthetized and have a breathing tube placed into the trachea, to enable breathing to continue *via* a ventilator, the inflation of a neck tourniquet could selectively lead to brain death alone, leaving the heartbeat and circulation to the vital, transplantable organs intact. This could insure effective clinical anesthesia during an execution and allow clinical brain death determinations to be performed in the usual clinical manner after transfer to a hospital, thus removing the transplant surgical team of any "participation" in the executions against any medical society prohibition. This last method has relevance as discussed below.

DISCUSSION

Laws of society exist to protect and balance the rights of the individual with those of the members at large. I will not propose to declare capital punishment as "right" or "wrong". Perhaps the current methods of execution are outdated and deserve change. Perhaps execution itself should be eliminated. This presentation attempts to provide facts and present multiple applications of modern anesthetic technique, which can be effectively automated, implemented and without introducing any degree of "duress" beyond that, which citizens accept daily, while undergoing routine anesthesia and/or clinical care. Premedications to alleviate fear are commonly available in both clinical and penal/pre-execution settings. Long IV catheters are/can be introduced (percutaneous intravenous central catheters) by trained nursing personnel in patients, who request them. Clearly, intravenous injection is by no means obligate to provide anesthesia as described above and morticians (i.e. non health care providers) are trained/capable to insert intravascular catheters to embalm the dead. There is no requisite to involve health care personnel against their will. As stated earlier, lethal administration of anesthesia drugs, due to the great dangers inherent in the use of this group of medicines, is quite possible without significant education or skill. It is quite in contrast, that the safe administration and emergence from anesthesia, requires the education, skill and vigilance of the trained professional.

On this following point, I would personally feel significant disservice to the readers and society at large, were I to

fail to discuss the topic of organ donation from the executed in this context. As stated, I have on numerous occasions, personally participated in the organ retrieval from "brain dead, yet heart-beating" cadavers. I and society believe they are dead based on legally signed affidavits. Executions occur with legally signed affidavits. I have participated on court ordered ECT treatments, on life threatening (ending) surgeries I have personally deemed inadvisable, have respected living wills, patient decisions and "do not resuscitate" documentations, Jehovas Witness wishes to not transfuse even to prevent death, as well as other personally unpleasant situations, as a professional anesthesiologist. I have anesthetized people, who have given their own organs as living related donors to relatives and even to complete strangers. As a citizen, I respect the fact that others have been called upon as jurors and deliberated the guilt and sentence of the charged individual. I too, if called, would do my best to represent society in this format. I do not wish to volunteer as executioner.

Can I in good conscience as a person, citizen, physician and Christian, fail to assist someone in their last hour of need? Condemned are offered last rights of faith upon request- a chance to repent. If the condemned would freely choose to donate their organs as an act of repentance, i.e. offer the gift of healing and life itself, to multiple individuals currently waiting for a heart, liver, kidney, pancreas, lungs (all organs subject to rapid deterioration and "wastage" unless preserved and removed within minutes after circulation has stopped), should I, could I, refuse to provide anesthesia to facilitate this wish? There is a clear shortage of transplantation organs worldwide. I honestly believe I, and many, could not justify the detriment to as many as 8 separate individuals unable to receive these vital organs, should my personal abhorrence to associate myself with an execution intercede. While multiple medical societies declare immoral, the participation in executions for medical practitioners, there has never been to my knowledge such declaration regarding organ retrieval from individuals declared dead. Participation in "non heartbeating donors", or the "just dead" has been controversial for anesthesia personnel, but not intensive or primary care doctors. Some acceptance, while controversial, of life support withdrawal, drug administration or IV line insertions prior to death to facilitate organ preservation is proposed-medical measures done only for reasons of organ salvage or to speed death. Indeed, the termination of circulation in "heart-beating cadaver donors" is typically produced by opening a flow clamp on a potassium containing organ preservation solution infusion to the heart-something easily done by a state appointed executioner or machine. Having made all other preparations for organ retrieval and a signed, valid and uncoerced consent for my anesthetic management for the procedure, how could I NOT provide competent, professional care to this repentant human and on behalf of the multiple waiting transplant recipients? Is it reasonable to participate in this situation by providing anesthesia and easing of pain to a living, repentant person. Upon completion of the execution, standard support measures to fulfill the obligation to the needy transplant recipients, by helping harvest the extremely valuable and life preserving organs appears reasonable. There ***is a severe*** need for organs with a growing list of transplant recipients. Should any available organs be wasted?

The current argument before the Supreme Court arose questioning the appropriateness of the methods of execution and not execution itself. The debate, regarding the fact that the amounts of thiopental administered to the executed individuals reported in a Lancet article from 2005, suggests but does not prove, there may potentially have been inadequate surgical anesthesia, based on post mortem blood samples and a possibility of multiple other factors [7]. The authors themselves admitted the only way to correctly document effective drug concentrations was to monitor and obtain arterial blood samples during the procedure [8]. The inmates studied in this article received typical anesthesia induction doses of 3-5 mg/kg, immediately followed by 1-1·5 mg/kg per *minute* (i.e. 60-90 mg/kg/*hour*) for maintenance. This maintenance dose was significantly higher than the effective dose found for patients treated to inhibit cerebral activity (so called "burst suppression" associated with deep unconsciousness) and inhibit cerebral metabolism, which was demonstrated to be effective with only a 2 mg/kg bolus followed by a 3-5 mg/kg per *hour* dose [9]. All executions were completed in (8·4 min, SD 4·7), on average 10 minutes, only slightly to perhaps twice as long as clinically the standard 3-5 mg/kg bolus dose of thiopental produces consistent unconsciousness in clinical patients [10]. The issue remains conjecture, if anything less than surgical anesthesia using thiopental may have occurred in any single individual under the prescribed execution conditions-something which cannot and will not ever be effectively studied. Switching to propofol anesthesia using the highest clinical doses or higher, immediately offers the advantage of known, reliable and continuous anesthetic administration as provided daily in the USA for surgeries [11]. However, only amnesia and not surgical anesthesia, is sufficient to insure lack of awareness to events. Unconscious movement under clinical anesthesia can occur at drug concentrations double or more than those needed to exclude memory of events. Furthermore, inmates are often given sedatives prior to the execution and these drugs are not reported or considered in the Lancet article. Finally the contention that inmates "fearful, anxious and hyperadrenergic would require increased doses" is another unsubstantiated fact. Many patients presenting for surgery are no less "fearful, anxious or hyperadrenergic"! Thiopental reliably depresses cardiac function and blood pressure at usual clinical doses, effectively counteracting increased blood flow found during the pre-injection awake state of an excited inmate or patient. "Awareness under anesthesia" is a modern serious concern for surgical patients, who are often administered much lesser amounts of anesthetic drug and exposed to significantly greater degrees of surgical stimulation. The best method to silence those opposed, would be to switch to a very high dose propofol anesthetic, which is well documented (see the package insert) for most surgical procedures. It is however true that this would introduce the significant pain of injection (found routinely in clinical anesthesia) prior to unconsciousness.

Perhaps the list of methods and choices for execution should be expanded and updated? Perhaps some or all of the above possibilities deserve consideration? As long as executions continue to be performed and transplant organs remain in severe shortage, it is time for the legal system and society itself to consider a plea to salvage all viable organs from anyone choosing to donate them, including the condemned.

Transplant recipients are not informed of the origin of the organs and are unlikely to reject them from a condemned man, even if it were shared information. Transplant surgeons would have no reservations from using healthy organs retrieved from any "heart-beating cadaver" and standard medical evaluation would verify the usefulness of the organ prior to transplantation. The state will not become liable for the medical services associated with organ retrieval, as this is covered by the organ retrieval process itself.

This paper is intended as an attempt to present scientific facts in lay terms, to allow all concerned to understand the contemporary issues important to the debate. I will not fail to state here, that my proposal regarding organ donation comes with a degree of personal trepidation. Lethal or "living related" organ retrieval from someone living and unanesthetized is clearly unacceptable and grotesque. It is important to me to recognize, that it would be necessary to provide one or more truly "humane" options for execution, that the personal choice to donate organs would not become a coerced attempt to find the most humane execution for oneself. It is also obvious to me, that providing anesthesia or other humane methods of execution, will raise the ante in the debate on physician assisted suicide: Why should the sick citizens of this country die miserable, painful deaths against their wills, once competent execution techniques are provided by the state under anesthesia for convicted murderers? Other societies have already made other accommodations in both cases. Should one even have a voice in the method of one's own execution? Clearly, in depth knowledge of the clinical reality of anesthesia can have significant bearing on decisions by the Supreme Court Justices, as well as other lay persons, forced to consider the reality and implications of these very pertinent and difficult decisions at this time. Quoting the authors of the original Lancet article questioning effective anesthesia for executions: "Physicians and particularly anesthesiologists now have the opportunity to redress the mistakes of the past, and inform the growing debate over whether and potentially how medicine should be used to kill" [12].

As society and technology advances, new legal and medical questions arise. Controversy regarding lethal injection, organ donation, end of life decisions and physician assisted suicide are only several interconnected contemporary issues of significant importance to the layperson, medical professional and legal system [13, 14] This paper attempts to present pertinent medical information regarding ethical issues in lay terms. The informed discussion of all interested parties will best serve every society in effectively balancing the many modern and difficult issues at hand into a contemporary and appropriate consensus.

REFERENCES

[1] Ralph Baze, *et al*. Petitioner *vs* John D. Rees, *et al*. Respondent. On petition for a writ of certiorari to the supreme court of kentucky petition for a writ of certiorari, capital case: http: //www.oranous.com/florida/IanLightbourne/07-5439_pet.pdf.

[2] Gajraj NM, Nathanson MH. Preventing pain during injection of propofol: the optimal dose of lidocaine. J Clin Anesth 1996; 8 (7): 575-7.

[3] Kempen PM. Lethal/toxic injection of 20% lidocaine: a well-known complication of an unnecessary preparation? Anesthesiology 1986; 65(5): 564-5.

[4] Ti LK, Pua HL, Lee TL. Single vital capacity inhalational anaesthetic induction in adults-isoflurane *vs* sevoflurane. Can J Anaesth 1998; 45(10): 949-53.

[5] Avidan MS, Zhang L, Burnside BA, *et al*. Anesthesia Awareness and the Bispectral Index. N Engl J Med 2008; 358: 1097-108.

[6] American Society of Anesthesiologists Task Force on Intraoperative Awareness.: Practice advisory for intraoperative awareness and brain function monitoring: a report by the american society of anesthesiologists task force on intraoperative awareness. Anesthesiology. 2006; 104(4): 847-64.

[7] Koniaris L, Zimmers T, Lubarsky D, Sheldon J. Inadequate anaesthesia in lethal injection for execution Lancet 2005; 365: 1412-14

[8] Zimmers T, Lubarsky D, Sheldon J, Koniaris L. Inadequate anaesthesia in lethal injection for execution. Lancet 2005; 24-30; 366 (9491): 1074-6; author reply

[9] Turcant A, Humeau A, Premel-Cabic A, *et al*. Thiopental kinetics under long term infusions. Anesthesiology 1985; 63: 50-54.

[10] Beck C, Pohl B, Janda M, Bajorat J, Hofmockel R. Narkosetiefe bei intubation: Vergleich zwischen Propofol und Thiopental. Anaesthesist 2006; 55: 401-406.

[11] Diprivan prescribing information: http://www1.astrazeneca-us.com/pi/diprivan.pdf.

[12] Zimmers TA, Lubarsky DA. Physician participation in lethal injection executions. Curr Opin Anaesthesiol 2007; 20 (2): 147-51.

[13] Liang BA. Special doctor's docket. Lethal injection: policy considerations for medicine. J Clin Anesth 2006; 18: 466-70.

[14] Truog RD. Consent for Organ Donation — Balancing Conflicting Ethical Obligations. N Eng J Med 2008; 358 (12): 1209-11.

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