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Anesthesia for the Elderly Patient

"My diseases are an asthma and a dropsy and, what is less curable, seventy-five."

– Samuel Johnson

Over 40 percent of all surgical procedures in the US are performed on patients over sixty-five, a remarkable statistic given that those over sixty-five comprise only 13 percent of the US population. Elderly patients are more likely than their younger counterparts to suffer serious medical complications such as a heart attack, pneumonia or kidney failure during or after their operation, further compounding the impact that caring for elderly patients has on the medical system.

Basics of Anesthesia

Some knowledge of the principles of anesthesia is useful before describing how aging alters the response to an anesthetic. There are three broad categories of anesthesia – local anesthesia, regional anesthesia and general anesthesia.¹ Local and regional anesthesia involves the injection of a drug such as lidocaine or bupivacaine that soak into nerves and block the electrical signals from travelling down the nerves. With local anesthesia the drug is injected under the skin in the area of the surgery where the nerves are diffusely spread about in the tissue, whereas in regional anesthesia the drug is injected next to large, discrete nerves travelling to the surgical area. For example, when injected at the right location in the armpit, the arm can be completely numbed up, allowing surgery to proceed without the patient feeling any pain. A spinal anesthetic involves placing the needle between the vertebrae into the spinal sac. The drug then reaches the nerves that are going to the lower half of the body, thereby making the patient numb from approximately the upper abdomen on down. An epidural anesthetic is similar to a spinal, only the needle is placed outside the spinal sac and typically a catheter is inserted (and the needle removed). An advantage of the catheter is to make it easy to give subsequent injections as needed.

A general anesthetic renders the patient unconscious during the surgery. Most often unconsciousness is rapidly achieved by injecting a large dose of a sedative, such as pentothal or propofol. Since the drug wears off quickly, it is immediately followed by a gas anesthetic to keep the patient asleep. During the surgery narcotic painkillers may be used to reduce how much gas is used, and to get a head start on the pain control after surgery. Sometimes drugs that paralyze the muscles must be used to facilitate the operation.

During any anesthetic the patient is watched carefully and continuously. A variety of monitoring equipment is used to follow the patient's vital signs. The electrical activity of the heart (electrocardiogram) is displayed on a monitor screen (Figure). Blood pressure is measured every few minutes with an automated machine. The oxygen level in the arterial blood is measured via a device that clips to a finger. During a general anesthetic a machine will measure the concentration of the gas anesthetic and also the level of carbon dioxide coming from the lungs. Careful monitoring is important because all anesthetics can lower the blood pressure, depress breathing and impair many of the body's defense mechanisms. The amount of anesthetic

given the patient must therefore be continuously adjusted to match the conditions present during the surgery.

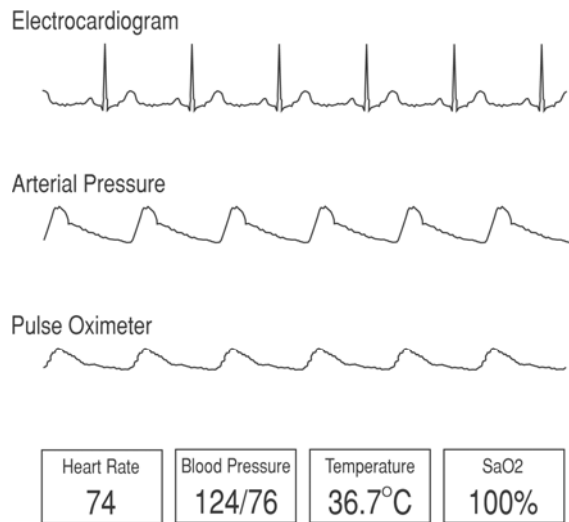


Figure. A stylized anesthetic monitor screen is shown with typical waveform and numeric displays. The top waveform shows the electrical activity of the heart. Each of the "spikes" is accompanied by a contraction of the heart. Heart rate in beats per minute is derived from the waveform and the value is displayed in the bottom left. The middle waveform shows the blood pressure obtained with a catheter (plastic tube) placed in an artery (usually at the wrist). The high and low values of the arterial pressure are displayed in the second box from the left. Blood pressure is usually measured with a cuff around the arm, however, and not with a catheter in the artery. The third waveform displays the strength of the signal from the pulse oximeter, a device that measures how fully loaded with oxygen the hemoglobin in the arterial blood is. The oxygen saturation is displayed in the bottom right box. That value should normally be at or near 100%, indicating that the arterial blood is carrying as much oxygen to the body as it possibly can. Lastly, body temperature is measured with a temperature probe usually placed in the esophagus and displayed in degrees Centigrade. Temperature measurement is important because the operating room is cold and patient hypothermia can lead to complications. Also, a rare disorder can cause body temperature to climb uncontrollably during anesthesia and can lead to patient death if not detected and treated promptly.

The Unique Challenge of the Elderly Patient

Aging decreases the ability of every organ system in the body to withstand stress, including those associated with surgery and anesthesia.^{2,3} Stress begins in surgery with the combined effects of the anesthetic and the surgical trauma. After surgery the patient faces a potentially long period of recovery from that trauma, as well as the stress of pain. Chronic disease such as stroke, heart disease, diabetes or high blood pressure also compromises the body's ability to withstand stress and makes the patient more vulnerable to complications such as a heart attack, pneumonia, kidney failure or even death. Aging has its greatest adverse impact on older patients who also have medical illness. Healthy elderly patients have only a modest increase in risk in comparison to healthy young adults. In patients with medical illness, however, old age dramatically increases risk.⁴ The challenge to the care of elderly patients lies in tailoring the anesthetic to the patient's medical illnesses as well as taking into account the effect of age on the responses to the anesthetic. In all phases of anesthetic care, everything is done with an eye to reducing the likelihood that complications will occur.

Preoperative Assessment

Before a patient has surgery, it must be determined that the expected benefits of the surgery outweigh the risks. With a healthy patient, this decision is usually straightforward. That may not be true for an elderly patient with multiple medical problems contemplating a high risk surgery. Sometimes it is useful to get specialists involved in order to perform more sophisticated tests that will better define the extent of the disease. Such testing may lead to therapy aimed at improving the medical status of the patient in order to decrease the risk of the surgery. For example, a patient with poorly controlled asthma might benefit from a few days of steroids to bring the asthma under control. With the current trend to performing as many surgeries as possible on an outpatient basis, many patients now go to preoperative clinics where the patient's medical history and current condition can be assessed, and further evaluation or treatment initiated well in advance of the scheduled surgery.

Intraoperative Management

Virtually all anesthetic drugs have more pronounced effects on elderly patients.^{2,3} Drugs typically last longer because metabolism, elimination of the drug from the body, slows with age. A given dose of drug usually has a greater effect on older patients because higher initial blood levels are achieved than in young patients, thereby permitting more drug to enter the brain. In some cases the older brain is also more sensitive to the drug. In consequence, elderly patients usually receive small doses, and whenever possible drugs are used that possess a short duration of action.

Maintenance of a stable blood pressure is also more difficult with older patients.⁵ Blood pressure is the product of cardiac output and vascular resistance, where cardiac output is the amount of blood the heart pumps to the body per minute, and vascular resistance represents how hard it is for blood to flow through the blood vessels. Vascular resistance is partly controlled by the brain, and that component of resistance increases with age. When an anesthetic numbs the brain, the vascular resistance decreases more than in a young adult and takes the blood pressure down with it. Furthermore, aging decreases the body's ability to resist changes in blood pressure, making changes in blood pressure due to external forces such as blood loss during surgery less opposed and therefore more dramatic. Fortunately, modest swings in blood pressure, whether up or down, are usually well tolerated by most every patient. Nevertheless, the control of blood pressure generally requires more direct manipulation by the anesthesiologist when caring for elderly patients.

The lungs are another area of great concern.^{2,3} Aging diminishes the transfer of oxygen to the blood and anesthesia worsens this problem. Elderly patients are therefore likely to need extra oxygen for a longer period of time after surgery or be at risk of having periods of too low blood oxygen levels. Aging also increases the likelihood that portions of the lungs will compress and make the lungs more prone for pneumonia. The reflexes in the mouth and upper windpipe protect against regurgitated stomach contents from entering the trachea and damaging the lungs. These protective reflexes also diminish with age, again making the older patient at higher risk of low blood oxygen or pneumonia. Deep breathing and coughing out secretions that accumulate in the lungs are important maneuvers done by the patient to help prevent low blood oxygen or pneumonia.

Although it is a controversial area, there is suspicion that surgery somehow causes blood to clot more easily.² That tendency might be a good thing at the site of the surgery, but it may also lead to clots forming at diseased areas of the arteries that supply blood to the heart or brain.

If so, those clots could lead to a heart attack or to a stroke. Prevention of these complications is a major area of current research.

Postoperative Care

Surgery, especially operations where the chest or abdomen is opened, creates a significant stress to the patient that continues for at least several days after the surgery. Besides problems such as pneumonia or a heart attack, older patients are particularly prone to becoming confused within a day or two of surgery.² Although the confusion almost always goes away, the condition may leave the patient in a more debilitated state for a long time thereafter and can require longer hospitalization and perhaps even nursing home care on discharge from the hospital. Patients may also suffer a potentially permanent decline in mental abilities in association with surgery.⁶ Prevention of both these phenomena are important areas of current research.

Anesthesiologists have been particularly involved with preventing complications by helping to provide better pain control after surgery. A popular method of pain control is the administration of morphine via a pump controlled by the patient. Within certain safety limits, a small dose of morphine is given each time the patient pushes a button. Narcotics such as morphine have their side effects, though, such as itching, nausea and sedation. In part to avoid these problems, non-narcotic drugs have been gaining popularity. For surgery on the arms or legs, the use of long-lasting local anesthetics can safely extend the anesthetic for up to a day after the surgery. Through mechanisms not yet fully understood, this technique may reduce the amount of pain experienced even after the local anesthetic has worn off.

Another option for pain relief after surgery is provided by the epidural catheter described previously.⁷ By administering a low concentration of both a local anesthetic and a narcotic through the catheter, excellent pain control can be achieved without affecting the patient's brain. The patient may now breathe more deeply and cough more easily, thereby helping to prevent pneumonia. Good pain control may also diminish the risk of other problems such as a heart attack. The exact role of pain control with epidural catheters is still unclear, but it appears that complications can be reduced in high risk, often elderly, patients.

Conclusion

The anesthetic care of the elderly patient is complex and demanding because of the effects of aging on organ function, plus the greater likelihood of chronic disease with increased age. Greater attention must be afforded such patients beginning with the evaluation and optimization of the patient's medical status. The anesthetic requires close attention to detail and in selected patients, special techniques may be useful in lowering the risk of complications.

References:

1. Morgan, G. Edward Mikhail, Maged S. *Clinical Anesthesia*, 2nd ed. New York, NY: Lange Medical Books/McGraw-Hill, 1996
2. Muravchick, Stanley. *Geroanesthesia*, St. Louis, MO: Mosby, 1997
3. McLeskey, Charles H. (ed). *Geriatric Anesthesia*, Baltimore, MD: Williams & Wilkins, 1997
4. Tiret, L., Desmonts, J.M., Hatton, F., and Vourc'h, G. "Complications associated with anaesthesia – a prospective survey in France." *Can Anesth Soc J* 33(1986):336-344
5. Rooke, G. Alec. "Autonomic and cardiovascular function in the geriatric patient." *Anesth Clin NA* 18(2000):31-46
6. Moller, J.T., Cluitmans, P., Rasmussen, L.S., et al. "Long-term postoperative cognitive dysfunction in the elderly: ISPOCD1 study." *Lancet* 351(1998):857-861
7. Liu, Spencer, Carpenter, Randall L., and Neal, Joseph M. "Epidural anesthesia and analgesia—their role in postoperative outcome." *Anesthesiology* 85(1995):1474-1506