To the Editor.—Mark Twain may have overstated his distrust of statistics, but the issue of interpretation of statistics comes to the forefront in the study by Arbous et al.1 and the accompanying editorial written by Warner.2 As the results of the study are discussed, Arbous et al. jump from describing associations between outcomes and management factors, to cause-and-effect descriptions: “it was found . . . a checklist decreased the risk,” “the reversal of the effect of opiates and muscle relaxants seems to decrease the risk,” and so on. Warner embraces these ersatz “risks” as showing “anesthetic management processes to dramatically reduce perioperative mortality.”

When one looks at baseline characteristics of the study and control groups, there are, as the authors note, huge differences in the categories of urgent/emergent nature, time of day procedure performed, and American Society of Anesthesiologists physical status. In fact, 40% of the study cases were rated American Society of Anesthesiologists V—not expected to survive for 24 h, with or without surgery (regardless of anesthetic management). If we accept that a large proportion of the study cases carry greater risk by virtue of their physical status and the emergent nature of the injury or disease process, and that urgent/emergent cases generally account for all the outside working hour cases, differences in anesthetic management processes between the two groups seem more coincidentally associated than causative. Were equipment checks performed less frequently in the study group because of the emergent nature of the cases? Was the lower percentage of two providers at termination of a procedure simply a function of the outside hour the procedure was performed? Was the lower reversal rate of opiates and muscle relaxants due to the fact that the study group was sicker, undergoing more complex procedures, and so remained intubated postoperatively? Did the study groups receive fewer narcotics and local anesthetics for postoperative pain because of their moribund (comatose?) or unstable condition?

This is not to suggest that anesthesia practice factors do not affect morbidity and mortality; some of the anesthetic practice factors in this study may one day be proven to be causative. But let us appreciate the method of this study for what it is: a tool to identify associations. Those associations then need to be further studied to identify them as causative or coincidental. Cars manufactured on Monday do not have more problems than others because that day of the week starts with the letter M. We need to look for truths, damn truths, and more than associations.

Brian C. Robertson, M.D., Marian Medical Center, Santa Maria, California. magoozer@aol.com

References

(Received for publication June 20, 2005.)
patient safety. However, we do wish to disabuse practitioners and administrators of the notion that implementing these simple anesthetic management principles will affect the anesthetic mortality rate unless or until a more definitive study of their contribution to anesthetic-related mortality and coma has been reported.

Michael J. Avram, Ph.D., Tom C. Krejcie, M.D. *Northwestern University Feinberg School of Medicine, Chicago, Illinois. mja190@northwestern.edu

Anesthesiology 2006; 104:203

To the Editor:—I applaud Arbous et al. for attempting a large multicenter study to identify anesthesia care factors that may cause mortality. However, the design of the study could allow for misleading conclusions. Failure to have controls of similar case type resulted in the conclusions that two anesthesia personnel at emergence, reversal of neuromuscular agents, postoperative pain medication, and no anesthesiologist relief were associated with less mortality.

My previous experience at a trauma center is that patients who die often have long surgery at night when anesthesiologists change shift. After surgery, the patient is kept intubated and transported to the recovery room without need of additional anesthesiology personnel. The neuromuscular agents are not reversed, and the patient is often too unstable to receive opiate pain therapy. Proper selection of control cases would show that this method of anesthesia care did not cause the death of the patient.

There is an old joke that oxygen is the most dangerous anesthetic, because all trauma patients who receive only oxygen for major surgery die. It is no joke when the lack of proper controls in a study leads to conclusions that will be quoted to change proper anesthesia care. The editorial by Dr. Warner was correct to state that case-control methodology does not prove that these are risk factors. This should have been stressed by Arbous et al.

Kenneth A. Schmidt, M.D., Valley Hospital, Ridgewood, New Jersey. kschmidt99@aol.com

References

(Accepted for publication June 20, 2005.)

Perioperative Morbidity and Mortality?

To the Editor:—While reading the article by Arbous et al. and the accompanying editorial by Mark A. Warner, M.D., I was struck by a few important details and one important comment.

In a case-control study, it is of utmost importance that the controls be carefully matched to the cases to make any inference as to statistically significant differences between the two groups. In the article by Arbous et al., it is obvious that the cases are essentially American Society of Anesthesiologists class IV and V patients (69.8%) who underwent long, urgent operations (65.4%) often of major complexity (59.3%). These cases were individually matched only by sex and age with controls who were usually American Society of Anesthesiologists class I and II patients (78.4%) undergoing shorter elective operations (87.4%) that were almost entirely of minor or intermediate complexity (93.5%).

A small amount of effort might have controlled for these and more characteristics and given us a meaningful set of significant criteria to help anesthesiologists provide safer anesthesia to patients. As it is, the conclusions reached by the article are the equivalent of determining that the difference in taste between wine and vinegar has to do with the use of a cork and the size of the bottle.

In Warner’s accompanying editorial, the editor could very well have used this article to show the failings of case-controlled studies and the importance of understanding the statistics before accepting the conclusions.

My comment comes from reading the editorial views expressed by Dr. Warner. We anesthesiologists enjoy the comparison between what we do and what commercial pilots do. Pilots can boast of a 6-sigma mortality rate, a feat few of us in anesthesia can claim. We steadfastly defend the use of ancillary anesthesia providers who are present alone during the greatest part of the anesthetic period. I wonder if any commercial pilot would even consider turning over the aircraft controls to the flight attendant, even though the plane is on auto pilot at 30,000 ft altitude, with the proviso “just call me if anything goes wrong.”

Julius R. Ivester, Jr., M.D., Roper Hospital, Charleston, South Carolina. ivester@aol.com

References

(Accepted for publication June 20, 2005.)
Impact of Anesthesia Management Characteristics on Severe Morbidity and Mortality: Are We Convinced?

To the Editor.—We read with great interest the article by Arbous et al. Although we commend the authors for designing an ambitious and creative study to address this important topic, we do have several reservations about the study design, interpretation of the results, and hence the conclusion.

Because anesthetic mortality and serious morbidity are rare events, the use of a case–control design is very appropriate. Case–control studies usually include several controls for every case to increase the power of the study and to increase the likelihood that the conclusions will be valid. In this study, the investigators used only one control per case (807 cases vs. 883 controls). A higher number of controls would have increased the probability that the controls were a representative sample of the entire cohort.

The main outcome in the study was death or coma within 24 h of surgery, an important and indisputable outcome measure. The limitation of this outcome is that many patients who experience perioperative complications die within days to weeks rather than within 24 h of surgery. Intraoperative management factors may impact their postoperative course and their eventual demise.

We understand that the investigators chose to limit the matching of controls only to age and sex to prevent bias and also to allow them to examine all factors affecting mortality in a multivariate model. The possible flaw with this approach in the context of their study is that American Society of Anesthesiologists (ASA) physical status classification is such a powerful confounding factor that it could have undermined their multivariate model. Most of the patients who died (>90%) had an ASA physical status of III–V. Fewer than 30% of the control patients had an ASA physical status of III–V (table 1).

This brings into question whether there were enough ASA physical status III–V patients in the control category to validate a multivariate calculation for other factors relating to mortality. This could have been addressed in two ways: The study could prospectively have enrolled only ASA physical status III–V patients, or many more control patients could have been included.

In addition to presenting odds ratios for rare events, it is important to present the number needed to harm. For example, the investigators presented an odds ratio of 10:1 for preventing death by adopting a universal practice of reversing muscle relaxants. We made some assumptions and calculated that the number needed to harm for the entire cohort might be 1 in 25,000. This means that 25,000 people on average would have to have muscle relaxation not reversed to result in one additional death. The odds ratio for preventing death by having two anesthesia providers present for all inductions and emergences was 10:6. This may translate to an even larger number needed to harm than for not reversing muscle relaxants. The cost of providing two anesthesia providers for every anesthetic—no matter how minor the surgery and no matter how healthy the patient—would be staggering and may not result in many lives saved. A similar study focusing only on patients with an ASA physical status of III–V might be more useful in identifying which anesthetic management factors are most important in decreasing the likelihood of death among the sickest patients presenting for high-risk surgery.

Despite our reservations, we appreciate the study of Arbous et al. and believe that it raises important issues. In particular, we believe that separating anesthetic from surgical death is a false distinction. This study highlights the contention that multiple aspects of perioperative care and management may impact on postoperative outcome. This is a seminal study that is likely to be extensively quoted. It is important to highlight some of its limitations and to avoid overinterpretation of the findings.

Guclay Bilen-Rosas, M.D.,* Menelaos Karanikolas, M.D., Alex Evers, M.D., Michael Avidan, M.B.B.Ch. *Washington University Medical School, St. Louis, Missouri. bilenrog@msnotes.wustl.edu

References


In Reply.—I clearly appreciate Dr. Robertson’s Mark Twain reference and his amplification of the limitations of case–control studies. However, I fear that his impressions of the article by Arbous et al. and my editorial are based on isolated statements contained within them. The isolated quotation of statements without appreciation or notation of full context can be misleading. Indeed, my editorial notes that “... a case–control methodology can be used to seek possible but not proven [emphasis added] risk factors.” Further, “... the findings in [the Arbous] study support many plausible assumptions.” Although I am likely biased, my statements do not seem to qualify as lies, much less as damn lies.

Dr. Avram and Krejcie are, as usual, absolutely correct that all statistical associations found using case–control methodology must be practically assessed in context and then subjected to more rigorous scrutiny in prospective studies to ascertain their validity. I thank Dr. Schmidt for supporting these contentions.

Finally, and to be perfectly candid, I do not know how to respond to Dr. Ivester’s comment on aircraft personnel. My editorial had nothing to do with distinctions between types of anesthesia personnel. Therefore, his comment does not seem pertinent to the current issues unless he disagrees with my statement that “... immediate availability of anesthesiologists to help when needed ... should be seriously considered when seeking opportunities to improve the perioperative outcomes of anesthetized patients.” I personally believe that this statement is quite appropriate, important, and relevant to good patient care.

Mark A. Warner, M.D., Mayo Clinic, Rochester, Minnesota. warner.mark@mayo.edu

Table 1. Distribution by American Society of Anesthesiologists Physical Status Classification

<table>
<thead>
<tr>
<th>Group</th>
<th>ASA I or II</th>
<th>ASA III–V</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead (cases)</td>
<td>68</td>
<td>739</td>
<td>807</td>
</tr>
<tr>
<td>Alive (controls)</td>
<td>692</td>
<td>191</td>
<td>883</td>
</tr>
<tr>
<td>Total</td>
<td>760</td>
<td>930</td>
<td>1,690</td>
</tr>
</tbody>
</table>

ASA = American Society of Anesthesiologists.

Anesthesiology 2006; 104:204–5

© 2005 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.
In Reply:—We would like to express our thanks for the critical assessments of our article “Impact of Anesthesia Management Characteristics on Severe Morbidity and Mortality.”1,2 All five letters address the same issue: Can causal associations be addressed in case-control studies, and should controls be fully matched to cases? Observational studies have a record of successful contributions to medicine in establishing causal relations and increasing knowledge on pathogenesis, etiology, prognosis, and diagnosis (smoking and lung cancer, asbestos and mesotheliomas, long-term propofol infusion and cardiac failure).3,4 For a rare outcome such as death after anesthesia, a case-control study is a particularly efficient research design.5-9 Our study, with the extensive collection of information on each anesthetic procedure of cases and controls, was not a fishing expedition, nor did the statistical analysis dredge for associations. It was based on previous knowledge of potential anesthesia management-related determinants of postoperative mortality that had previously been qualitatively addressed but rarely quantified, and on common sense. The risk factors that, in our study, were significantly and independently associated with postoperative mortality and severe morbidity confirm what many anesthesiologists suspect and support our previous knowledge. Like any study, whether observational or interventional, ours only increases the causal probability of previous views and decreases the size of the confidence interval. Consequently, intervention studies will need to confirm what we have found.

The second issue to be addressed is the marked lack of understanding of the principles of the case-control design as expressed in the letters—in particular, the erroneous view that confounding bias is reduced (as completely as possible) by matching of controls to the cases. Three questions should be addressed: (1) Should we have fully matched the controls; (2) can the risk factors in anesthetic management as observed in our study be explained by the fact that the cases were sicker, more frequent emergency cases outside working hours, and so on; and (3) is there evidence for important residual confounding? The answer to all of these questions is no.10-12

Controls in a case-control study should represent those at risk of becoming a case: they provide estimates of the background frequency of an exposure (such as anesthesia management-related factors) in individuals who are free of the outcome. Fortunately, cases and controls are different. There are several factors that cause someone admitted to surgery to become a case or stay a control. What is the consequence of attempts to match as completely as possible? A major part of the thus highly selected group of controls would comprise patients who should belong in a museum for being alive. Importantly, it would not have been possible to correct in the multivariate analysis for the matched factors, and it would be unclear which bias we had introduced of unknown factors by matching on a few known factors.

Two authors (Drs. Robertson and Schmidt) specifically raise the question of whether the difference we found in some anesthetic management factors between cases and controls could be explained by the fact that the cases were sicker, more frequent emergency cases outside working hours, and so on. Indeed, in this study, there should be concern that the condition of the patient (American Society of Anesthesiologists physical status classification) and the characteristics of the procedure (emergency, outside office hours) are potential confounders, because patient and procedure factors do influence anesthesia management and also affect outcome. However, rather than extensive matching, the proper way to address this issue in a case-control study is to measure the potential confounders and correct for them in the analysis. This is what we did. Indeed, introduction of important characteristics of patients and procedures did change the risk estimates related to anesthesia management factors, showing that they are confounders of the relation. There was, however, a limit to the effect and the number of relevant confounders. In our view, therefore, residual confounding was not an important issue in our study.

Apart from anesthesia management, the American Society of Anesthesiologists physical status classification was obviously and not surprisingly the most important determinant of outcome. The number of patients with American Society of Anesthesiologists physical status III-V among the controls was large enough for proper adjustments in the analysis (25%).

In our study, we planned a qualitative analysis and a quantitative analysis. Both have been published, and they convey fundamentally different information rather than a simple duplication of the same findings as suggested by Drs. Avram and Krejcie.13,14 It is interesting to compare both reports because they show marked agreement but also demonstrate that qualitative and quantitative analyses are complementary. The qualitative analysis looked at overall anesthetic management with all available information collected, as judged by a panel of anesthesiologists. In lengthy discussions, an opinion was formed about the extent of contribution of anesthesia to the fatal outcome. However, although on overall impression no major anesthesia management factors were found to have contributed to the death in 692 cases, they were included in the case-control study because they contain important information about anesthetic care (measured by an extended questionnaire and the anesthetic form) and reveal information that is difficult to extract in a qualitative analysis.

We hope to have addressed the letters to the editor to the satisfaction of the authors. We also hope that this response helps to support the important role of case-control methods in risk research to a better understanding of its principles. This is not to neglect the point made by Dr. Warner in the editorial accompanying our findings.15

M. Sesu Arbous, M.D., Ph.D., Anneke E. E. Meursing, M.D., Ph.D., Jack W. van Kleef, M.D., Diederick E. Grobbee, M.D., Ph.D., 1 Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht, and Dutch Association for Anesthesiology, Utrecht, The Netherlands. d.e.grobbee@jcuazu.nl

References


11. Vandenbroucke JP. When are observational studies as credible as randomised trials? Lancet 2004; 363:1728-31

© 2005 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.
Of Mice and Men and Type II Errors

To the Editor.—In response to the hypothesis that prolonged exposure of neonates to anesthetic drugs causes long-term neurocognitive deficits in humans, as it seems to do in mice and rats,1 Soriano et al.2 published a graph of the IQs at ages 4 and 8 yr of children who had undergone surgical repair of congenital heart defects as neonates using a standardized anesthetic regimen including high-dose barbiturates and opiates. Those IQ results were interpreted as showing ‘no significant differences between the study groups and the population norms.’2

The graphical representations of the IQ data are not accurate, but the means and SDs can be obtained from table 5 of Ferranti et al.3 At both 4 and 8 yr of age, the full-scale IQs of children exposed to sustained anesthesia as neonates were statistically significantly lower than population norms (P < 0.0001 and P < 0.02, respectively). The 95% confidence interval at age 4 yr is 90.2–94.9, and the 95% confidence interval at age 8 yr is 94.7–99.5. The 95% confidence interval for age 8 yr includes the risk of an IQ decrement of one third of an SD. The 95% confidence interval at age 4 yr indicates that a one-third SD decrement is highly probable, and it includes the risk of a two-thirds SD decrement.

In Reply.—Dr. Hartung is correct in pointing out that we erroneously stated that there were “no significant differences between the study groups and population norms.”1 The purpose of our letter to the editor was not to disprove the hypothesis that “data obtained in rodents apply to humans.”

We have read that there were “no significant differences between the study groups and population norms.”1 The purpose of our letter to the editor was not to disprove the hypothesis that “data obtained in rodents apply to humans.”

Sulpicio G. Soriano, M.D.,* Paul R. Hickey, M.D. "Children’s Hospital Boston, Boston, Massachusetts. sulpicio.soriano@childrens.harvard.edu

References


(Accepted for publication August 30, 2005.)

Statistical significance notwithstanding, clinical significance is often in the eye of the beholder. In the eye of this beholder, these data do not argue against the hypothesis that the data obtained in rodents apply to humans.

John Hartung, Ph.D., State University of New York, Brooklyn, New York. john.hartung@downstate.edu

References


(Accepted for publication August 30, 2005.)

Sulpicio G. Soriano, M.D.,* Paul R. Hickey, M.D. "Children’s Hospital Boston, Boston, Massachusetts. sulpicio.soriano@childrens.harvard.edu

References


(Accepted for publication August 30, 2005.)
Interscalene Block Superior to General Anesthesia

To the Editor—I read with interest the article by Hadzic et al.1 about the use of interscalene block compared with general anesthesia for outpatient rotator cuff surgery. Although I agree that there are advantages to using nerve block anesthesia for outpatient shoulder surgery, I believe the comparator group receiving general anesthesia in the current Clinical Investigation1 was a recipe for failure. I am not surprised by the 16% hospital admission rate for refractory pain observed in those patients receiving general anesthesia. I would hope with our current understanding of the pathophysiology of acute pain that we as anesthesiologists will offer our patients more effective perioperative analgesic techniques. I was surprised that the current clinical investigation failed to use nonopioid analgesics, including nonsteroidal antiinflammatory drugs, in a multimodal approach to perioperative pain management as outlined by the recent American Society of Anesthesiologists Practice Guidelines for acute pain management in the perioperative setting.2 A more aggressive preventive multimodal pharmacologic approach3 including the use of nonsteroidal antiinflammatory drugs, acetaminophen, intraarticular local anesthetics, opioids, and α2 agonists and postoperative cold therapy may have resulted in a less dramatic benefit compared with interscalene block. Failure to do so may result in inadequate analgesia for our patients, as demonstrated in the current study by Hadzic et al.1

Scott S. Reuben, M.D.
Baystate Medical Center and the Tufts University School of Medicine, Springfield, Massachusetts.
scott.reuben@bhs.org

References

(Accepted for publication August 30, 2005.)

Benefits of Regional Anesthesia over General Anesthesia for Outpatient Rotator Cuff Surgery

To the Editor—I read with interest and am in full agreement with the findings of Hadzic et al.1 regarding the benefits of regional over general anesthesia for outpatient rotator cuff surgery. Patients undergoing shoulder surgery during interscalene block (ISB) anesthesia and intraoperative sedation were able to bypass phase I postanesthesia care unit in greater numbers that patients receiving general anesthesia (GA). In addition, regional anesthesia resulted in fewer unplanned hospital admissions, a faster time to discharge, fewer adverse events (including nausea, vomiting, sore throat), and greater patient satisfaction. None of the patients in the ISB group required treatment for pain before discharge home, whereas 80% of patients in the GA group required pain management despite wound infiltration and intraarticular instillation of local anesthetic by the surgeon.

However, the authors seem to have overlooked a study published by us out of Columbia University Medical Center (formerly Columbia-Presbyterian Medical Center) in which we reviewed 103 consecutive patients who underwent shoulder arthroscopic surgery during either GA or ISB anesthesia with sedation between August 1988 and March 1990.2 Before the primary author’s arrival at Columbia-Presbyterian Medical Center in July 1989, most shoulder surgery was performed during GA. The use of ISB anesthesia was subsequently encouraged, and the benefits were so obvious that within a short time, the suggestion that GA be used for shoulder surgery was met with a great deal of resistance from the surgeons. As with the study of Hadzic et al.,2 we found that the benefits of ISB over GA for shoulder surgery included a shorter hospital stay, fewer unplanned admissions, fewer adverse events, and greater patient satisfaction.2

The comments by Hadzic et al.1 regarding the study by Weber and Jain2 are certainly valid and are supported by similar comments in our study regarding perceived disadvantages of regional anesthesia. With respect to the time factor, regional anesthesia is performed at Columbia University Medical Center in a “block room” before the patient’s entry into the operating room. After completion of the operative procedure, the patient is wide awake, pain free, without GA-associated side effects, and ready to be discharged to the postanesthesia care unit immediately after placement of the surgical dressing, i.e., time is saved when the practice of regional anesthesia is optimized. Weber and Jain2 reported a 13% incidence of failed ISB, and 92% of patients required additional opioid analgesics after ISB. This high percentage of patients requiring postoperative opioid analgesics raises the question as to how successful the ISBs were, because it is most unusual for a patient to require any form of analgesia in the postoperative period after an ISB for shoulder surgery until the effect of the local anesthetic has worn off. Adequate training and experience certainly play a major role in the success as well as the complication rate associated with regional anesthesia.

At Columbia University Medical Center, we would have a great deal of difficulty attempting to perform a study similar to that performed by Hadzic et al.1 because approval by the surgeons to perform shoulder surgery during GA as part of a study would be all but impossible. Hence, the study by Hadzic et al.1 is an extremely welcome reminder of the benefits of regional over general anesthesia for shoulder surgery.


References

(Accepted for publication August 30, 2005.)
In Reply—We thank Dr. Reuben for his comment and agree with him in that a more aggressive preventative approach to multimodal pain management may have affected the outcome of our study. Our study however, was designed before the Practice Guidelines for Acute Pain Management in the Perioperative Setting were published by the American Society of Anesthesiologists Task Force on Acute Pain Management. Regardless, without a trial comparing interscalene block (ISB) versus general anesthesia and incorporating such a multimodal approach in patients having outpatient rotator cuff surgery, any discussion regarding the outcome can be only speculative.

We thank Dr. Brown for his comments and agree with his remarks. We would also like to apologize for failing to cite the report by Dr. Brown et al.; this publication simply did not come up in our literature search.

We thank Drs. Weber, Parise, and Jain for taking an interest in our study. For the sake of completeness, we would like to clarify the terminology used—Drs. Weber, Parise, and Jain repeatedly use the term scalene anesthesia; the proper term is interscalene block. More importantly however, their comments are in sharp contradiction to the available literature including their own data. Drs. Weber, Parise, and Jain say that rotator cuff repair does not require “any extraordinary efforts to manage perioperative pain” and that the 16% admission rate for pain management in our study is unacceptable. In their own report, however, 170 (78%) of 218 patients had rotator cuff repair, of which 92% were admitted and required parenteral narcotics. Both in their publication and in this letter, Drs. Weber, Parise, and Jain repeatedly emphasize the risk of neurologic complications related to ISB and support their concerns by citing a report by Tetzlaff et al. However, as the title of the publication by Tetzlaff et al. indicates, they did not describe a neurologic complication of ISB, but an unusual case of idiopathic brachial plexitis.

We are also not surprised that these authors had difficulty with correlating the cost analysis that we presented in the Discussion section to the description of patient charges in their own article.
To the Editor— I read with interest the prospective audit of routinely measuring cardiac troponin I (cTnI) levels postoperatively in infranalicular aortic surgery by Le Manach et al.1 The authors have proposed a classification of two separate groups of postoperative myocardial infarction (PMI) based on their findings. However, I think that aspects of both the methodology of the study and the presentation of results are open to criticism and that the validity of their distinction between early and delayed PMI is questionable.

It is not clear why the value for cTnI that the authors consider to be abnormal changed in the study and in their participating institution from 0.5 ng/ml from September 1995 to November 1999 to 0.2 ng/ml from November 1999 onward. It seems that the same machine was used for testing cTnI throughout the study period. This parameter is the basis of the definitions of both myocardial damage and delayed PMI and also the proposed difference between the early and delayed PMI groups and is clearly a key issue. Regardless of whether the institution changed its normal values for cTnI, it would seem that the most appropriate methodology would be to analyze the whole population by the same rules. It would be of interest whether the endpoints would differ from that reported if all patients were reanalyzed at 0.2 ng/ml and at 0.5 ng/ml.

The abstract states that the cTnI profiles between the delayed PMI group before the cTnI threshold for PMI was reached and the myocardial damage group were identical. In the main part of the Results, it is only written that the profiles are comparable. Even so, the only evidence presented for this is a graph of two “representative” patients. To describe the two profiles mentioned as identical would require descriptive statistics of cTnI values to be presented against time for each of the different groups, with a mathematical analysis of their difference. I also note that there was not even a “representative” example described of the other two groups.

The timing of the 24-h cutoff for the difference between early and delayed PMI was predetermined and arbitrary. The authors state that in the early PMI group, PMI was not preceded by subinfarction myocardial damage, but did any of the early PMI group patients have abnormal cTnI for 18 rather than 24 h? If so, how do we know that this was not significant myocardial damage? It would seem to be a more robust choice of timing if at first the pattern within the population was examined and then the most appropriate cutoff was chosen.

The authors note that only the early PMI group had an increased incidence of previous myocardial infarction and hint that this supports their hypothesis of different etiology in the two PMI groups. I note that 57 comparisons are made in table 2. Because the P values are only described as less than 0.05 and not specified, it is hard to know how significant their four P values of less than 0.05 in table 2 really are when you would expect almost three to occur just by statistical probability. Defining two groups on their differing temporal characteristics, proving statistical difference in a clearly related temporal parameter in the absence of any other differences in nonrelated parameters, and then inferring that the two groups are fundamentally different is a weak argument.

The opinion that the time when the cTnI is abnormal but not
In Reply:—We thank Dr. Bould for his interest in our article.1 Our definition of myocardial infarction was based on the normal values in our specific laboratory.2 The threshold for abnormal cardiac troponin I (cTnI) was modified by the laboratory of our hospital, which, after an improved accuracy of the dosage technique of cTnI, considered as abnormal a value above the serum 99th percentile of the normal population.3 Because the normal value in our laboratory changed, so did the definition of myocardial necrosis. This is in complete agreement with the definition of myocardial infarction in the literature, which clearly considers cTnI plasma level as the accepted standard to evidence postoperative myocardial infarction. The description of the natural history of cTnI changes would seem to be more useful if we knew whether the ischemia was silent or associated with evidence that would have resulted in appropriate therapy anyway. I would like to know whether the myocardial damage group or the patients with abnormal cTnI before PMI had chest pain, dyspnea, heart failure, arrhythmias, or other electrocardiographic changes suggestive of ischemia.

In conclusion, the authors have not shown a bimodal distribution that would justify the classification of PMI as early and delayed, nor have they conclusively shown a fundamental difference between rapid-onset and delayed-onset PMI groups on the evidence as presented. Moreover, I think the suggestion that early PMI is “hitherto unrecognized in the postoperative setting” is unfounded.

M. Dylan Bould, M.B., Ch.B., M.R.C.P., F.R.C.A., Royal Brompton Hospital, London, United Kingdom. dylanbould@yahoo.co.uk

Reference


(Accepted for publication October 12, 2005.)

In conclusion, the authors have not shown a bimodal distribution that would justify the classification of PMI as early and delayed, nor have they conclusively shown a fundamental difference between rapid-onset and delayed-onset PMI groups on the evidence as presented. Moreover, I think the suggestion that early PMI is “hitherto unrecognized in the postoperative setting” is unfounded.

M. Dylan Bould, M.B., Ch.B., M.R.C.P., F.R.C.A., Royal Brompton Hospital, London, United Kingdom. dylanbould@yahoo.co.uk

Reference


(Accepted for publication October 12, 2005.)
Is Xenon Really Neuroprotective after Cardiac Arrest?

To the Editor—Xenon has recently been shown to act as a neuroprotective agent in several in vitro and in vivo models of acute neuronal injury, probably inhibiting the N-methyl-D-aspartate receptor.1,2 In the May issue of ANESTHESIOLOGY, Schmidt et al.3 provided pioneering data on the effects of xenon on porcine brains assessed by hemodynamic, electrophysiologic, and metabolic measurements in a large animal model of cardiac arrest and subsequent cardiopulmonary resuscitation. Using a microdialysis technique, they documented that levels of glycerol, an integral part of the cell membrane, are significantly lower after 90 min of reperfusion in pigs that received xenon anesthesia before cardiac arrest was induced when compared with a control group that was anesthetized with a total intravenous regimen. No other parameter, including glutamate, lactate, lactate/pyruvate ratio, brain tissue partial pressure of oxygen, and intracranial pressure, showed significant differences between the groups.

In the Western hemisphere, approximately 800,000 people annually experience sudden cardiac death.1,5 Although survival rates are increasing, complete neurologic recovery is often far from certain, and by the time of hospital discharge, every second patient is neurologically severely disabled or comatose.6 Accordingly, there is urgent need to find strategies that ameliorate neuronal injury.

In this respect, the study by Schmidt et al.3 is of high clinical relevance. However, we believe that some major limitations in the study design and the interpretation of the results are not adequately discussed.

First, a major drawback of this study that detracts from its clinical significance is that the authors elected to use an extremely short duration of cardiac arrest that results in only minor brain damage, if at all.7 It is therefore not surprising that the authors failed to establish differences in extracellular glutamate values. In contrast, the evidence for glycerol as a surrogate for neuronal damage is weak because glycerol is a naturally occurring three-carbon alcohol that is ubiquitously present in considerable amounts in the human body and an integral part of the energy metabolism.8 Glycerol readily moves across the blood-brain barrier, and therefore, increases in dialysis fluid are not exclusively indicative of nerve cell damage but might reflect overall metabolic changes or changes due to exogenous sources.9,10 Second, animals received xenon before cardiac arrest was induced. In the overwhelming majority of cases, however, cardiac arrest occurs suddenly and unexpectedly. A possible indication for xenon pretreatment might be procedures that require short periods of circulatory standstill, such as insertion of implantable cardioverters/defibrillators, which is known to be associated with neurocognitive sequelae.11 Third, the authors should consider the possibility that the anesthetic regimen might have biased the results because they used an opioid for pain relief, which reportedly exerts neuroprotective properties.12 Finally, definitive parameters of neurologic injury, i.e., measurements of serum markers of nervous tissue damage and neurohistopathologic examinations of vulnerable brain regions, would have been of major benefit to the study. In conclusion, the authors did not demonstrate that xenon is really neuroprotective in the setting of global ischemia and reperfusion, and accordingly, we believe that the title of the article, “Xenon Attenuates Cerebral Damage after Ischemia in Pigs,” overstates the data presented. Notwithstanding these important limitations, we acknowledge and appreciate that the authors have applied xenon for the first time in this clinically highly relevant model, and we hope that the article will stimulate further research in this area.

Michael Fries, M.D., Joachim Weis, M.D., Ph.D., Rolf Rossaint, M.D., Ph.D. University Hospital RWTH Aachen, Aachen, Germany. m.fries@ukaachen.de

References


(accepted for publication October 12, 2005.)

In Reply—The study presented in “Xenon Attenuates Cerebral Damage after Ischemia in Pigs”1 was designed and performed in our Department of Cardiac Anesthesia (Ulm, Germany). After cardiac bypass surgery, neurologic complications are well known to be a major problem leading to prolonged intensive care unit stay and additional costs.2 With this investigation, we aimed to simulate a situation of expected transient cessation of cerebral perfusion with a definitive offset and onset. In this clinically relevant situation, the depletion of central nervous system’s energy stores occurs within 2–4 min of anoxia, leading to cellular damage and possible consecutive irreversible cell death. As described, this expected situation might be relevant, e.g., in temporary clipping in cerebral aneurysm, aortic arch surgery, or carotid surgery.

In preliminary studies, we observed that the percentage of animals with return of spontaneous circulation after cardiac fibrillation times exceeding the period as applied in our study significantly decreased.
To the Editor—Damage to the teeth can occur during general anesthesia and is a common cause of claims against anesthesiologists. A detailed knowledge of the preanesthesia dental status provides a reliable way to distinguish valid from fraudulent (and often expensive) claims of injury. Here we present a simple system for performing and documenting a dental examination.

In North America, the standard convention for numbering teeth starts with No. 1 as the right upper wisdom tooth, proceeds around the maxillary arch to No. 16, drops to the wisdom tooth immediately below (No. 17), and thence proceeds around the mandibular arch to the lower right wisdom tooth (No. 32). The numbers are assigned to specific teeth, so a missing tooth is counted even though it is not there.

The anterior teeth are of most interest to an anesthesiologist because these are most likely to be damaged during intubation, or if a partially anesthetized patient should bite down hard on a rigid airway. A simplified charting system for these teeth is shown in figure 1. The right upper canine (No. 6) is easy to identify. It and the left upper canine (No. 11) bracket two central incisors, Nos. 8 and 9 (the “Bugs

We agree with Fries et al. and regard it to be an advantage if additional diagnostic tools are used to contribute to the explanation of central nervous system damage assessment. Being a noninvasive tool and therefore possibly an option for human studies as well, magnetic resonance imaging scans were added to this experimental setting. We performed magnetic resonance imaging scans 4 h after return of spontaneous circulation and calculated the apparent diffusion coefficients, being used as a method to assess the water content of the central nervous system as a parameter for tissue damage. Interpretation of technical and anatomical aspects regarding the achieved data was difficult because, to our knowledge, there have been no comparable data published about German Landrace pigs until the present. Preliminary technical data from this study were published recently.

Regarding neuroprotective effects of xenon after global ischemia, we found a significant benefit for the xenon-treated group versus the total intravenous anesthesia group in apparent diffusion coefficients results. The combination of magnetic resonance imaging findings and cerebral microdialysis results are regarded to be valuable to demonstrate the neuroprotective effect of xenon more clearly.

Michael Schmidt, M.D., P.D., Helmut Reinelt, M.D., P.D., Thomas Marx, M.D., P.D. *University of Ulm, Ulm, Germany. michael.schmidt@medizin.uni-ulm.de

References


(Accepted for publication October 12, 2005.)

A Simple Preanesthesia Dental Examination

Anesthesiology 2006; 104:212–3 © 2005 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.
To the Editor.—We recently reported fatal aortic thrombosis in an adult undergoing repair of a thoracoabdominal aneurysm using cardiopulmonary bypass (CPB) and deep hypothermic circulatory arrest in the setting of aprotinin and adequate heparinization.1 We report a second case of fatal thrombosis after mitral valve replacement for endocarditis in the setting of aprotinin and disseminated intravascular coagulation.

A 69-year-old woman presented with fatigue and right-sided weakness. She had a history of breast carcinoma treated with mastectomy and high-dose chemotherapy. She was taking tamoxifen. Her physical examination was positive for purpura, right hemiplegia, and an apical holosystolic murmur with radiation to the axilla. She had no peripheral stigmata of endocarditis. Brain imaging showed multiple embolic cerebral infarcts. A transthoracic echocardiogram revealed multiple, large mitral vegetations and severe mitral regurgitation. Her laboratory studies revealed thrombocytopenia, hypofibrinogenemia, and disseminated intravascular coagulation. Blood cultures were sent, and empiric antibiotic therapy was commenced. After consultation with a hematologist, the patient was given cryoprecipitate. The patient was subsequently referred for mitral valve surgery.

The patient underwent general endotracheal anesthesia. Anesthetic monitoring consisted of standard monitors (as per the American Society of Anesthesiologists), a radial arterial line, an oximetric pulmonary arterial catheter, and transesophageal echocardiography. The patient was given aprotinin (Bayer Corporation, Pittsburgh, PA) as follows: 2 million kallikrein inhibitory units intravenously as a load, followed by a crystalloid prime also loaded with aprotinin (2 million kallikrein inhibitory units). The aprotinin was commenced just after induction of general anesthesia. Heparinization was with bolus bovine heparin to maintain the kaolin activated clotting time greater than 400 s. The patient underwent uncomplicated bioprosthetic mitral valve replacement on hypothermic CPB.

Separation from CPB was uneventful. After protamine administration, there was still significant microvascular bleeding. This was treated with titrated administration of cryoprecipitate and platelets. Approximately 30 min after the commencement of this transfusion, there was sudden cardiogenic shock that required emergent CPB after reperfusion. During this time, transesophageal echocardiography demonstrated thrombus in the left atrium and descending aorta. Left atriotomy revealed significant thrombus on the mitral prosthetic valve as well. Separation from CPB thereafter was impossible because of refractory biventricular failure. Further resuscitative efforts were stopped.

To our knowledge, this is the first reported case of fatal thrombosis after mitral valve surgery for endocarditis in the setting of aprotinin and disseminated intravascular coagulation. Aprotinin reduces transfusion burden in valve surgery for endocarditis and is possibly beneficial in disseminated intravascular coagulation.2,3 Aprotinin has been associated with thrombosis after valve surgery for endocarditis despite adequate heparinization but in the setting of congenital afibrinogenemia.4 This recently reported case occurred in a young adult with multiple perioperative thrombotic events. There was cardiogenic collapse after separation from CPB due to coronary thrombosis. The patient survived after a prolonged hospital stay. The accompanying expert commentaries comprehensively discuss the role of aprotinin in this scenario, including disseminated intravascular coagulation and endocarditis. The reader is referred to these commentaries for further details.

Clearly, in our case, there was a complex interaction of procoagulant and anticoagulant influences that ultimately resulted in a net fatal thrombotic result. It is not possible on the basis of one case to delineate the exact role of aprotinin in this complex pathophysiology. This case demonstrates, however, that fatal thrombosis is possible in association with aprotinin in the setting of cardiac surgery for endocarditis and acquired hypofibrinogenemia. Further research is required to understand and prevent this uncommon but important perioperative complication.

John G. Augoustides, M.D.,* Todd Kilbaugh, M.D., Hilary Harris, B.A., John H. Glick, M.D., Michael Acker, M.D., Joseph S. Savino, M.D. *Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania. yiandoc@hotmail.com

References


(Accepted for publication September 12, 2005.)

Support was provided solely from institutional and/or departmental sources.

Anesthesiology 2006; 104:213

© 2005 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.