The YEAR BOOK of

Surgery

1979

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Annual Overview

General Considerations – A significant reduction in ascorbic acid levels postoperatively unrelated to the extent of surgical trauma or the volume of blood transfused has been demonstrated. The prophylactic requirements in postoperative patients have not been resolved. Additional evidence has appeared indicating that myasthenic patients with thymomas have less chance of remission from myasthenia after thymectomy than do those without neoplasms.

Fluids, Electrolytes and Nutrition – Sophisticated studies are being performed on the fluid and electrolyte response to surgical trauma. Several articles confirm the fact that the adrenocortical response in terms of aldosterone secretion is a response to surgical trauma. Furthermore, it is becoming increasingly obvious that this response can be obviated almost entirely by the administration of saline during the operative procedure. This prevents the extracellular depletion that turns on the adrenocortical response. Whereas these small changes are difficult to quantitate, it is obvious from measurement of hormonal studies that the adrenocortical response to injury can be turned off if extracellular volume repletion is administered intraoperatively while the depletion as sequestrational or third-space injury is occurring.

More studies are focusing on both the role and the limitation of total parenteral nutrition. The limits are being established, and one study in this year's articles outlines the uselessness of L-amino acids in the postoperative period in the usual patient undergoing moderate surgical trauma. The study concludes that L-amino acid solutions have no advantage over conventional intravenous therapy. There is no question that the technique of hyperalimentation has been overused in recent years, with infection and other complications resulting. Studies such as those appearing now should reduce these overuses of an otherwise extremely helpful technique.

More refined studies continue to define the need for intravenously administered fat solution. Most investigations now agree that with total parenteral nutrition at least a sufficient amount of intravenously administered fat should be used on a weekly basis to prevent development of essential fatty acid deficiency. Other investigations are attempting to employ fat solutions intravenously in order to use peripheral lines for intravenous nutrition. One current study reveals that if intravenously administered fat is pushed to the maximum in combination with L-amino acids, caloric needs can be supplied, but starvation and septic malnutrition cannot be reversed with such solutions. However, if this combination of peripherally administered fluids is used early, caloric maintenance can be achieved.

Shock – The total literature regarding shock that appeared during

the past year is of both increased quantity and quality. The quality of the articles shows increased sophistication, and those articles published in answer to clinical questions are more specifically focused than in previous years. It is also apparent from the quantity of articles that hemorrhagic shock continues to be a major problem for the surgeon.

The most avidly pursued area in the effects of hemorrhagic shock appears to be the cell itself. A series of papers examines cellular membrane transport and cellular energy function. Other articles report attempts to manipulate the cellular response to shock injury. The sophisticated studies on cellular injury document the defect in cellular membrane transport in skeletal muscle cells previously indicated. These studies also further delineate changes in red blood cell membrane transport and, in addition, in vascular smooth muscle as well as in hepatic cells. Cellular injuries from a single episode of shock, measured in a number of ways, persist for many days. Pharmacologic manipulation of cellular response is in its embryonic stage but, nevertheless, some of the studies utilizing glucagon as well as insulin do appear promising.

Some specifically targeted clinical studies are being done comparing the use of whole blood with packed red blood cells for resuscitation from hemorrhagic shock. Most of the pressure for this study comes from complications such as hepatitis associated with usage of whole blood in the stored phase. There are reports of legal implications and action concerning the use of whole blood in transmission of hepatitis virus. Metabolic studies currently under way indicate that whereas packed cells may be beneficial in association with isotonic saline as volume expansion, many things may well be lost by the use of packed cells, particularly in large volumes. One study documents a reduction in host defense as measured by some opsonic activity when packed cells were used. No cold globulins were administered, as if whole blood were used. Consequently, the possible salvage gained by using packed cells may be obviated by the loss in host resistance that is so critically depressed, at least ins far as the reticuloendothelial system is concerned by hemorrhagic shock.

The increasing usefulness of autotransfusion in the severely injured patient with massive blood loss in the abdominal cavities is further explored. It is apparent that blood contaminated with bowel organisms due to intra-abdominal injury may be returned safely to most patients as long as antibiotic coverage is supplied prior to the use of the autologous blood. If there is any hazard at all, it would exist for those patients having extremely large transfusions; however, experimentally at least, even this hazard is obviated by appropriate antibiotic therapy accompanying the autotransfusion.

The serious problem of postinjury pulmonary insufficiency is now being brought more clearly into focus. Most authors agree that if a patient sustaining severe injury is carefully monitored from the outset and put on a regimen of early progressive ventilatory therapy, the mortality rate for posttraumatic pulmonary insufficiency can be reduced to less than 0.3%. It is also clear that the so-called shock lung is

a myth and that most pulmonary insufficiency after injury is from sepsis. Some contribution to this entity is made by aspiration of gastric contents or from unrecognized direct pulmonary injury. One question attacked rigorously with controlled randomized prospective studies is that of the benefit of adding albumin to the usual resuscitative regimen of saline solution with whole blood. Several excellent studies indicate that the addition of albumin to the initial resuscitative fluid carries nothing but detrimental effects. One article shows clearly a remarkable decrease in respiratory function when albumin is added. Another article demonstrates quite well that nothing is gained when albumin is added to the initial resuscitative fluid, and the cost factor is absolutely prohibitive. In addition, it is interesting that there is a decrease in renal function clotting factors when hyperalbuminemia is produced by the addition of extra albumin to initial resuscitative fluid. The current standardized regimen of initial saline solution plus whole blood is still the preferred method of management for resuscitation of hemorrhagic shock.

There are continued efforts to further define one of the reduced host defense mechanisms; i.e., the depression in opsonic glycoprotein activity. One preliminary article by the group that originally worked out this significant mechanism, led by Doctor Saba, indicates that opsonic protein can be supplied by use of appropriate human plasma fractions and that the opsonic protein levels can be returned toward normal. Although further definition is needed, initial results indicate that there was also accompanying clinical improvement.

Several articles this year deal with prevention of stress ulceration in patients who sustained hemorrhagic ischemic gastric mucosa. Several reports indicate potential benefit from the use of cimetidine. One report indicates that cimetidine increases mucosal blood flow. However, on direct endoscopic visualization of the gastric mucosa during hemorrhagic shock, there still appear to be focal areas of ischemic mucosa, and the quantitative benefits to be gained from cimetidine are yet to be substantiated. The honored regimen of maintaining high intragastric pH above 5.0 advocated originally by Silen, has received further support from the studies of hydrogen back-diffusion.

Sepsis continues to plague the patient who has sustained shock, and particularly shock and injury. There are several interesting approaches detailed in this year's literature that tend to minimize the septic complications. One of these is an in-depth study of calcium metabolism in the septic patient. These studies, using more sophisticated technology, indicate that there is, in fact, a significant calcium leak during sepsis, and the administration of calcium as well as magnesium may be shown to be extremely beneficial in the treatment of sepsis.

Vasodilator therapy, often advocated for the treatment of sepsis, is now being put into better perspective; it apparently does have a place later in the course of septic shock after many other modalities have been tried. In this setting there is an occasional patient in whom vasodilator therapy can be seen to be of remarkable benefit.

Trauma—It is gratifying to see that the care of the trauma patient is receiving continued attention from surgeons. Several articles in the

past year indicate that satisfactory emergency medical service delivery in the United States, while improving, still has a long way to go. One article documents the fact that patients with severe injuries, specifically children – in whom trauma is the leading cause of death – are still being delivered to the nearest hospital rather than that center best equipped to deal with life-threatening injury. It will obviously take a massive and continued effort on the part of surgeons, particularly at the local level, to effect systematic and effective emergency medical services to stimulate the delivery of traumatized patients to an appropriate facility.

There are several studies examining the role of antibiotics in patients with penetrating abdominal trauma. Most authors agree there is no question that such patients should have antibiotic therapy immediately on admission to the hospital. Further, it is clear that some combination of antibiotics is worthwhile in an attempt to control both aerobic and anaerobic infections. Many series show reductions in the rate of intra-abdominal sepsis after penetrating abdominal injuries from approximately 8% or 10% to less than 1% or 2%. Antibiotics that control both anaerobes and aerobes, particularly those having their origin in the gastrointestinal tract, are used. Many reports attest to the reliability of abdominoperitoneal lavage in the diagnostic accuracy necessary in patients with blunt trauma and questionable or unobtainable clinical signs of significant intra-abdominal injury.

Several improved approaches measuring the alterations in host defense in response to injury have appeared. One such approach is the use of skin testing with five standard recall antigens. This is done on admission and then weekly in patients with blunt penetrating missile injuries. The mortality and morbidity statistics were impressively different in those who had demonstrated some degree of anergy defined by the response to the skin test. In addition, further definition of altered host resistance has been offered by the measurement of specific host defense alteration, including white cell function and change in opsonic glycoprotein activity.

Specific details and the appropriateness of monitoring the severely injured patient are again more clearly defined. Several articles record the usefulness and need for pulmonary artery monitoring in patients with severe multiple injury and, in selected patients, the continued measurement of cardiac output as a measure of cardiac work in response to therapy. It is apparent from the literature that the persistent problem of overmonitoring patients with severe injury is now being combated very well, and it appears that the overall results are being improved with the use of more appropriate and selective monitoring.

The critical nature and surgical difficulty of handling several specific organ injuries is being explored much better, as shown in the articles that appeared during the past year. These include many critical organ injuries, such as trauma to the esophagus, duodenum, liver and retroperitoneum, as well as vascular injuries. It is clearly emerging that arterial embolization for control of surgically inaccessible regions will become a very useful technique. This procedure currently is being applied in retroperitoneal hemorrhage in association with massive pelvic

fractures, as well as in deep hepatic parenchymal injuries, particularly after surgical repair. One specific organ injury needing a well-controlled clinical trial of organ salvage is the traumatized spleen in a child, as there is the risk of subsequent overwhelming infection after splenectomy in patients who do not have hematologic disease. Currently nonoperative treatment of minimal splenic injury is not being done in a controlled fashion. Consequently, unless some sensible plan emerges, an increase in mortality from intra-abdominal bleeding from a correctable injury such as splenic rupture will result.

Angiography has emerged as a distinct and useful clinical adjunct in the emergency management of peripheral arterial injuries. When the usual clinical indications for vascular exploration and repair do not exist, carefully executed angiography is a clinical extension that can be used in a positive and a negative fashion. In addition, the arteriographic studies may help localize the site of injury, particularly in the patient with multiple injuries in a specific vessel in an extremity.

Wound Healing—Clinical reports of refinement of surgical techniques making it possible to transfer large composite tissue grafts nourished by microvascular anastomoses have added a new dimension to the treatment of soft tissue defects produced by ischemia and pressure. Free transfer of a composite tissue flap followed by microanastomoses of blood vessels in the recipient area is becoming sufficiently reliable as a means of reconstructing large defects in difficult areas to be the method of choice for some wounds. In addition to reports on the use of free microvascular transplants and more conventional local advancement flaps, there are findings concerning increased experience with myocutaneous flaps, particularly the gastrocnemius muscle and overlying skin to repair difficult anterior tibial cutaneous defects. The problem of an unhealed perineal wound after pseudomembranous colitis and inflammation of the terminal ileum still causes surgeons considerable difficulty for undefined reasons. Aggressive surgical débridement or even excision of the wound and transfer of musculocutaneous flaps from the gracilis region were more successful last year than were conventional skin grafts in previous reports. Synthetic absorbable sutures appear to be gaining popularity, largely because there seems little doubt now that they are strong enough to provide adequate tensile strength for abdominal and chest wounds. Last year there were reports of nonabsorbable sutures serving as a nidus for urinary and biliary calculi—another reason for the increasing popularity of synthetic absorbable sutures. Closure of the pelvic peritoneum after extirpative surgery was shown to be unnecessary in human beings. These reports confirm experimental evidence showing that peritoneum is replaced in a few hours by migrating cells from within the peritoneal cavity. Experimentally, the importance of inflammation short of necrosis (even inflammation produced by blood) as a factor in the accelerating rate of gain of tensile strength was demonstrated again. Nutritional requirements of healing wounds still appear to be relatively small when compared to the nutritional needs of immunologic systems. The role of nutrition, even hyperalimentation, is not as clear in the case of healing of an abdominal wound or a chest wound as it is in other organ systems.

Infections—Ultrasound examination as a diagnostic tool when intraperitoneal infection is suspected appears to be indicated relatively earlier than it previously was utilized. Obesity and lack of patient cooperation mitigate against an accurate diagnosis; a negative scan, or course, does not rule out sepsis. Accurate localization of intra-abdominal sepsis by ultrasound was shown in 1979 to be accurate and useful in an increasing percentage of patients. Amebic abscess of the liver has been demonstrated particularly well by ultrasound techniques. Moreover, serial scanning has been shown to be effective in following the response to therapy of amebic hepatic abscess.

Enthusiasm still prevails, despite controversial data and opinions, over the use of antibiotic lavage to prevent intraperitoneal sepsis. Kanamycin and clindamycin appear to have produced the best results in 1979; the reader cannot be certain, however, about the importance of local effect in the peritoneum. After all, intraperitoneal instillation of most drugs provides a rapid conduit into the vascular tree and subsequent vascular distribution.

Studies performed on the usefulness of operative swab cultures in subsequent therapy of surgical infections strongly suggest that only swabs planted immediately in transport medium produce any useful therapeutic information. Clindamycin and gentamicin continue to be the most effective agents in treating general anaerobic surgical infections. Previous fear of toxic colonic reactions after administration of clindamycin seem now to have been overestimated. Plastic wound drapes were shown not to reduce the incidence of wound infection significantly when compared with other drapes.

Serratia marcescens infection continues to increase in frequency in surgical patients. Urinary catheters appear to be the prime portal of entry for *Serratia* organisms; prevention is still more effective than therapy. Parotidectomy, despite the small but distressing incidence of facial nerve palsy, was reported to be adequate treatment for chronic suppurative parotitis. Intravascular coagulation seems to be emerging as a pivotal occurrence in the development of immunologic paralysis after major trauma.

Burns—The leading cause of death for burned patients treated adequately to prevent infection still appears to be exhaustion. Energy depletion primarily is from evaporative water loss. Laminar air flow was studied as a possible contributing factor to evaporative water loss and was found to be as safe as any other environment for the acutely burned patient. Internal protein synthesis, necessary to replace protein during accelerated turnover found in burned patients, is an additional cause of energy depletion. The fundamental cause of accelerated protein metabolism in the burned patient still is unclear. The problem, however, appears most serious in children. Although controversy exists over proper use of albumin during early treatment of burned human beings, additional evidence was reported last year to show that interstitial edema, particularly pulmonary interstitial edema, can be prevented and relieved by the use of solutions containing colloid rather than electrolytes only. More experience with ketamine anesthesia

suggests that skillful administration of the drug can overcome the previous reluctance to use ketamine in adults because of the fear of postoperative nightmares. Ketamine was used quite successfully in 1979 in adults as well as children. Although it is relatively rare as a primary cause of pulmonary injury, inhalation of toxic substances or hot particles was shown again to be responsible for some of the more serious pulmonary complications in burned patients. *Pseudomonas* infection was particularly dangerous and more prevalent than reported previously in patients suffering acute respiratory burns. Resistance to infection apparently was increased in some patients by transfusion of granulocytes. The most dramatic results were seen in patients with ecthyma gangrenosum. Large doses of aminoglycosides also appeared to have been effective in some patients when conventional doses failed to control infection. Mucosal permeability was shown to be important in the development of gastric hemorrhage after thermal injury. Although gastric hemorrhage clearly is a multifactoral problem, cimetidine appears to be increasingly effective as a preventive measure.

Transplantation and Artificial Organs—The past year has seen some potentially significant advances in the immunobiology of transplantation. In 1978 we stated that no new immunopharmacologic agents for immunosuppression had appeared in the past 10 years. Now at least one immunosuppressive agent has potential significance, as does a new approach to immunosuppression through total lymphoid irradiation.

The new immunosuppressive agent is cyclosporin-A, a fungal metabolite with effective antilymphocytic activity. Green and co-workers have reported potent immunosuppressive activity in rat heart, pig heart and dog kidney allograft survival. In addition, at the 1978 International Transplantation Conference in Rome, Calne reported encouraging results in cardiac and liver allografts in pigs. More recently he has published a brief report on its effect in a few patients with kidney allografts. Cyclosporin-A appeared to be a reasonably successful immunosuppressive agent, although it appears to be moderately toxic to the liver and kidneys. Until the extent of this toxicity is determined, it will have limited clinical application.

Perhaps more encouraging as a method of immunosuppression is the use of total lymphoid irradiation (TLI), as described by Slavin, Strober and Kaplan from Stanford University. Total lymphoid irradiation employs Kaplan's "mantle" radiation treatment described for use in Hodgkin's disease, and results in T cell depletion, but does not cause significant depression of bone marrow. In animals, it has been used as a single agent to abrogate rejection and, when it is combined with donor bone marrow transplantation, a stable state of chimerism (without graft-vs.-host reaction) has been described. In addition, successful chimerism in dogs with permanent skin graft survival has been reported. Studies on other animal systems are under way, along with some preliminary clinical trials. If the clinical trials can substantiate the immunosuppressive effectiveness of TLI in bone marrow transplantation without graft-vs.-host disease, then perhaps the dream of success-