John G. Brock-Utne

Clinical Anesthesia

Near Misses and Lessons Learned

Second Edition

Springer

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To the next generation:

Matthew B. Brock-Utne
Tobias J. Brock-Utne
Anders C. Brock-Utne
Jasper L. Brock-Utne
Stefan S. Brock-Utne
Charlotte E. Brock-Utne

Foreword

Training of anesthesiologists has changed dramatically during my 20+ years in academics. More and different clinical rotations have become required for residents, often at the expense of time spent in the relatively "mundane" environment of the operating room. But the operating room and similar sites are where most anesthesiologists will practice their specialty. With less time for training, how can anyone possibly learn how to respond to every unusual, rare, and occasionally life-threatening anesthetic emergency that can arise during routine clinical care? Simulation labs have been a wonderful addition, but often it is little tricks combined with outside of the box thinking, that is, the fine polish needed to become a true consultant in anesthesiology.

In the newest edition of *Clinical Anesthesia: Near Misses and Lessons Learned*, Dr. John Brock-Utne presents multiple examples of real, unique, and unanticipated clinical scenarios, where his quick thinking and years of experience prevented near catastrophe. Each chapter is a single case, with a description of the background and the problem encountered. More importantly, Dr. Brock-Utne presents the solution to the problem (often quite simple and elegant), a summary of the lessons learned, and references. Like telling stories around a campfire, Stanford attendings and residents alike have always enjoyed listening to Dr. Brock-Utne tell his "war stories." While reading this book, I could almost hear his voice. Now, a new and larger audience can profit from his knowledge and expertise, like many of us have benefited over the years at Stanford University. The only question I have is how does he always seem to be in the middle of such craziness? Better him than me, because he always knows how to get out of a jam and I have learned much from him over the years. Enjoy.

Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University, Stanford, CA, USA

Timothy Angelotti

Preface to the Second Edition

Dear reader,

Some of you may have read the first edition of *Clinical Anesthesia: Near Misses and Lessons Learned* published by Springer in 2008. Unfortunately the layout of the first edition had the clinical problem and the solution on the *same* page. This was obviously not ideal.

Hence, I was delighted when Rebekah Collins, senior medical editor at Springer, suggested a new edition in which they would correct the layout of the book, i.e., have the problem on one page and the solution with a discussion of the problem on a separate page. This layout had been successfully used in the following three books that I have written, namely, the first edition (1999) and second edition (2013) of *Near Misses in Pediatric Anesthesia* and first edition (2011) of *Case Studies in Near Misses in Clinical Anesthesia.*

The first edition of *Clinical Anesthesia: Near Misses and Lessons Learned* had 62 cases. In this second edition, those 62 cases have been modernized with updated references. Forty-one new cases have been added totaling 103 cases. I sincerely hope you will enjoy mulling over these clinical anesthesia problems as much as I have enjoyed writing them.

At times the solutions would seem simplistic to some readers. This will of course depend on their level of training or experience. For this I do apologize. However, the suggested management of the cases may be controversial, for this I do not apologize. My sincere hope is that these cases may form the bases for a teaching discussion between faculty member and medical students and resident/fellows in training in anesthesiology and critical care.

To paraphrase Hippocrates:

The art is long,
Life is short;
Experiment perilous,
Decisions difficult.

After 47 years in clinical anesthesia, I honestly can say that Hippocrates was right.

Stanford, CA, USA — John G. Brock-Utne

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Tim Angellotti (associate professor of anesthesiology) at Stanford for kindly agreeing to write a foreword for this book.

Last, but not least, my wife, Sue, our three boys, their wives, and our five grandsons and one granddaughter.

Contents

Case 1: No Fiber-Optic Intubation System: A Potential Problem

You are to anesthetize a 19-year-old Indian woman (42 Kg) who is otherwise healthy but is coming for a removal of a large keloid scar (7 cm × 8 cm) on the front of her neck. This was caused 2 years before by hydrochloric acid (HCl) when she tried to drink it in an attempt to commit suicide. Someone prevented her from doing so, but during the tussle that ensued, the large cup of HCl spilt down the front of her neck causing a severe third-degree burn. She survived but is now left with a large keloid scar that has pulled her chin to nearly touch the sternum, and she can only open her mouth slightly (0.5 cm between the top and bottom teeth). You see this young woman in the preoperative area and decide that an awake nasal or oral fiber-optic intubation is needed. Unfortunately, there is no scope available, and the surgeon tells you that if we do not do it today, the young woman will not come back. You decide to proceed and take her back to the operating room after an IV is started and 1 mg of midazolam. After routine monitors are placed, you attempt an inhalation induction with sevoflurane to be followed by a blind oral or nasal endotracheal intubation. Unfortunately, you lose her airway during the induction and she stops breathing. The saturation falls to 82%. You turn the sevoflurane off and attempt to ventilate with 100% oxygen but with great difficulty. With the sevoflurane off, she slowly commences to breathe again and her saturation improves. Your attempt at an awake nasal intubation also fails. There is no other airway equipment available, for example, a Trachlight (Laerdal Medical A/S, Stavanger, Norway). You suggest to the surgeon that he does a tracheostomy under local anesthesia. The surgeon says that will be impossible as there are no landmarks, and it is very difficult to anesthetize the keloid scar with local anesthesia. But more important is the fact that the tracheostomy will be in the surgical site, and therefore it is not an option. You attempt to place the smallest pediatric LMA that you can find. Unfortunately, even that LMA is too big. In desperation you now try to pass a pediatric gum elastic bougie blindly into her trachea both through the mouth and nose. This also fails. Understandably she is now getting very upset and agitated. The surgeon looks at you and wonders if there is anything else that can be done to secure the airway without doing a tracheostomy. What will you suggest?

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Solution

Many years ago (1973) in King Edward 8 Hospital, Durban, South Africa, Dr. Derek Ardendorf a plastic surgeon and I were confronted with this problem. An inhalational induction failed, and Dr. Ardendorf chose not to do an elective tracheostomy for the reasons mentioned. So what did we do? I gave the patient the following drugs intravenously: diazepam 5 mg followed by atropine 0.6 mg and ketamine 2 mg/Kg. With the patient asleep but breathing, the surgeon cut away at the keloid making it possible for me to extend her neck and open her mouth. When I could get the laryngoscope in the mouth and saw the epiglottis, I gave succinylcholine 40 mg and secured the airway. Hemostasis was then achieved and the surgery was completed successfully. I kept an eye on future development and she did very well. The last time I heard from her, she had gotten married.

Discussion

To put this problem more in perspective: in those days this case was done without oximetry, capnography, and automated noninvasive blood pressure machine. However, we had ECG machines in most rooms. Furthermore, there were no pediatric gum elastic bougies or LMAs. The LMA was introduced into the United States in about 1990.

Lesson

In difficult cases like these, it is imperative that you and the surgeon agree on a plan and preferably have plans B and C. Furthermore, you must have confidence in your colleague's ability as well as your own.

Case 2: Is the Patient Extubated?

An otherwise healthy 48-year-old man is being ventilated in the ICU following major abdominal surgery. You are called urgently because the ICU nurse informs you that she can hear air escaping from the patient's mouth. She is concerned that the patient may have become extubated. His vital signs are HR 90, BP 140/90, and oxygen saturation 96% on FiO_2 of 100%. You arrive and find him somewhat sedated but agitated. You talk to him but he does not answer back despite trying to do so. The nurse tells you that the patient was previously saturating at 92–94% on 40% FiO_2. The ventilator is alarming. The endotracheal tube (ETT) (#8) is taped at 22 cm. A universal bite block (B&B Medical Technologies, Vista, CA 92083) is seen in his mouth (Fig. 1). The bite block consists of a 5-cm-long hollow plastic tube that has a 0.5-cm-long longitudinal opening. This opening stretches from top to bottom going through the whole length of the bite block. An anchoring device (a plastic strap) is available on the bite block so as to attach it to the ETT. An audible leak is heard. You detach him from the ventilator, and with an Ambu bag, you confirm that he has got bilateral air entry although they are distant. Air/bubbles can be heard/seen coming from his mouth. You decide to blow up the ETT cuff, as there must be a leak due to lack of air in the ETT cuff. However, the cuff on the pilot tubing is already blown up and feels very tight. You push some more air into the pilot tubing. No improvement is seen and you can still hear a leak at the mouth. The ventilator continues to alarm.

What will you do and what is the cause of your dilemma?

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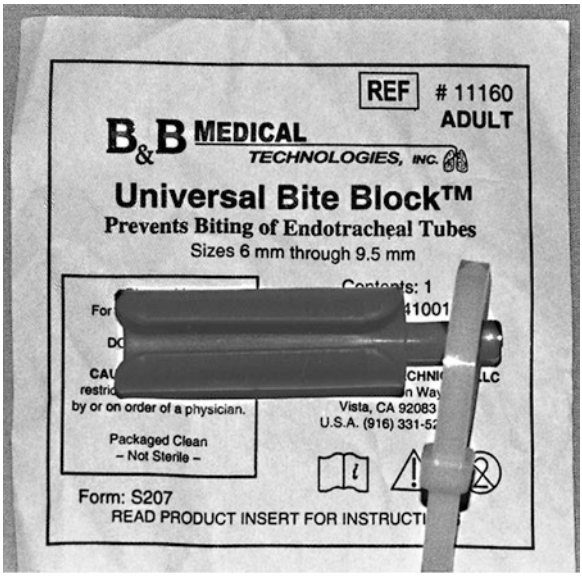

Fig. 1 Universal bite block

Solution

Since you believe there must be something wrong with the cuff and/or pilot tubing, you exchange the existing ETT with a new ETT using a gum elastic bougie [1]. The cuff on the new ETT is blown up and no more leaks are heard. The patient is sedated and the ventilator now works without alarming. You look at the ETT and the bite block that have been removed in one piece (i.e., they are both anchored together with the plastic strap). You see the cause of the problem. The bite block had migrated down the ETT and clamped off the pilot tubing completely (Fig. 2). If one had discovered the problem, one could have moved the bite block up the ETT, thereby releasing the obstruction in the pilot tubing (Fig. 3).

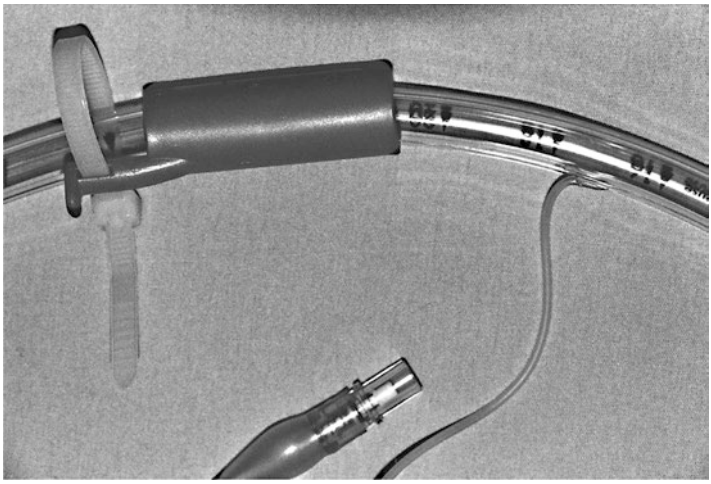

Fig. 2 Bite block seen on ETT

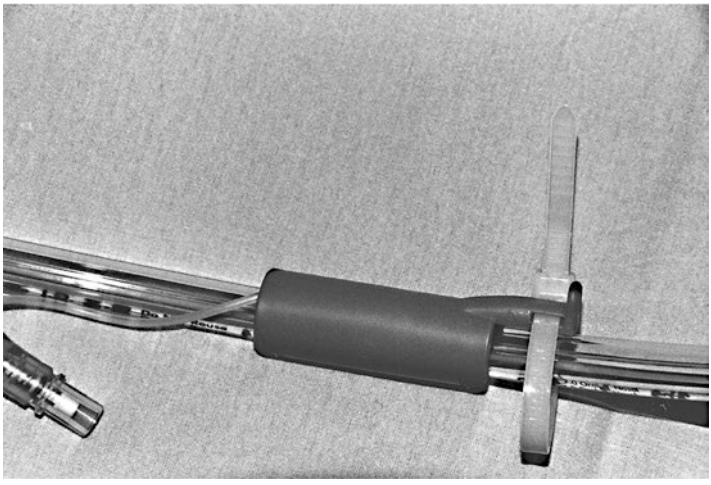

Fig. 3 Bite block shown to clamp off pilot tubing

Discussion

This case is similar to a previously described case [2]. When faced with obstructed pilot tubing, that causes a leak due to the inability to fill the ETT cuff with air, the correct thing to do is to relieve the obstruction if possible. If that cannot be done, then one is forced to replace the ETT. Replacing the ETT may also be considered the safest thing to do, as the original pilot tubing may generate a leak anytime after the obstruction is relieved.

Lesson

Beware of bite blocks as they can cause problems.

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Case 3: A Strange Computerized ECG Interpretation

A 38-year-old man is scheduled for vasectomy reversal. He is healthy except for a history of several anxiety attacks, after a death of his youngest child, 6 months before this procedure. His symptoms included shortness of breath, palpitations, and dizziness. He denies any history of cardiac or neurological disease, syncope, exercise-induced chest symptoms, and any family risk factors for coronary artery disease. He states he is fit and his wife concurred that he exercises regularly. Since the patient was deemed healthy and not scheduled for major surgery, he was not evaluated in the Anesthesia Preoperative Assessment Clinic prior to surgery.

On the day of surgery, a full history and examination is done. The history was as above with one general anesthetic for sterilization which had been uneventful. On examination nothing abnormal was detected. His initial blood pressure was 133/73 mm Hg, and the heart rate was 73 sinus rhythms by palpation. Since the patient is concerned that his anxiety symptoms might actually represent a cardiac disorder and no previous ECG had been done, an ECG is ordered. With the patient lying flat, a 20 G intravenous catheter is inserted in the back of his right hand. The ECG is done at the same time. The ECG is shown below (Fig. 1). The patient is awake and cooperative but feels a bit anxious. His blood pressure is 80/50 mm Hg and heart rate deemed to be regular at 36 beats per min.

With the above information and now the result of the computerized ECG, what would you do? Will you proceed or will you cancel the case for further workup by cardiologist? What will you tell the patient about his ECG?

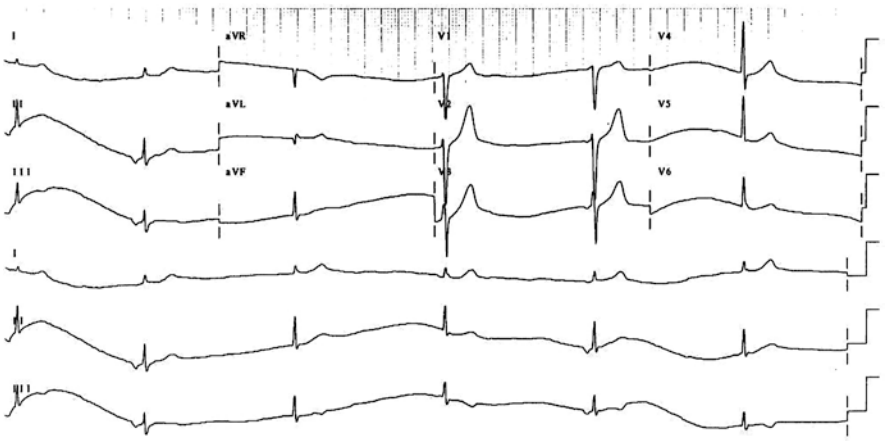

Fig. 1 Abnormal ECG prior to general anesthesia (see text) atrial fibrillation, ventricular rate 35, borderline ST elevation

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Solution

A diagnosis of vaso-vagal reaction was made and the patient was treated with atropine 0.5 mg IV. An ECG repeated 5 min later shows sinus rhythm at a rate of 51 bpm (Fig. 2). The patient was evaluated as stable, and he was reassured that this second ECG was normal. He was told that the reason for the repeat ECG was that he had had a fainting episode while the IV was being placed. The faint had caused his heart to slow down and give an abnormal ECG tracing. He underwent an uneventful general anesthetic, and two subsequent ECGs done in the postanesthesia care unit at 2 and 4 h after the initial abnormal tracing showed sinus rhythm with a normal heart rate and a borderline left axis deviation. His PACU and post-discharge course was uneventful.

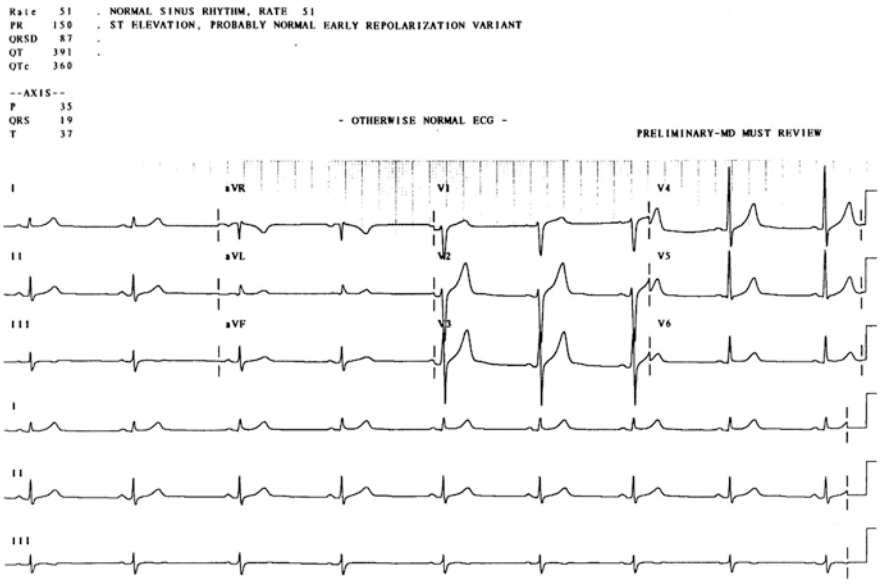

Fig. 2 Normal ECG after vaso-vagal reaction and treatment with atropine 0.5 mg IV

Discussion

A similar case has been reported previously [1]. Computerized ECG programs have been used in clinical practice for nearly 20 years. Surprisingly, there is little published date analyzing their accuracy and effect on clinical practice. A study by Jakobsson et al. [2] showed that 82% of computer interpretations were judged to be adequate, versus 64% of the physician's interpretations. Spodnick [3] found that computer interpretations of ECG's recorded 1 min apart were significantly and grossly different in 36 of 92 (39%) unselected pairs of tracings. Of interest here is that atrial fibrillation

was the computer interpretation in 11 of the 36 pairs for one tracing, but a totally different rhythm was diagnosed in the second identical tracing. Our case presents several limitations of computer ECG interpretation. Firstly, the machine incorrectly diagnosed atrial fibrillation, while in fact Fig. 1 shows two abnormal rhythms present. Broad inverted P waves are seen in two complexes in the rhythm strip from leads II and III (at the bottom of Fig. 1), suggesting an ectopic atrial focus. P waves generated by the sinus node should be upright in all leads except V 1, where they may be biphasic [4]. Figure 2 shows the return of normal P-wave morphology, in which the P waves are upright in all leads. In the remainder of the complexes seen in the rhythm strips from leads II and III (Fig. 1), no P waves are present, which is consistent with junctional rhythm. In essence the computer program misinterpreted the variable rate (due to the alternating presence of two "escape" rhythms) and the absence of P waves in a majority of the complexes as atrial fibrillation.

Should this patient have had an ECG preoperatively a few days prior to surgery? Roizen recommends not obtaining ECG's in asymptomatic men under the age of 40 years [5]. This is based on the very low incidence of significant abnormalities detected on the preoperative ECG in men under the age of 40 who are asymptomatic and who have had a thorough preoperative evaluation [6]. At Stanford, healthy asymptomatic men under the age of 50 do not undergo routine preoperative ECG testing in the Anesthesia Preoperative Assessment Clinic [7]. In retrospect, if a preoperative NORMAL ECG had been found, one would not have ordered a repeat preoperative ECG on the day of surgery. As it was, the abnormal ECG, obtained on the day of surgery, did little to reassure him that he was not suffering from some potentially significant cardiac disease. In this case, the computer interpretation was significantly in error and, if not reviewed, could have led to an unnecessary surgical cancellation with possible hospitalization and added stress to the patient. It is important to realize that ECG programs do not consider other pertinent clinical data, like with this relatively fit, young, anxious man with no history of heart disease and who is having an IV started while the ECG tracing was obtained. Atrial fibrillation, with a very slow ventricular response rate, might be expected in a patient with chronic atrial fibrillation and a very high serum digoxin level or with serious underlying conduction disease.

Lesson

A computerized ECG result must always be reviewed by the physician and interpreted in light of clinical data.

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Case 4: An Elderly Lady with a Fractured Neck of the Femur

An 83-year-old lady (70 kg, 5'5" tall) is admitted to the emergency room after a fall in her nursing home. She has a fractured neck of the femur, but otherwise no trauma. In addition, she has many medical problems, including coronary artery disease, hypertension, and chronic obstructive lung disease. On examination she is cooperative, orientated for time and place. She has mild to moderate bilateral ankle and sacral edema, HR 100 atrial fibrillation, and BP 170/100. The EKG shows an old MI with left axis deviation. Room oxygen saturation is 91%. Her chest is clear except for crepitations at the bases and increased respiratory wheeze. She is orientated for time and place and requests a spinal anesthetic as she is worried about going to sleep. You are happy to oblige and explain that she must either sit up or lie on her side for you to do the spinal. She absolutely refuses to sit up or lie on her side claiming this will be very painful. She has received 10 mg of morphine in the emergency room. You attempt to sit her up but she complains of severe pain. You give her midazolam 0.5 mg and fentanyl 50 micrograms slowly. A little later she says she is feeling better. However, her oxygen saturation has now fallen to 87 % on room air. Supplemental oxygen improves to 93%. When you attempt to sit her up again, she refuses point blank. You consider giving her a small dose usage of ketamine so that you can place the spinal in a lateral position. However, ketamine can produce unacceptable increase in BP, and the prior use of atropine to prevent excessive salivation can produce an unwanted increase in heart rate.

What else could you do to make her pain-free, so that you can perform the spinal block?

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Solution

A femoral nerve block.

Discussion

This is a relative easy block to perform, if you do it frequently. I normally do this block as soon as the patient has agreed to a spinal anesthetic for a fractured neck of the femur, preferably in the preoperative holding area. By the time the patient arrives in the OR, the block is working. As to the anatomy: the vein, artery, and nerve lie from medial to lateral. The femoral nerves lie behind and lateral to the vascular sheath and, unlike the vessels, are not within it. All three are deep to the fascia lata, but unfortunately the exact position of the femoral nerve in relation to the artery is inconstant. It may be close to the sheath or several centimeters lateral to it. Remember also that it is usually more deeply placed. These factors often make the blocking of the nerve more difficult than anticipated. When the sciatic and femoral nerve blocks are combined, the femoral nerve block is the one that most often fails [1]. However, the advent of the nerve stimulator does make this block easier. When successful, it provides analgesia for the upper part of the femoral shaft, including the neck. The technique consists of drawing a line between the anterior superior iliac spine and the public tubercle [2–4]. This line marks the inguinal ligament. The needle should be inserted just below the ligament and 1cm lateral to the artery. You may feel a "click" as the needle passes through the fascia lata. If this occurs, you should be ascertaining paresthesia or a nerve twitch with the stimulator. If you are 3–4 cm deep in an average-sized person, you are too deep. Start again either laterally or medially. I deposit 15–20 ml of lidocaine 1–1.5% and find this in most cases to be very satisfactorily. If you do not find the nerve, then inject it in a fanwise fashion, from the artery to a point 3 cm laterally to it.

Lesson

In these cases, a successful femoral nerve block can be invaluable, and your patients will thank you.

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Case 5: A Spinal Anesthetic that Wears Off Before Surgery Ends – What to Do?

A 68-year-old woman, previously healthy, is scheduled for a large inguinal hernia repair. She has a class 3 Mallampati score and weighs 230 lbs and is 5 feet 5 inches. She tells you that a previous general anesthetic, not long ago, was complicated by great difficulty in securing the airway with an endotracheal tube. She was advised to tell any future anesthesiologist about this potential problem. She is nervous about a general anesthetic and requests a spinal anesthetic. You place an uneventful spinal at L3-4 with 1.4 ml bupivacaine 0.5%. The spinal works well and the legs are placed in lithotomy position and the surgery begins. Operative problems, mainly with lack of proper equipment, are encountered, and the procedure that should have taken 30 min. is now 2 h and still ongoing. The patient begins to complain of pain. You give some sedation with midazolam up to 2 mg and fentanyl up to 75 mg, while the surgeon injects into the surgical site and around with 50 ml of lidocaine 1%. Neither has much effect, as the patient still complains of pain and looks irritated by the whole proceedings. You consider an awake fiber-optic intubation, followed by a general anesthetic. Unfortunately, you are now told that all fiber-optic intubation equipments are being serviced and would not be back before tomorrow. You dismiss the idea of more sedation and inducing general anesthesia via a face mask as being potentially too dangerous. The surgeon, who is a friend of yours and usually very reliable with his estimated surgical time, tells you that he will be only 10–15 min. You believe him, but what are you to do?

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Solution

You ask the patient to take 30 ml of oral Bicitra (an antacid) which she does. Metoclopramide 10 mg IV is also given prior to giving atropine 05 mg [1] and IV ketamine 1–2 mg/kg. In these cases ketamine can be a real winner, as respiration is not depressed except in large doses [2]. An adequate surgical anesthesia is established and the surgeon completes his case. Both he and the patient are very grateful.

Discussion

The prevention of aspiration cannot be guaranteed with the use of ketamine, without safeguarding the airway. Where there is a risk of aspiration, an oral antacid and IV metoclopramide should be considered. Both drugs also increase the lower esophageal tone, and the oral antacid acts via increasing the pH of the stomach [3, 4]. A related compound to ketamine is phencyclidine, which was used in anesthesia but withdrawn because of the high incidence of hallucination [5]. It is however still used in animals. An intravenous dose of 2 mg/kg of ketamine will produce anesthesia in 30 s and last for 5–10 min. An intramuscular dose of 10 mg/kg results in anesthesia in 3–4 min, lasting 10–20 min. Remember that you must always use a drug like benzodiazepines and/or droperidol prior to ketamine, in order to reduce the incidence of emergence sequelae [6]. These include postoperative disorientation, confusion, and irrational behavior. Auditory and visual hallucinations are common. Visual hallucinations with terrifying dreams are, in the author's opinion, much more common than auditory problems. When ketamine was first introduced in 1965 by Domino et al. [7], this was a real problem until a remedy suggested by Dundee et al. [8] using an opiate-hyoscine premedication decreased the incidence. However, small amounts of benzodiazepines are more effective. Excess salivation with the use of ketamine can also be a problem, and glycopyrrolate or atropine may be required.

Lesson

Remember ketamine [9] in these cases, as it can be a real "lifesaver." As an aside the drug is also now being used to treat depression [10].

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