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Perioperative Medicine: An expanding topic to be taught to medical students

Abstract: A future physician must no longer view the Anaesthetist as only the figure at the head of the operating theatre table, but rather as a physician involved in the care of the surgical patient through the preoperative, intraoperative, and the postoperative periods.

Methods: These concepts rather than the pharmacology are vital for all physicians regardless of specialty, and thus are stressed. Accordingly, technical skills include airway management and intravenous access. The Clerkship should expand these concepts, while encouraging students to explore areas of interest.

Discussion: Specific information that should be covered in a clinical Perioperative Medicine course includes history and preoperative evaluation, laboratory testing, cardiovascular pharmacology, assessment and management of ventilation and management of subsequent pain. At the Arabian Gulf University in the 2-week Anaesthesia Clerkship, the students are taught to assess ventilation, both with physical diagnosis and with monitors. They are required to perform bag-mask ventilation along with endotracheal intubation with both the Miller and MacIntosh laryngoscope blades. In the 1-month elective course, enhanced airway instruction includes additional experience with difficult intubations and mask ventilation, fiberoptic intubation, laryngeal mask insertion, light wand intubation, and percutaneous cricothyrotomy. The teaching of cardiopulmonary resuscitation (CPR) is also within the domain of the perioperative physician. It is important that all physicians know the basics of resuscitation and Advanced Cardiac Life Support (ACLS).

العلاج الطبي قبل الجراحة. التوسع في تدريسه لطلاب كلية الطب

المستخلص: طبيب الجيل القادم يجب أن لا ينظر الى المخدر كرمز بجانب طاولة العمليات الجراحية ولكن كطبيب مهتم برعاية المريض،

خلال الفترات قبل ضمن وبعد العمليات الجراحية *

الطرق: معلومات معينة يجب أن تغطي في تدريس الطب السريري قبل البضع تشمل تاريخ المريض والتقييم قبل البضع، الفحوصات، الأدوية

المتعلقة بدراسة القلب، تقدير ومعالجة التهويه ومعالجة الألم الناتج بعد ذلك * هذه المعلومات ضرورية لجميع الأطباء بغض النظر عن

التخصص ويكون التركيز عليها أكثر من مجال العقاقير * المهن اللازمة تشمل معالجة / معاينة القصبة الهوائية، والمسار لدخول

الأوردة * المرحلة الأكلينيكية يجب أن تشمل هذه المعلومات وفي نفس الوقت ترغب الطالب في انماء حب الإستطلاع *

النتائج: برنامج التخدير في المرحلة الاكلينيكية * بالإضافة إلى الدرجة المتطورة لعلاج الإنعاش القلبي والرئوي (ACLS) *

الخلاصة: البرامج التعليمية التي تهتم بتدريس الطب قبل البضع والتي تعطي الرعاية للمريض تكون كادر من الممارسين على مقدرة

لتقديم هذه الخدمات وبالأخص تكوين جيل من الأطباء والمرضى ذوي التوقع لتوفر هذه الخدمات *

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Introduction:

Anaesthesia has experienced exponential growth in recent years. This has resulted in part from the provision of surgical therapy to older, sicker patients. In addition, there has been an increased demand for anaesthetists to provide their unique skills in venues outside the traditional operating theatre environment. Anaesthetists now help prepare patients for surgery; provide sedation, analgesia, and amnesia in clinic sites remote from

the operating theatres (eg, radiology suites); manage chronic and postoperative pain; and practice critical care medicine. Anaesthetists are especially involved in the care of individuals who have undergone extensive operations, have had complications from surgery, or are the victims of trauma! The areas of acute pain medicine, chronic pain medicine, and cancer pain management have expanded rapidly also. Finally, the extent of involvement in even traditional areas of practice, such as cardiothoracic anaesthesia, has increased greatly in recent years due to increased technology (eg, transoesophageal echocardiography, ventricular assist devices, etc) and to the increased expertise and commitment of anaesthetists as members of the care team. These changes have led to a new definition of anaesthesia - as the practice of anaesthesia, perioperative medicine, and pain medicine. The breadth of this current practice makes anaesthesia one of the most exciting and vibrant of medical specialties.

This broader definition of the specialty leads to both opportunities and challenges for practice groups. These opportunities therefore include new areas of practice that enhance our image as complete physicians. The challenges will also include expectations from others that may be difficult to meet without fundamental changes in attitudes, skills, and work expectations of existing practitioners.

The common theme in the expanding scope of perioperative medicine practice is provision of care throughout a periprocedural interval. It is believed that this type of practice represents the future of our specialty. (Longnecker 1997, Deutschman 1996) We should examine the physiologic consequences of surgery and demonstrate the rationale for considering the period surrounding an operation as unique. This will be followed by an examination of other considerations involving perioperative medicine, and a discussion of why anaesthetists are especially well-prepared to assume responsibility for perioperative care. Finally, we will review the goals that must be achieved in a perioperative practice and outline our strategy for implementation of the perioperative agenda.

Essential to this discussion is a definition of the perioperative physician. It is clear that the management and modification of the inflammatory response to surgery or trauma requires an intimate knowledge of the underlying physiologic processes and the skills to intervene effectively to modify this sequence. Furthermore, it allows us to define the

perioperative interval as the time that begins with the decision that a patient requires an operation and ends when the transition from catabolism to anabolism is complete. Using this knowledge and this definition, it is useful to illustrate the value of a perioperative physician on preoperative, intraoperative, and postoperative care with individual examples.

Discussion:

The preparation of a patient for surgery requires a keen understanding of the events that will occur during the course of the operation and afterward. In healthy individuals, the need for extensive preoperative evaluation and management is minimal. However, when a patient has pre-existing diseases, appropriate preoperative management may have a profound effect on intraoperative and postoperative events. For example, consider the patient with poorly controlled hypertension, taking a minimal dose of a diuretic, who presents for elective surgery. An individual without an understanding of perioperative physiology might be tempted to control this individual's blood pressure by increasing the dose of diuretic. The patient would then present for elective surgery in a state of relative hypovolaemia. Induction of anaesthesia would likely remove many of the mechanisms that compensate for hypovolaemia, leading to compromised organ blood flow. In the management of this patient, a perioperative physician would be more likely to administer a beta blocker, a non-piperazine calcium channel blocker, or an angiotensin-converting enzyme inhibitor as a safer, more effective way of controlling hypertension with less risk of compromising tissue blood flow on induction.

Another important example involves a patient with significant coronary artery disease presenting for major surgery. Recent studies indicate that in such patients with only mild to moderate ventricular dysfunction, initiation of preoperative beta blockade can improve outcome not only in the perioperative period but also up to 6 months after surgery. However, it requires the judgment of a perioperative physician to determine whether the patient is indeed a candidate for beta blockade. Of concern are intraoperative events, such as the nature of the operative procedure, expected blood loss, unmeasured fluid losses, and anaesthetic requirements. Furthermore, beta blockade will impact on postoperative consequences such as fluid

shifts, pain management, ventilation, oxygenation requirements, and ambulation. In addition, beta-blockers affect important metabolic pathways that are essential to tissue repair (for example, the hepatic gluconeogenic pathway, of key importance in providing the glucose required by white blood cells). These concerns must be balanced against the potential risk for myocardial ischaemia. The perioperative physician, versed in the pros and cons of these issues, is invaluable in deciding whether the patient is indeed a candidate for beta blockade.

An extensive knowledge of perioperative physiology and pharmacology will also influence intraoperative management. Expert intraoperative management should be guided by a firm understanding of the patient's preoperative status. This is one area in which little change in current anaesthesia practice is required; but the perioperative physician must consider the impact of the intraoperative plan on postoperative care. Consider, for example, decisions regarding the use of invasive monitoring. Whereas a pulmonary artery catheter may not be required for intraoperative care, it may be essential after surgery, especially in a patient in whom capillary leak is exaggerated. An even simpler example involves the placement of a Foley catheter in a patient with moderate renal insufficiency undergoing a relatively short procedure. The catheter is not essential during surgery but may be invaluable in the postoperative period, in which a decrease in urine output may be the first sign of compromised renal function.

Provision of care can be simplified and improved by the participation of a perioperative physician who is aware of the implications of preexisting disease and the effects of intraoperative management. For example, a physician who understands that tachycardia is dangerous for the patient at risk for myocardial ischaemia will avoid pethidine for postoperative analgesia because pethidine has an atropine-like structure and can increase heart rate. Familiarity with the pharmacokinetics of the different opioids used for neuraxial analgesia is important in the management of a patient with marginal respiratory function. Similarly, knowledge of interactions among inhaled anaesthetics, neuromuscular blocking drugs, and electrolytes such as calcium or magnesium is invaluable in the management of postoperative respiratory insufficiency. Finally, cognizance of the operative procedure, the potential for compromise of cardiac or renal function and peripheral oxygen delivery in the face of even relative hypovolaemia, the loss of

fluid into the "third space," the potential for pulmonary embarrassment, and the need to carefully monitor intravascular volume are essential to provide appropriate fluid management in the patient recovering from major vascular surgery.

The preceding discussion indicates that the basis for an anaesthesia perioperative medicine department arises from knowledge of the distinct physiologic responses that surgery or trauma provoke, an understanding of how pre-existing conditions and drug therapy can modify these responses, and a commitment to viewing the perioperative interval as a continuum to enhance care. There are no prospective, randomized, controlled data to demonstrate the value of this approach. However, a number of studies, such as the investigation focusing on beta blockade in patients with myocardium at risk, indicate the value of continuous intervention throughout the perioperative period. (Mangano *et al* 1996) Similarly, a number of studies, both retrospective and prospective, using concurrent or historical controls, indicate that involvement of a specifically trained individual in postoperative care improves outcome. This is consistent with the approach used in some countries, where postoperative care is the province of the anaesthetist. Thus, logic, physiology, practice in other countries, and the results of some studies indicate the value of the perioperative approach to care.

The expansion of the scope of anaesthesia practice to include perioperative medicine has economic consequences as well. These alterations take two forms. First, the adoption of a perioperative medicine agenda, with emphasis on provision of care outside the operating room, will increase the number of interactions between patients and anaesthetists. (Shapiro 1997)

Equally important is the economic effect of the improved efficiency that accompanies institution of the perioperative agenda. These are exemplified by data reported from Stanford University Medical Center, where the establishment of a preoperative evaluation center had dramatic results.² The availability of medical records before preoperative evaluation was improved, cancellations of cases on the day of operation were decreased by nearly 90%, and unnecessary cardiology, pulmonary, and medical consults were decreased. The number of laboratory tests per patient was reduced from 6.12 to 2.75; this effect alone decreased costs by \$112 per patient, saving the hospital approximately \$450,000 over a 6 month period. A study done in the surgical

intensive care unit at the Hospital of the University of Pennsylvania demonstrated a decrease of mechanical ventilation, consultations, units of blood or blood products administered, invasive monitors placed, and laboratory tests when patients were managed by an intensive care unit-based postoperative team (comprising surgeons and anaesthetists) compared with the traditional method of care delivery by a general surgeon not based in the intensive care unit. (Hanson *et al* 1999)

A final economic benefit of the perioperative agenda lies in the delivery of better care and improved outcomes. For example, the Stanford study not only demonstrated a reduction in unnecessary tests and unneeded consultations, but the incidence of complications during the study period was actually reduced. The study in the surgical intensive care unit of the Hospital of the University of Pennsylvania documented that a decrease in a number of costly practices could be accompanied by a decrease in the complication rates. Thus, it is likely that implementation of a perioperative medicine agenda will have economic effects not only in direct cost savings but also by improving outcome and reducing the need to treat avoidable complications.

Why Anaesthetists are Ideally Suited to the Practice of Perioperative Medicine

The market forces shaping the practice of medicine demand cost-containment coupled with high-quality care. Logically, this is best accomplished when a single individual or a group of individuals assumes responsibility for global supervision of the care for each patient. Logic dictates that individuals who are involved fully with the care of patients in the perioperative period are better equipped to perform these tasks. We believe that anaesthetists are the ideal practitioners to provide such perioperative care, and others concur. For example, in a treatise on the future of medical practice in the United Kingdom, (Wickham 1994) (a surgeon) proposed that "the anaesthetist [sic] will be responsible for preoperative and postoperative care" as specialties realign in the future.

Anaesthetists are uniquely trained to understand and modify the physiology of the perioperative period, to recognize the implications of pharmacologic intervention superimposed on the stress response, and therefore to manage patients during this time. The prudent anaesthetist, trained in modern anaesthesia practice, has an understanding

that is useful in preparing a patient for surgery and planning intraoperative care based on the postoperative needs of the patient. Most anaesthetists are trained in the medical aspects of perioperative care because training in postanaesthesia care, pain management, and critical care medicine are required in anaesthesia residency programmes, and most programmes include formal exposure to the preoperative evaluation of surgical patients.

Finally, the practice of perioperative medicine requires a familiarity with administrative issues. For effective implementation, it is essential to have a sense of the forces that govern efficiency in a hospital setting. In this respect, anaesthetists bring many benefits to the role. In training, most anaesthetists assume some responsibility for management of the surgical schedule. In many settings, the global management of the operating rooms and the surgical schedule is the responsibility of anaesthetists, who can provide an unbiased view of both the dynamics of patient flow and the value of capital expenditures. Anaesthetists are most often hospital-based and therefore have an appreciation of costs, staffing patterns, and other important global details that can affect both perioperative care and hospital costs. Thus, from both the medical and administrative points of view, the anaesthetist is especially well-suited to assume the role of perioperative physician.

Undergraduate Medical Education: Teaching and Research

A student graduating from a medical school should understand the basic elements of perioperative medicine and recognize the role of the anaesthetist in the management of the patient during the perioperative period, including preoperative evaluation and treatment, intraoperative management, critical care, and management of acute and chronic pain.

Perioperative physicians who are involved in the teaching of basic medical science bring valuable and unique material to the students, and demonstrate that anaesthesia and perioperative medicine are based on firm scientific principles. Anaesthetists traditionally teach in the pharmacology section of the pre-clinical years about general and local anaesthesia. Perioperative physicians can also teach the physiology and pathophysiology of the cardiovascular and pulmonary systems. A physician who is skilled in transoesophageal echocardiography

can provide a dynamic conference about myocardial function, demonstrating concepts with actual images.

The first need therefore, is to identify and appoint gifted teachers. Beyond having access to the best teachers, instructing from excellent curricula, the students must be involved as much as possible in the special projects of their department, ranging from special reports to videoconferencing and telemedicine. High-level research is also fundamental to high-level teaching.

Conclusions: Key Factors for Success

In principle, the keys to building a successful system of perioperative medicine are simple. Appropriate personnel, who are trained to understand the underlying physiology that makes perioperative care logical and who are willing to "go the extra mile" to make the process work, are perhaps most important. A commitment from colleagues and administration to support the service, both with referrals and at least initial financial support, is required. Creative thinking, designing of programs that extend "outside the box," and flexibility are keys to success. Perhaps most important of all is a commitment to carefully evaluate and re-evaluate the overall benefits of the programme on a continuous basis. This will allow the service to refine that which works, discard that

which does not, and institute new and innovative approaches on a regular basis. If perioperative medicine represents the evolution of anaesthesia, the next step in the evolution of perioperative medicine is likely to be the ability to openly and critically evaluate and refine our approaches.

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