Additional utility was introduced by Flynn and McGowan when the single-needle technique was applied to the subclavian vein approach, allowing the cannula to be left in place for several weeks. Yet there has been concern with the tendency for single-needle dialysis to recirculate the same blood and such equipment is not always available or functional. These limitations have led to the development of a double-lumen coaxial catheter suitable for subclavian cannulation, allowing hemodialysis through a single #8 French catheter (Vas-Cath, Shiley). This steadily increasing variety of vascular access for patients requiring exigent dialytic therapy provides valuable flexibility.

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Gastric Mucosal Erosion

GASTRIC MUCOSAL EROSION in seriously ill patients is defined as multiple, superficial mucosal defects that occur with serious illness from sepsis, trauma, respiratory failure, uremia or shock. The underlying pathophysiology is obscure and varied and includes such different entities as Curling's ulcer in burn patients, Cushing's ulcers, ulcer occurring from administration of various drugs such as aspirin and alcohol, reflux of bile and the "ICU syndrome" or that which occurs in seriously ill patients in surgical intensive care units. The incidence of ulceration or bleeding from such ulcers (or both) is variable and has been estimated to occur in anywhere from 3 percent to 6 percent of patients who are seriously ill to upwards of 54 percent of patients with intracranial disease, the diagnosis being made by endoscopy.

Over the years the incidence of upper gastrointestinal bleeding from acute gastritis and acute stress ulceration appears to be decreasing. Many of the factors attributed to this decreased incidence are greater attention to appropriate nasogastric drainage, intensive replacement of fluids in burn trauma and seriously ill patients and improved respiratory management. Particularly important has been the attention to better nutritional support, the advent of intravenous administration of hyperalimentation and the widespread occurrence of routine intragastric alkalinization. Despite the presence of gastritis in acute mucosal lesions, few of these patients (less than 20 percent) ever bleed to the point where they require operative intervention.

Maintaining the gastric luminal pH at 7.0 with antacids has resulted in a decreased incidence of ulceration in seriously ill patients. In a prospective study by Priebe and Skillman in 1980, findings in a group of patients treated with antacids were compared with those in a group treated with cimetidine. In 37 patients receiving antacids, no bleeding was noted as opposed to an 8 percent bleeding rate in those given cimetidine. Other studies have indicated no differences in prophylaxis between cimetidine and antacids and that using one or the other was significantly better than no treatment. Zinner and associates noted that the benefit of antacids over cimetidine was greatest among those patients with the greatest number of risk factors. It was apparent that antacids more satisfactorily achieved adequate pH control ($pH>3.5$).

Once bleeding occurs, a wide range of nonoperative approaches has been used, such as continued antacid installation and administration of cimetidine, along with iced gastric lavage and localized gastric cooling. Others have advocated the use of endoscopic electrocoagulation or endoscopic coagulation with a laser or both. Prostaglandin has been shown in studies using animals to have some promising usefulness but is not yet available for human use. Evidence exists that vasopressin given intravenously has a similar effect to intraarterially administered vasopressin. The effectiveness of vasopressin on the rate of bleeding from acute gastritis is variable. Recurrent bleeding is the rule and using vasopressin rarely alters the decision to operate.

When surgical intervention becomes necessary, a variety of procedures have been advocated, with a more extensive operation such as gastric resection or total gastrectomy having the greatest mortality and morbidity. Vagotomy and pyloroplasty with suture ligation of the bleeding site has the best overall clinical effect with the lowest mortality. Satisfactory cessation of bleeding, however, is usually achieved only when actual suture of a bleeding site is possible. Recurrent bleeding is generally best managed by a total or near-total gastrectomy. The percentage of patients requiring operation has continued to drop as advances are made in adequate prophylaxis.

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Infection in Burn Patients

BARRIERS AGAINST INFECTION of a burn wound include asepsis, antisepsis, prompt burn excision and wound closure, effective nutrition, either prophylactic or therapeutic (or both) use of systemic antimicrobial agents and immune factors.

Whereas sterile laminar airflow plus barrier isolation has been reported in one or two centers to prevent cross-infection, no definitively controlled study has yet confirmed this or shown the cost-effectiveness of this aseptic technique. In experimental studies using animals, *Aloe vera* applied topically appears promising for its antimicrobial properties and in preventing progressive burn ischemia, but it remains inadequately

tested for use in humans. Silver sulfadiazine cream remains the most popular topical agent in use, 0.5 percent silver nitrate solution and mafenide acetate cream being appropriate in special circumstances. Prompt excision and autografting of third-degree burns has been associated with reduction in hospital stay and mortality in several categories of patients, but requires considerable experience to be consistently safe and effective in very large burns. Fresh split-thickness allograft skin remains the best tested autograft substitute, but several artificial skin substitutes have proved useful in special circumstances, and some may prove to have advantages (like the absence of immunologic rejection in scar formation) not present in allograft skin.

Maintenance of body weight and nitrogen balance using enteral nutrition with an unusually high kcal-to-gram nitrogen ratio (about 100:1) is associated with improved survival, at least in children and probably also in adults. Prophylactic intraoperative administration of antibiotics is standard therapy during excision of large burns. Routine use of prophylactic antistreptococcal antibiotics on admission has been questioned, however, though no harm or development of antibiotic-resistant bacteria has been noted.

Finally, while a very promising area of sustained and intensive research, mortality and morbidity due to monocyte, lymphocyte, polymorphonuclear leukocyte or humeral immune abnormalities (or all of these) remain unaltered in large human burns except for nonspecific and indirect measures such as those noted above.

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Ascites and the Peritoneovenous Shunt

ASCITES is an often difficult-to-manage, potentially lethal complication of advanced liver disease. Its precise pathophysiology remains undefined. Increased portal pressure and decreased oncotic pressure allow transudation of lymphatic fluid into the peritoneal cavity, causing ascites. This fluid shift reduces effective plasma volume, which then stimulates the renal renin-angiotensin-aldosterone mechanism to preserve sodium and water. Strict sodium and water restriction, judicious use of loop diuretics and giving aldosterone inhibitors will control ascites in most patients. However, some become totally refractory to such therapy or oliguria, azotemia, encephalopathy or hepatorenal syndrome develops. Previously, treatment of such refractory ascites by paracentesis and ascitic fluid infusion or the use of Holter-type peritoneoatrial shunts resulted in temporary improvement only. Portacaval shunt remained the only effective surgical treatment, presumably acting by reducing portal pressure.

In 1972 LeVeen introduced a one-way, pressure-activated valve or peritoneovenous shunt, which permits continuous infusion of ascitic fluid into the superior vena cava. This valve opens with a pressure gradient of 2 to 4 cm of water. The apparatus can be inserted under local anesthesia. The collection tubing is placed in the peritoneal cavity; the valve is seated under the abdominal wall muscles, and the venous outflow tubing is led subcutaneously and passed through the internal jugular vein into the superior vena cava. Respiration activates the valve. Diaphragmatic descent during inspiration causes a rise in intraperitoneal pressure and a reduction in intrathoracic pressure, resulting in a greater than 4 cm gradient across the valve. The valve then opens, fluid passes from the abdomen to the superior vena cava, blood volume increases and diuresis occurs. If blood volume increase exceeds diuresis, the central venous pressure rises, the gradient drops and flow ceases.

Rapid diuresis with increase in renal blood flow, glomerular filtration and sodium excretion follow successful peritoneovenous shunt insertion. However, complications may occur. Meticulous surgical technique is necessary to avoid ascitic fluid leak, sepsis or immediate mechanical shunt failure. Progressive fibrin deposition may cause delayed shunt failure. About a third of peritoneovenous shunts require revision. Complications from this shunt include pulmonary edema, diffuse intravascular coagulation, superior vena cava thrombosis and bacterial peritonitis. Such complications may require shunt ligation or removal.

Despite these problems, continued experience with this shunt has confirmed its efficacy in selected patients who have cirrhotic ascites, endophlebitis hepatica obliterans (Budd-Chiari syndrome), chylous ascites, pancreatic ascites and malignant, cardiogenic and nutritional ascites. It may be of benefit in some patients with hepatorenal syndrome. Relative contraindications to a peritoneovenous shunt include patients with severe alcoholic hepatitis and jaundice, severe encephalopathy, variceal hemorrhage, acute tubular necrosis, peritoneal sepsis, coagulation disorders and heart failure. Recent technical innovations include the Denver peritoneovenous shunt, which permits various flow rates, and the temporary external Silberman shunt, used in patients with acute ascites.

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Preoperative Nutrition Therapy

MANY OBSERVATIONS support the concept that poor nutrition has an adverse effect on the postoperative course of surgical patients. In 1936 Studley reported a tenfold increase in postoperative mortality among patients treated for intractable peptic ulcer disease who