Cerebral arteriovenous malformation in pregnancy: Presentation and neurologic, obstetric, and ethical significance


TRANSACTIONS OF THE SIXTY-FIRST
ANNUAL MEETING OF THE SOUTH ATLANTIC ASSOCIATION OF
OBSTETRICIANS AND GYNECOLOGISTS

Cerebral arteriovenous malformation in pregnancy: Presentation and neurologic, obstetric, and ethical significance

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Key words

Cerebral arteriovenous malformation
maternal loss of capacity
persistent vegetative state
brain death-death by neurologic criteria
surrogate decision maker

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Cerebral arteriovenous malformations infrequently complicate pregnancy. We sought to determine the neurologic, obstetric, and ethical significance of such malformations. We present the clinical course of 2 pregnant women with arteriovenous malformations who experienced cerebral hemorrhage and a loss of capacity for decision making. We also review the neurologic and obstetric significance of arteriovenous malformations in pregnancy. Various treatment options with concern for pregnancy and the prognosis for arteriovenous malformations are outlined. The ethical issues involved for pregnant patients whose decisional capacity is compromised as a result of cerebral injury are explored. A review of persistent vegetative state and brain death (death by neurologic criteria) occurring in pregnancy allows us to explore many issues that are applicable to decisionally incapacitated but physiologically functioning pregnant women. We outline a document, the purpose of which is to obtain advance directives from pregnant women regarding end-of-life decisions and to appoint a surrogate decision maker. We believe that evaluation and treatment of the arteriovenous malformation may be undertaken without regard for the pregnancy and that the pregnancy should progress without concern for the arteriovenous malformation. (Am J Obstet Gynecol 1999;181:296-303.)

Neurologic injury during pregnancy can impair decision-making ability and may compromise optimal care of either the pregnant woman or the fetus or both. We present the cases of 2 pregnant women with arteriovenous malformations with cerebral hemorrhage, each associated with impaired capacity for decision making. An arteriovenous malformation is a congenital tangle of abnormal arteries and veins with interposed cavernous vascular channels that are neither arteries nor veins. It can be asymptomatic and discovered incidentally or can be accompanied by headache, seizures, or focal signs. The most significant presentation is acute hemorrhage into the brain, ventricles, or subarachnoid space. The prevalence of arteriovenous malformation is estimated as 1 in 1000, but it is probably more common because many times such malformations are asymptomatic. Treatment options are surgery, vascular embolization, and irradiation applied in varied sequences and combinations.

Case reports

Case 1.
A 23-year-old unmarried primigravid woman at 12 weeks' gestation was brought to a community hospital after she was found wandering and confused. Shortly after admission, she became comatose with decerebrate posturing. Evaluation revealed an intraventricular hemorrhage from a large left temporal arteriovenous malformation. Because there was no spousal surrogate, her parents became the surrogate decision makers and requested termination of the pregnancy if this would be in the patient's best interest. The patient had not previously executed advance directives or expressed desires that could be used to guide the decision makers. The pregnancy was a surprise to the parents. Surgical correction of the arteriovenous malformation in the dominant hemisphere was judged too great a risk, and gamma-radiation was considered too damaging to the fetus. Medical preference was for embolization and radiation, which was to be delayed until after delivery. Several months later, she underwent cesarean delivery of a healthy male infant. She was successfully treated for the arteriovenous malformation and has returned to work.

Case 2.

An 18-year-old unmarried woman who lived with her mother experienced headache, confusion, and disorientation. A computed tomography scan discovered a 2- to 3-cm left parietal arteriovenous malformation with bilateral intraventricular hemorrhage. The patient was found to be 17 weeks pregnant, which was a surprise to her family. Tracheostomy and maximum sedation were required because the patient exhibited severe neurologic deficits. Her divorced mother was the major decision maker. The mother sought termination of the pregnancy in the best interests of her daughter, but Virginia law restricts the power of surrogates in relation to pregnancy termination. She underwent uncomplicated surgical resection of the arteriovenous malformation at 21 weeks' gestation and was discharged to rehabilitation with no change in neurologic status. She recovered some verbalization and ambulation during rehabilitation but remains neurologically impaired. Spontaneous labor occurred at 33 weeks' gestation with an uneventful delivery.

In both cases the patients were pregnant and lost capacity for decision-making ability. There were no advance directives or durable powers of attorney for health care decisions and no clear indication of either patient's desires or the value given to the pregnancy by either patient. The surprised parents were thrust into the role of surrogate decision makers because there was no spousal surrogate. However, it was unclear whether termination of the pregnancy could be justified either medically or ethically.

The question of who should decide for the patient and on what grounds became important in each case. The surrogates could not gauge the value of the pregnancy to the pregnant women from any previously expressed wishes or statements. On the basis of the sudden and devastating injury, consideration for the survival and recovery of these women was paramount, and the parents wanted their daughters to be afforded optimal treatment without regard for the fetus. Both explored the possibility of pregnancy termination, fearing that pregnancy endangered their daughters' chances for survival and recovery.

Hemorrhages such as those in our subjects may cause severe brain injury. For the woman who has had a stroke and is aphasic and perhaps confused but who is able to eat, drink, and function on her own, at least for vital functions, there is little ethical turmoil, and normally one would not
consider termination of pregnancy. The more difficult ethical dilemmas arise when one is faced with a pregnant woman who has had severe brain damage and is in deep coma with a bleak prognosis for recovery or who is judged to be in a persistent vegetative state or to have undergone "death by neurologic criteria" (brain death). Decisions must be made concerning the placement of a tracheostomy and permanent feeding tube in a pregnant patient with severe brain damage and a bleak but uncertain prognosis. Ethical problems may also arise when the family refuses permission for life-sustaining interventions or when the family demands pregnancy termination to allow for aggressive treatment of the pregnant woman's condition.

Several terms must be defined. First, to say that a patient is incapacitated with severe brain injury but not brain dead or designated as being in a persistent vegetative state means that the subject has severe brain injury, such as deep coma, that requires intensive life support mechanisms but does not meet either the criteria for persistent vegetative state because of a short time period (1 month is necessary to establish a diagnosis of persistent vegetative state) or the criteria for brain death. An example would be deep coma.

To say that a patient is in a persistent vegetative state indicates the following: (1) The patient is awake but unaware of self or environment with no purposeful interactions; (2) the patient has diffuse cortical dysfunction with relative sparing of brain stem structures; (3) the patient does have some sleep-wake cycles, eye opening, swallowing, and reflex auditory and visual orienting reactions without purposeful visual tracking, but there is no speech or response to command or noxious stimuli. This requires at least 2 months of observation before such conclusions can be considered applicable. Persistent vegetative state is recognized as a terminal illness under Virginia statutes.

Death by neurologic criteria (brain death) indicates the absence of either spontaneous or evoked cortical and brain stem neurologic function. This is recognized as death in most jurisdictions. The subject can be kept alive only by heroic interventions to sustain respiratory, circulatory, and nutritional functions.

**Literature review**

Most of the cases in the literature deal with issues concerning brain death in pregnancy but are applicable to cases in which maternal capacity is lost or compromised. We reviewed arteriovenous malformations in pregnancy, case reports of successful support of brain-dead pregnant subjects, recommendations for support, controversy over how to view the brain-dead subject, cost issues to society, and the role of the surviving family in the decision-making process.

**Significance and implications of arteriovenous malformations in pregnancy.**

More than 250 women with pregnancy complicated by an intracranial arteriovenous malformation have been reported.[2][4] The natural history and prevalence of intracranial arteriovenous malformations during pregnancy are largely unknown because some arteriovenous malformations remain asymptomatic. Pregnancy does not appear to increase the likelihood of hemorrhage from an arteriovenous malformation. Many women with known arteriovenous
malformations have been advised not to become pregnant because of concern about hemorrhaging. This may bias the data toward better outcomes during pregnancy because women with serious lesions or prior bleeding may not become pregnant. Hemorrhage from intracranial arteriovenous malformations tends to occur at a younger maternal age than that from saccular aneurysms and is not related to parity. These lesions have been reported to bleed at any time during pregnancy, labor, or the puerperium. In several reports the route of delivery had no bearing on the rate of maternal complications, and it is recommended that the route of delivery be based on obstetric considerations. If vaginal delivery is chosen, however, a passive second stage of labor with forceps delivery is advised. Cesarean delivery is often advised for women with lesions detected and repaired late in pregnancy or for those with lesions that remain un repaired.

Medical management to support brain-dead pregnant patients for prolonged periods to allow maturity of an unborn fetus is quite complex and requires multidisciplinary teamwork and both respiratory and cardiovascular support. Cessation of spontaneous respiration (part of the definition of brain death) requires ventilatory support. Maternal blood pressure must be supported to avoid decreasing uteroplacental flow. Panhypopituitarism may develop with diabetes insipidus and adrenal insufficiency. Loss of hypothalamic thermoregulation may lead to either hypothermia or hyperthermia. Nutritional support, including parenteral nutrition, is important for fetal growth. Last, strict infection control precautions are necessary because sepsis develops more easily. Successful support has been reported from 36 hours to 15 weeks. Bernstein et al suggest that there is no gestational limit on the ability to support a brain-dead pregnant woman to procure a live infant (Table I).

<table>
<thead>
<tr>
<th>Series</th>
<th>Diagnosis</th>
<th>Duration of support</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field et al</td>
<td>Brain-dead, unexplained cause</td>
<td>22nd-31st wk</td>
<td>Live birth at 31 wk; child doing well at 18 mo</td>
</tr>
<tr>
<td>Bernstein et al</td>
<td>Brain-dead, massive head injury</td>
<td>15th-32nd wk</td>
<td>Live birth at 32 wk; infant doing well at 11 mo</td>
</tr>
<tr>
<td>Dillon et al</td>
<td>Brain-dead, encephalitis</td>
<td>23rd-27th wk</td>
<td>Live birth at 27 wk; normal infant</td>
</tr>
<tr>
<td>Heikkinen et al</td>
<td>Brain-dead, ruptured aneurysm</td>
<td>21st-31st wk</td>
<td>Live birth at 31 wk; infant doing well at 8 mo</td>
</tr>
<tr>
<td>Wuermeling, Erlangen case</td>
<td>Brain-dead, massive head injury</td>
<td>15th-20th wk</td>
<td>Severe maternal infection; spontaneous abortion; support withdrawn</td>
</tr>
<tr>
<td>Vives et al</td>
<td>Brain-dead, meningitis</td>
<td>27 wk; supported for 36 h</td>
<td>Live birth at 27 wk; child doing well at 14 mo</td>
</tr>
</tbody>
</table>
Table I. Case reports of successful support of brain-dead pregnant subjects

<table>
<thead>
<tr>
<th>Series</th>
<th>Diagnosis</th>
<th>Duration of support</th>
<th>Outcome</th>
</tr>
</thead>
</table>

Table II lists the ethical issues that may arise when a pregnant woman has a serious and incapacitating brain injury.

Table II. Ethical issues arising in pregnant women with serious brain injury

<table>
<thead>
<tr>
<th>Should the pregnancy be terminated or sustained?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should the pregnant patient be supported or allowed to die?</td>
</tr>
<tr>
<td>Whose interest is primary, that of the fetus or that of the mother?</td>
</tr>
<tr>
<td>Who is the proper surrogate decision maker?</td>
</tr>
<tr>
<td>What are the limits to the surrogate's power for decision making in the case of a pregnant patient with severe brain injury and loss of capacity?</td>
</tr>
</tbody>
</table>

Legal issues surrounding brain death and pregnancy.

The duration of the pregnancy has great bearing on the prognosis and on ethical and legal decision making. In an early pregnancy (before viability) the medical staff or the family might suggest termination of pregnancy to allow for aggressive treatment of the underlying maternal disease state. The legal implications may vary from state to state. Very few young women contemplate this kind of disaster, and even fewer have executed an advance directive (Table III).

Table III. Legal issues concerning surrogate's powers and differences in laws on a state-by-state basis

| The surrogate's power is limited by the presence of a pregnancy in many states. |
| States may require a higher level of evidence (such as clear and convincing) to validate a surrogate's decision. |
| The absence of an advance directive or durable power of attorney or any previously expressed wishes or desires on the part of the patient may add great difficulty to the decision-making process. |
| Thirty-five states place pregnancy limitations on advance directives. |
| Twelve states place pregnancy restrictions on durable powers of attorney for health care decisions.
Weisbard has proposed a complex and lengthy advance directive document that includes a specific section on pregnancy. One section deals with "permanent unconsciousness," which is defined as a comatose or persistent vegetative state with no reasonable hope for recovery in which the subject may opt for life-sustaining measures for as long as possible to preserve fetal life. Alternatively, the subject may opt that life-prolonging measures not be used, recognizing that this is likely to result in death. Specific attention is paid to pregnancy decisions. The subject is asked for specific instructions in the event of incapacity, recognizing that these decisions may have grave consequences for the fetus.

Ethical dilemmas arise when one is faced with a pregnant woman who has lost decision-making capacity and are intensified when the woman is in a coma with a poor prognosis, is in a persistent vegetative state, or is considered dead by neurologic criteria (brain-dead). If the woman is not terminally ill, most jurisdictions will not allow surrogates to make decisions to terminate a pregnancy, and many restrict advance directives and durable powers of attorney for health care decisions in this situation also. However, removal of life support is allowed in the presence of pregnancy in the terminally ill incompetent patient, even though this will indirectly result in the death of the fetus; this varies on a state-by-state basis.

The question of the proper surrogate to make decisions for an incapacitated pregnant woman is a delicate one. There is a definite hierarchy proposed in law, which is accepted in most jurisdictions, with priority given to those higher on the list (Table IV).

<table>
<thead>
<tr>
<th>Table IV. Hierarchy for surrogate decision makers</th>
</tr>
</thead>
<tbody>
<tr>
<td>A person designated orally or in writing in an advance directive-durable power of attorney for health care decisions</td>
</tr>
<tr>
<td>A guardian authorized by the court</td>
</tr>
<tr>
<td>The spouse</td>
</tr>
<tr>
<td>An adult child or adult children of the patient</td>
</tr>
<tr>
<td>A parent or parents</td>
</tr>
<tr>
<td>An adult brother or sister</td>
</tr>
<tr>
<td>Any other relative in order of blood relationship</td>
</tr>
</tbody>
</table>

**How do we view a brain-dead pregnant woman?**

How does one refer to a brain-dead pregnant subject? Should the parturient subject be referred to as a patient or as an inanimate cadaveric incubator? Siegler and Wikler, in reviewing the case report of Dillon et al, cautioned that their use of the labels "dead" and "alive" was inconsistent (Table V).
### Table V. Options for consideration of status of pregnant brain-dead woman

<table>
<thead>
<tr>
<th>Series</th>
<th>View of woman</th>
<th>Consequence for surrogate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bernstein et al[6]</td>
<td>Terminally ill patient</td>
<td>Maternal autonomy prevails*</td>
</tr>
<tr>
<td>Veatch[13] (see also reference [11] )</td>
<td>Terminally ill patient</td>
<td>Maternal autonomy prevails*</td>
</tr>
<tr>
<td></td>
<td>Woman considered dead</td>
<td>Be guided by Uniform Anatomical Gift Act</td>
</tr>
<tr>
<td>Kantor and Hoskins[15]</td>
<td>Ordinary pregnancy mode</td>
<td>Treat as living woman who is terminally ill*</td>
</tr>
<tr>
<td></td>
<td>Cadaveric incubator</td>
<td>Beneficence for fetus prevails; no rights accorded to subject</td>
</tr>
<tr>
<td></td>
<td>Cadaveric organ donor</td>
<td>Be guided by Uniform Anatomical Gift Act</td>
</tr>
</tbody>
</table>

*Respect for maternal autonomy expressed in advance directive, in previously expressed wishes used by surrogate in process of subjective judgment, or by decision of surrogate based on weighing of ratio of benefits versus burdens.

In Table VI we summarize previous publications that have attempted to answer the following question: "In whose best interests should we act" in the case of loss of capacity during pregnancy?

### Table VI. In whose best interests should we act?

<table>
<thead>
<tr>
<th>Series</th>
<th>View of best interest</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field et al[5]</td>
<td>Woman is viewed as cadaveric incubator</td>
<td>Maternal autonomy ceases with death; fetal beneficence prevails</td>
</tr>
<tr>
<td>Wear et al[16]</td>
<td>Near viability, fetal right to beneficence prevails</td>
<td>Challenge refusal of surrogate to allow maternal support for short term to allow fetal maturity</td>
</tr>
<tr>
<td>Goodlin[17]</td>
<td>Primary obligation to mother</td>
<td>Allow her to die with dignity</td>
</tr>
<tr>
<td>Loewy[18]</td>
<td>Woman must be used as a respected end for herself</td>
<td>Allow woman to die with dignity</td>
</tr>
</tbody>
</table>
Table VI. In whose best interests should we act?

<table>
<thead>
<tr>
<th>Series</th>
<th>View of best interest</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frader[19]</td>
<td>Would not allow technologic tyranny to override reverence for the dead</td>
<td>Allow woman to die with dignity to facilitate prompt burial</td>
</tr>
<tr>
<td>Bernstein et al[6]</td>
<td>Strong reliance on previously expressed desires of woman or, if none, on wishes of family</td>
<td>Extensive education and disclosure for family and hope for a collaborative decision between family and caregivers</td>
</tr>
<tr>
<td>Glover[20]</td>
<td>Family centered, based on remaining intact relationships of surviving family</td>
<td>Family decision, based on prognosis for fetus, what is known of woman's values and preferences, and effect of whole process on family</td>
</tr>
<tr>
<td>Chervenak and McCullough[21]</td>
<td>Brain-dead body is personless and devoid of rights accorded to the living</td>
<td>Support of woman justified by fetal beneficence but should be governed under strict roles of experimental project</td>
</tr>
</tbody>
</table>

The brain-dead pregnant subject has been described in terms of "postmortal pregnancy." Postmortal pregnancy is a complex situation in which 4 different aspects must be examined:

1. The construction of the woman as a reproductive environment.
2. The construction of the fetus as an autonomous person.
3. The dying person as an object of intensive care and medical experimentation.
4. The individual person's right to die with dignity.

In the first two aspects there is a conflict between the woman and the fetus. The woman's right for self-determination (autonomy) impinges on the fetus' claim for personhood and beneficence.

In the last 2 aspects the conflict is between a person's right to die with dignity versus the medical and scientific interest in maintaining the life functions of a dead person's body. If death is seen as a private and personal event, then even after death the body is not viewed as a mere means to an end. Dying is a process that culminates in death. If life functions are maintained, "death" actually precedes dying. The medical-legal criterion of brain death constitutes a distinction between the person before death and an objectified dead body.

Comment

There is no consensus as to whether, how, and under what circumstances the life of a brain-dead pregnant woman should be maintained over many weeks. In the capable patient, maternal autonomy is considered almost inviolable in our scheme of ethics in the United States. The issue
becomes clouded when the woman loses her connection with reality, which we call capacity. There are some who would deny any semblance of personhood to the brain-dead pregnant subject and would allow beneficence for the unborn to be the governing factor. Others would be governed by prior expressed wishes either as present in a written declaration or as previously expressed by the subject. Others would focus on the family and allow the family to determine the course of action.

The cost of maintaining a brain-dead subject over an extended period to produce a child is probably best estimated to cost half a million dollars or more. Is this a justifiable expenditure of society’s scarce resources?

There is a legal hierarchy regarding the appointment of surrogate decision makers (Table IV). Although it is clearly organized, it may be difficult to put into practice. Young women usually do not contemplate devastating injury or loss of capacity nor have they discussed such possibilities with others or put their wishes and desires into written documents. A spouse or family member is called on, in the midst of their grief, to comprehend this grave situation, to make life-and-death decisions for the pregnant subject, and to bear the burden of these decisions as they affect the fetus. Dilemmas may arise when there is disagreement between the caregivers and the surrogate or surrogates, between surrogates, or between surrogates and the other members of the family.

How we view the brain-dead pregnant woman influences decisions. If the subject is accorded the status of a terminally ill patient, then maternal autonomy, as expressed either by a written advance directive or by previously expressed wishes, will prevail. If the subject is a "cadaveric incubator," then "it" has no autonomous rights and would be sustained for the benefit of the fetus. If obligation to the unborn child is the governing factor, then viability and outcome of the pregnancy should prevail. If the Uniform Anatomical Gift Act is operational because the subject signed a donor card or, in the opinion of the surrogate, would have wished to donate organs, then it can be judged that she is willing to donate her body as an incubator for the benefit of the fetus. If respect for the dead or near dead is the motivating factor, then the woman should be allowed to die with dignity. With the family-centered approach, recommendations should be offered after extensive education and consultation with the family unit. In keeping with the humanistic view of medicine, we would encourage the view of the patient as a terminally ill pregnant woman, which focuses on maternal autonomy and places great weight on the previously expressed wishes of the woman.

**Ethical guidelines and conclusions**

It is difficult to offer an algorithm for loss of capacity in pregnancy that will be applicable to all cases. In an emergency or before the woman's condition is clarified, all measures should be instituted to sustain life. Decisions of this magnitude must be finalized only after the surrogates are fully aware of the diagnosis and prognosis.

We can propose no plan that would justify withdrawal of medical management or termination of the pregnancy for the patient who has a loss of capacity caused by cerebral injury but still possesses the ability to function on her own without continuous life support. It is fairly well established that in most jurisdictions surrogates would not have the power to demand or consent
to pregnancy termination as a direct intervention. If a persistent vegetative state or brain death is established or if the pregnant patient is, in the evaluation of the health care team, incapacitated with a poor prognosis, strong consideration should be given to the subject's advance directive or durable power of attorney. This must be evaluated individually. Consultation with judicial authorities is indicated because pregnancy restrictions on advance directives and durable powers of attorney for health care decisions vary between states. If there is no advance directive or durable power of attorney for health care decisions, then direction must be sought from previously expressed statements of the subject and an assessment by the surrogate as to what the subject's wishes would be in such a catastrophe. Failing all else, the surrogate must base a decision on an assessment of the benefits and burdens entailed. Life support is withdrawn from severely brain-damaged patients in the nonpregnant state in many cases without a formal diagnosis of persistent vegetative state or brain death but rather on the basis of a dismal prognosis by the health care team and some sense of the patient's prior wishes. The presence of pregnancy imposes, in most jurisdictions, some limitations on this practice. Termination of pregnancy in an incapacitated patient is not allowed in most jurisdictions, even at the behest of a legitimate surrogate. By contrast, withdrawal of life support in the patient declared terminally ill, in a persistent vegetative state, or brain-dead is acceptable.

For caregivers in the case of a subject who is in deep coma with a bleak prognosis and terminally ill or declared brain-dead or to be in a persistent vegetative state, we suggest recommendations based on those proposed by Dillon et al\(^7\) and Loewy\(^18\) to present to the surrogate or surrogates:

- If pregnancy is <24 weeks' duration, no life support should be offered to the mother for the sake of the fetus.
- If the event is equally devastating to the fetus, no treatment should be offered.
- From 24 to 28 weeks' gestation, intervention is possible but should be undertaken only after intense education of and consultation with the surrogate and family members.
- If the pregnancy has reached 28 weeks, then it should be sustained until fetal maturity is attained or worsening of maternal condition necessitates delivery.

A dispute between the caregivers and surrogate, between surrogates, or between the surrogate and other family members may occur. Every effort should be made to keep the situation private. Mediation may be helpful with the aid of an ethics consultation and pastoral consultation with respect to the patient's professed religious beliefs. If education and mediation fail and the caregivers are firmly convinced that the surrogate is not acting in the best interests of the patient or the fetus, the courts may be asked to appoint a guardian. This should be considered only as a last resort.

Finally, we would encourage all pregnant patients to execute an advance directive and durable power of attorney for health care decisions. We propose an additional section to the usual advance directive specifically designed for pregnancy. It is defined in sixth-grade language and covers loss of capacity in general, as well as loss of capacity caused by deep coma with bleak prognosis, persistent vegetative state, and brain death.

We thank Hochschuldozent Dr Bernhard Debatin of the University of Leipzig for contributing his insights on how to view the brain-dead pregnant patient and her fetus and to Paul A.
Lombardo, PhD, JD (Institute of Law, Psychiatry, and Public Policy, University of Virginia), for legal insight regarding advance directives and their variances in different jurisdictions.

REFERENCES


Discussion

DR GUY I. BENRUBI, Jacksonville, Florida. Dr Finnerty and his coworkers are to be commended for bringing before the society a paper that requires ethical analysis and discussion, as well as 2 issues that any obstetrician may potentially face. Discussion of pregnancy maintenance in a brain-dead pregnant mother will become increasingly relevant because technologic advances in life support will enable physicians to enter previously unanticipated realms. This very difficult ethical dilemma should be a frequent topic of discussion at multiple meetings of our specialty, and therefore such discussion should be encouraged and joined.

The manuscript as submitted to me essentially consists of 2 papers in one. The first part of the manuscript described 2 patients with arteriovenous malformations during pregnancy and the ethical concerns that arose over the appropriate medical action when the diagnoses were made. The authors presented the cases fully and then described the decision not to terminate pregnancy but to treat expectantly.

A medical dilemma that leads to an ethical consultation is no different than any other clinical situation. It requires a systematic analysis by some organized method. Many of these methods are available in the literature, with the most common ones being the Albert Jonsen 4-box technique or the Four Principles method. In both of these methods data are organized in a systematic way in 4 categories. Once the data are arranged in these "boxes," each box can be evaluated as to which clinical decision has the most weight. I would have liked to see this type of analysis for the 2 cases of arteriovenous malformation that Dr Finnerty and his coworkers presented. Such a discussion published in the literature would have had interest and value for obstetricians faced with similar situations in the future.

The authors, after presenting these two cases, decided to discuss a different entity, postmortem maintenance of pregnancy for fetal indications. The strength of this part of the paper is in a very complete listing of various approaches that other authors have used in previous publications on this matter. After a full catalogue of possible analytic lead-off points, the authors declared their Equal Opportunity-Affirmative Action institution preference for one and then proceeded with the last part of the paper. I would have enjoyed a more detailed analysis as to why the authors chose the particular model they decided on as being the most ethically valid one.
In their paper the authors say that there are 3 possible approaches to pregnancy maintenance in a postmortem state. One approach is to view the patient as a terminally ill autonomous person, thereby granting total dominance to her wishes. Another approach is to see the dead subject as a cadaveric incubator "possessing no rights." A third approach is to view the deceased body as a voluntary organ donor. After listing the possible approaches, the authors stated that they "encourage the view of the patient as a terminally ill pregnant woman." It would have been of value to describe the analysis that led to this conclusion. Why do they believe that this particular model has the greatest ethical weight in these clinical situations? Why do they reject the voluntary organ donation model or the cadaveric incubator model? What are the potential negative implications of either one of the models rejected? For instance, do they believe that the cadaveric model may have disastrous societal implications? If, in fact, we accept the cadaveric model, does that mean that anyone can harvest organs without permission? Does it mean that we will have harvesting companies who will be lurking right outside emergency departments and following patients into the hospital? Would health maintenance organizations sign contracts with harvesting companies for exclusive harvesting use of organs in patients who die under their plan? Would people get discounts if they decide to sign up with certain harvesting providers once they sign with their health maintenance organization? Would we have harvesting companies contracting with the state to harvest organs from executed criminals, and would that, in fact, lead to an increased number of executions with harder chances for appeal?

Obviously, discussion of these possibilities may seem ludicrous, but, in fact, a paper that analyzes ethical decision making in a clinical situation needs to approach these potential results in a systematic manner.

Finally, what I believe is an excellent contribution of this work is the concept of advance directives specific to pregnancy, as well as the model for advance directives that Dr Finnerty and his coworkers present.

Once more, I thank the authors for their work and for the initiation of discussions of these two very important topics.

**Dr Wade Neiman**, Lynchburg, Virginia. Would you suggest that members of the South Atlantic Association counsel their patients on the initial obstetric visit, because this seems to be extremely helpful for those patients who go on to have problems late in pregnancy? Have you found other physicians amenable to this suggestion?

**Dr Finnerty** (Closing). We wish to thank Dr Benrubni for his cogent discussion and his erudite and provocative addition to our presentation. I will attempt to answer the questions he posed.

First, Dr Benrubni asked why we encourage the view of the brain-dead pregnant woman as a terminally ill patient rather than as a cadaveric incubator or as a voluntary organ donor. It is our sense that our whole orientation as practitioners of a healing art is directed toward the welfare of the patient. We believe that it is more in keeping with our concept of the practice of medicine to treat a patient rather than maintain a cadaveric incubator or consider the brain-dead pregnant woman a source of organs to be harvested. The construct of the brain-dead pregnant woman as a patient allows us to balance the principles of autonomy for the woman and beneficence toward
the fetus while at the same time sharing an ethics of caring with the surrogates and the surviving family.

Dr Benrubu next asked why we reject the cadaveric incubator model and the voluntary organ donor model. The cadaveric incubator model totally rejects any rights of or respect for the brain-dead subject. This goes against most of our societal norms, which accord great respect and reverence for our dead and sanctity for their bodies. Desecration of the dead is considered a heinous crime.

From a practical standpoint, most young pregnant women have not committed to organ donation or signed pledges to donate organs. Also, in the usual management of brain-dead patients, they are sustained for only a short period if there is to be an attempt to harvest organs. This is justified by the great potential value of these organs to another in need. In the case of sustaining the pregnant brain-dead mother, we are contemplating weeks of highly intensive care. We believe that a relationship based on the centuries-rich tradition of the patient-doctor relationship is the best milieu in which to establish and sanction this effort.

We would agree with Dr Benrubu's fear that if we use the cadaveric incubator model we may be opening the door to abuse in the harvesting of organs. We would hope that it would never come to harvesting companies staking out emergency departments or to states harvesting from criminals. It is as a safeguard against such possible abuses that we were led to support the concept of the brain-dead woman as a terminally ill patient with all rights accorded to her under the principles of autonomy, beneficence, and nonmaleficence.

Dr Neiman asked whether we would suggest that members of the South Atlantic Association counsel their patients on the initial obstetric visit concerning an advance directive, because this seems to be extremely helpful for those patients who go on to have problems late in pregnancy. He also asked whether we have found other physicians amenable to this suggestion.

As Dr Neiman knows (being a participant in our study to judge this very question), we are attempting to perform a prospective trial to evaluate patient willingness to sign such a directive. Perhaps by next year we can report on patient and physician acceptance of this concept, their willingness to participate, and the feelings expressed by patients when being asked to contemplate catastrophic events and to sign such a document.

I have to report that the concept of asking maternity patients to execute an advance directive has not been embraced with enthusiasm by the practicing community.