Case Reports

Use of Drotrecogin Alfa (Activated) in Bariatric Surgery Patients with Severe Sepsis Syndrome: Experience in an Urban Community Teaching Hospital

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Background: Severe sepsis syndrome (SSS) and septic shock have an associated mortality ranging from 31 to 60%. Drotrecogin alfa (activated), activated protein C (APC), has been shown in a recent trial to decrease mortality from 44 to 31% in patients with SSS and a high risk of death. We present 3 patients who developed SSS after bariatric surgery and were treated with APC as part of comprehensive therapy for sepsis.

Methods: At our institution, patients must have SSS plus an APACHE II score ≥25 in order to receive APC. JL is a 43-year-old man who developed SSS (APACHE II score 26) after Roux-en-Y gastric bypass. ML is a 33-year-old man who developed SSS (APACHE II=28) because of a distal obstruction 2.5 years after gastric bypass surgery. TQ was a 35-year-old man who developed SSS (APACHE II=35) in the setting of laparoscopic banding.

Results: After receiving 90% of the 96-hour infusion, JL developed ecchymoses and a decrease in his platelet count; thus, the drug was stopped. ML received a full 96-hour infusion. Both patients made a full recovery from their SSS and were successfully discharged from the hospital. TQ developed septic shock and expired despite all efforts.

Conclusion: Weight alone should not be considered a contraindication to the use of APC. Close coordination between the intensivist and surgeon is recommended for bariatric surgery patients with SSS, so that a rapid determination can be made as to the patient's risk of death and eligibility to receive APC.

Key words: Severe sepsis syndrome, activated protein C, drotrecogin alfa, morbid obesity, bariatric surgery, anastomotic leak

Introduction

Severe sepsis syndrome (SSS) is common and deadly, with mortality from recent trials averaging 44% and total annual deaths in the United States of more than 200,000.1 This entity can be a complication of bariatric surgery. For this reason, the bariatric surgeon should be aware of the latest evidence-based changes in the management of this syndrome.2-4 Recent data indicate that the warning signs of a leak after Roux-en-Y gastric bypass can be difficult to detect; tachycardia and tachypnea may be the most useful clinical indicators.5 Importantly, when these signs are combined with a clinical suspicion for infection, the patient meets the Society of Critical Care Medicine/American College of Chest Physicians criteria for sepsis syndrome; if acute organ dysfunction is present, the patient can be diagnosed as SSS.6

It has become evident that by early recognition of the disease and implementing a rapid, coordinated, comprehensive approach, the critical care team can reduce mortality in sepsis.7 Recent landmark studies associated with improved outcomes in SSS include
the use of lower tidal volumes in patients who develop the pulmonary manifestation of sepsis, acute respiratory distress syndrome (ARDS), and of low-dose glucocorticoids in those patients with SSS and evidence of partial adrenal insufficiency. Although there is mounting evidence that the use of pulmonary artery catheters per se may not lead to improved outcomes in the critically ill, a recent important study documented that with early, aggressive, protocol-guided goal-directed therapy, in-hospital sepsis mortality could be decreased by 34%.

In spite of these advances in the management of SSS, it has been difficult to find a pharmacotherapeutic agent that can successfully target the sepsis cascade itself. The current theory is that in SSS, three major biological pathways, the inflammatory, coagulation, and fibrinolytic cascade, fail to respond to normal homeostatic factors. The closely-linked inflammatory and coagulation cascades are hyperactive, while the fibrinolytic cascade is inhibited. Examples of agents where there was great hope for efficacy but mortality benefit could not be proven in SSS, include antibody against TNF-α, high dose glucocorticoids and, in a recent study, the anticoagulant antithrombin III.

Activated protein C (APC), drotrecogin alfa (activated), was felt to be a potential therapeutic agent for SSS, as it combines anticoagulant, anti-inflammatory and profibrinolytic properties. Its efficacy was proven in a recent large multicenter randomized controlled trial (PROWESS, Protein C Worldwide Evaluation in Severe Sepsis) of over 1,600 patients (27% post-surgical). In this study, the overall 28-day mortality in patients with SSS was reduced by nearly 20%. The entrance criteria (Table 1) for the PROWESS trial were quite strict. For example, although the accepted definition of sepsis is infection plus 2 or more SIRS (Systemic Inflammatory Response Syndrome, Table 1) criteria, a patient was required to have 3 of 4 SIRS criteria to be entered into the PROWESS trial. The standard definitions for acute organ dysfunction were used; the patient could have the organ dysfunction for no longer than 24 hours. Once they were enrolled in the study, another 24 hours could elapse before starting the drug. Thus, there could be a maximum of 48 hours of acute sepsis-induced organ dysfunction before initiation of the APC infusion. The PROWESS trial included patients with

| Table 1. Inclusion criteria for the use of APC in the PROWESS trial: defining Severe Sepsis Syndrome |
|------------------------------------------------------|
| **Infection Criteria** | Known or suspected infection evidenced by: |
| - white cells in normally sterile body fluid |
| - perforated viscus |
| - radiographic evidence of pneumonia |
| - a syndrome associated with a high risk of infection (e.g., ascending cholangitis) |
| **Modified SIRS Criteria** | Patients had to meet at least 3 of the following 4 criteria: |
| - core temperature \[\geq 38 \, ^{\circ}C (100.4 \, ^{\circ}F) \text{ or } \leq 36 \, ^{\circ}C (96.8 \, ^{\circ}F)\] |
| - heart rate \[\geq 90 \, \text{beats/min}\] |
| - respiratory rate \[\geq 20 \, \text{breaths/min or } \text{PaCO}_2 \leq 32 \, \text{mmHg}\] |
| - white-cell count of \[\geq 12,000/\text{mm}^3 \text{ or } \leq 4,000/\text{mm}^3 \text{ or } >10\% \text{ immature neutrophils}\] |
| **Organ Dysfunction Criteria** | Patients had to meet at least 1 of the following criteria: |
| - cardiovascular: systolic blood pressure \[\leq 90 \, \text{mm Hg or MAP } \leq 70 \, \text{mm Hg for at least 1 hr despite adequate volume resuscitation, or the use of vasopressors to achieve the same goals.}\] |
| - renal: urine output \[<0.5 \, \text{ml/kg of body weight/hr for 1 hr despite adequate volume resuscitation.}\] |
| - pulmonary: \[\text{PaO}_2/\text{FiO}_2 \leq 250 \text{ if other organ dysfunction present or } \leq 200 \text{ if lung was only dysfunctional organ.}\] |
| - hematologic: platelet count \[<80,000/\text{mm}^3 \text{ or decreased by 50\% in 3 days preceding enrollment}\] |
| - metabolic: \[\text{pH } \leq 7.30 \text{ or base deficit }>5.0 \, \text{mmol/liter AND plasma lactate }>1.5 \, \text{X upper limit of normal.}\] |

Data adapted from reference 17. SIRS = Systemic Inflammatory Response Syndrome, APC = Activated Protein C. PROWESS = Protein C Worldwide Evaluation in Severe Sepsis. MAP = mean arterial pressure. \(\text{PaO}_2\) = partial pressure of arterial oxygen. \(\text{PaCO}_2\) = partial pressure of arterial carbon dioxide. \(\text{FiO}_2\) = fraction of inspired oxygen.
SSS, whether or not they were at high risk of death as determined by their APACHE II score.

The exclusion criteria in the PROWESS trial were also rather stringent (Table 2). The ones that are most relevant to the bariatric surgeon include: surgery within 12 hours of infusion, active postoperative bleeding, gastrointestinal bleeding within 6 weeks before study, known hypercoagulable condition, history of bone marrow, lung, liver, pancreas or small-bowel transplantation and chronic renal failure requiring dialysis as well as acute pancreatitis. Patients could, and did, receive prophylactic doses of both unfractionated and low-molecular weight heparin. Acute renal failure per se was not a contraindication to entering into the study.

APC is now approved by the Food and Drug Administration (FDA) for use in patients with SSS and high risk of death (in whom the relative risk reduction was 30%). At our institution, the protocol for the use of APC is quite rigorous and emu-

| PROWESS trial exclusions | FDA contraindications to APC |
|--------------------------|-----------------------------|
| Pregnancy or breast-feeding | Active bleeding |
| Age <18 yr or weight >135 kg | Hemorrhagic stroke within 3 months |
| Platelet count <30,000/mm³ | Intracranial or spinal surgery within 2 months |
| Conditions that increased the risk of bleeding such as: | Severe head trauma within 2 months |
| • surgery within 12 hours before infusion | Trauma with increased risk of significant bleeding |
| • active postoperative bleeding | Epidural catheter |
| • history of: | Intracranial mass or neoplasm |
| severe head trauma, intracranial surgery or stroke | Cerebral herniation |
| within 3 months before study, intracerebral arteriovenous malformation, mass lesion of the CNS or cerebral aneurism, congenital bleeding diatheses, gastrointestinal bleeding within 6 weeks before study unless corrective surgery had been performed, trauma considered to increase the risk of bleeding | |
| Known hypercoagulable condition: | |
| resistance to APC, hereditary deficiency of protein C or S or antithrombin III, presence of anticardiolipin antibody, antiphospholipid antibody, lupus anticoagulant or homocysteinemia or recently documented or highly suspected deep-vein thrombosis or pulmonary embolism | |
| Family or physician or both not in favor of aggressive treatment | |
| Patient not expected to survive 28 days | |
| Moribund state in which death was perceived to be imminent | |
| HIV infection with CD4 count of ≤50/mm³ | |
| History of bone marrow, lung, liver, pancreas or small-bowel transplantation | |
| Chronic renal failure requiring dialysis (acute renal failure not an exclusion criteria) | |
| Portosystemic hypertension, chronic jaundice, cirrhosis or ascites | |
| Acute pancreatitis with no source of infection | |
| Use of the following medications: | |
| unfractionated heparin >15,000 U/day, LMWH | |
| > prophylactic dose, warfarin within 7 days, | |
| acetylsalicylic acid >650 mg/day within 3 days, | |
| thrombolytic therapy within 3 days | |

Data adapted from reference 17. SIRS = Systemic Inflammatory Response Syndrome. APC = Activated Protein C. PROWESS = Protein C Worldwide Evaluation in Severe Sepsis. CNS = central nervous system. HIV = human immunodeficiency virus. LMWH = low-molecular-weight heparin. FDA = Food and Drug Administration.
lates the PROWESS trial inclusion criteria. A patient must have a clearly documented infection, and meet 3 of 4 SIRS criteria. In addition, he/she should demonstrate evidence of sepsis-induced organ dysfunction. The APACHE (Acute Physiologic and Chronic Health Evaluation) II score must then be calculated. The patient may receive the drug if their score is ≥25 (see Discussion for more details of APACHE II score). APC can only be ordered by a small group of Critical Care and Infectious Disease attendings, in an attempt to ensure that the drug is prescribed appropriately.

In the PROWESS trial, patients with a weight >135 kg were excluded. There is no fundamental physiologic reason, however, that this drug should not be effective in the post-bariatric surgery patient population. In addition, there is growing evidence that obese patients have an elevated baseline inflammatory state, and as such are at high risk for developing the overwhelming inflammatory response that characterizes SSS. There is other data suggesting that if the bariatric surgery is successful and the patients lose weight, the basal inflammatory status improves. For these reasons, we present our experience with drotrecogin alfa as part of a comprehensive sepsis management plan in three patients who developed SSS after bariatric surgery.

Case Reports

Case 1

JL is a 43-year-old man (BMI 48 kg/m²) with type 2 diabetes who underwent laparoscopic Roux-en-Y gastric bypass (RYGBP) for morbid obesity. Against medical advice, the patient decided to leave the hospital 2 days after his procedure. He then proceeded to eat inappropriately large amounts of food. Seven days after the RYGBP, the patient presented to the emergency department of our hospital with hypotension (blood pressure 75/45 mmHg), tachycardia (heart rate 115/min) and respiratory failure, requiring intubation in the emergency department. In addition, he complained of severe diffuse abdominal pain, associated with nausea and vomiting. Based on his physical examination, he was taken to the operating-room (OR), where a distended distal stomach and twisted jejunal loops of the biliopancreatic limb were found, with associated inflammation and edema. The jejuno-jejunal anastomosis was resected and revised, and a 16F gastrostomy tube was inserted. No gross perforation was noted.

He was then admitted to the surgical intensive care unit (ICU) for further evaluation and management, where he subsequently went into cardiovascular failure with an APACHE II score of 26. JL was empirically started on ampicillin, aztreonam and metronidazole postoperatively to cover intraabdominal flora. On postoperative day 1, antimicrobial therapy was switched to cefepime, vancomycin and metronidazole to broaden coverage. Postoperative sputum and blood cultures revealed methicillin-sensitive Staphylococcus aureus and epidermidis, respectively. Vancomycin was subsequently discontinued and cefepime and metronidazole were continued with expectation to complete a 7-day course of therapy. Quinupristin/dalfopristin was added empirically to the regimen when blood cultures drawn on postoperative day 4 revealed Enterococcus faecalis. Following sensitivities of the Enterococcus faecalis and identification of Acinetobacter anistratus from sputum cultures on postoperative day 8, cefepime, metronidazole and quinupristin/dalfopristin were discontinued, and ampicillin/sulbactam was started for a 10-day course.

Twelve hours after completing his surgery, he was started on drotrecogin alfa for a planned 96-hour infusion. Approximately 86 hours into the infusion, however, the patient began to develop significant ecchymoses, and it was felt that the infusion should be stopped. Prior to that, the patient had a decrease in his platelet count from 150,000/mL to 80,000 /mL with an associated elevation in his international normalized ratio (INR) to 2.9. He also had a neurologic event of an unclear nature. As there was concern that this may have been a seizure, a CT scan of the head was performed, which was unrevealing. The patient had a prolonged course in the ICU, but ended up being a 28-day survivor and was able to leave the hospital.

Case 2

ML is a 33-year-old man (BMI 42 kg/m²) who presented to our hospital with severe abdominal pain
associated with nausea and obstipation 2.5 years after an open RYGBP. CT scan of the abdomen revealed a distended distal excluded stomach with dilation of the duodenum and biliopancreatic limb. He was urgently taken to the OR where a diagnostic laparoscopy was performed revealing an obstruction at the jejuno-jejunalostomy and copious amounts of stagnant material in a twisted biliopancreatic limb. The jejuno-jejunal anastomosis was resected and a new one was created between the alimentary and biliopancreatic limbs; the patient subsequently and rapidly developed SSS manifesting as ARDS (severe hypoxemia with bilateral infiltrates on chest roentgenogram and PaO$_2$/FiO$_2$=65) and cardiovascular failure; an APACHE II score of 28 was calculated. His creatinine increased acutely from 0.9 mg/dL to 1.9 mg/dL with associated oliguria (urine output <0.5 mL/kg/hr in spite of aggressive volume resuscitation). His serum lactate was >2 times the upper limit of normal for our hospital.

On admission into the ICU, he was empirically started on ampicillin, metronidazole and ciprofloxacin postoperatively to cover intraabdominal flora. Ampicillin and metronidazole were discontinued on postoperative day 5 and ciprofloxacin was continued to complete a 7-day course of therapy. Following the identification of methicillin-resistant *Staphylococcus aureus* (MRSA) in a sputum culture and *E. coli* in an abdominal tissue culture on postoperative days 6 and 7, respectively, vancomycin was started for a 10-day course of therapy and cefepime was started for a 5-day course of therapy. MRSA was subsequently identified on follow-up bronchoscopy and sputum cultures on postoperative days 9 and 12. Although the patient was culture-negative for *C. difficile*, oral metronidazole was started empirically on postoperative day 12.

Given the severity of his multi-system organ failure, drotrecogin alfa (activated) was started; he was able to tolerate the 96-hour infusion without difficulty. The patient sustained a sepsis-induced coagulopathy; his platelet count decreased from a preoperative level of 305,000/mL to a nadir of 21,000 on day 4 of the infusion. Similarly, his INR increased from 1.0 to 2.8 during the same time. Both of these parameters normalized as his SSS resolved. The patient was appropriately supported with fresh-frozen plasma, platelet transfusions and vitamin K. Despite a somewhat challenging postoperative ICU course, including persistent respiratory failure presumably from irreversible lung damage secondary to ARDS, the patient was a 28-day and long-term survivor.

**Case 3**

TQ was a super-obese 35-year-old man (BMI 85.9 kg/m$^2$) with obstructive sleep apnea / obesity hypoventilation syndrome requiring home noninvasive positive pressure ventilation, who was admitted for a laparoscopic banding procedure. Intraoperatively, venous engorgement was noted in the omental fat pad. During mobilization of the fat pad, a venous injury occurred. Due to excessive hemorrhage and the complexity of the anatomy, the laparoscopic banding was not performed. The patient became hemodynamically unstable in the recovery-room and was returned to the OR where the vascular injury was repaired and the bariatric procedure was performed. The patient was then taken to the surgical ICU where he was successfully extubated the next day and transferred to a standard surgical floor 5 days later.

On postoperative day 7, the patient became tachycardic and developed respiratory failure. He was rapidly brought to the ICU where he clearly had developed SSS secondary to an abdominal wound infection. His PaO$_2$/FiO$_2$ was approximately 200, and his chest roentgenogram revealed bilateral infiltrates, compatible with ARDS. The patient was returned to the OR where approximately 2 L of purulent material was drained from his peritoneal cavity. His empiric broad-spectrum coverage included intravenous ciprofloxacin and ampicillin/sulbactam to cover intraabdominal flora. On postoperative day 2, metronidazole was started for additional anaerobic coverage. The only positive cultures were *Enterococcus* species from the peritoneal fluid. The patient was febrile to 40.6°C (105°F) and developed profound cardiovascular failure; the critical care team was unable to keep his mean arterial pressure ≥65 despite 3 different vasoressors (including vasopressin). He also sustained sepsis-induced renal failure requiring renal replacement therapy, and was found to have elevated liver function tests, consistent with ischemic hepatitis (“shock liver”). As the APACHE II score at that time was 35 and the patient was not actively bleed-
ing, a continuous infusion of drotrecogin alfa was started. Despite all heroic efforts, the patient expired 10 days after the initial procedure. He had received approximately 44 hours of his 96-hour APC infusion. Table 3 summarizes the SIRS criteria, organ dysfunction, and APACHE II score for the three patients.

Discussion and Conclusion

Obesity remains an epidemic in the USA. Recommendations by physicians for diet and exercise can be ineffective. In contrast, medical therapy can be fraught with often dangerous side-effects. For some patients, surgery may be their only viable weight-loss option. The complication rate after surgery, although low, is real and associated with a high mortality, given the increased number of co-morbidities often found in these patients. In addition, although some authors have recently reported that the overall morbidity associated with laparoscopic procedures may be lower than with open bariatric surgery, the laparoscopic leak rate can be elevated during the initial phase for any given institution as the clinicians become facile with the procedure. Management of the postoperative bariatric patient should include early enlistment of a qualified critical care team once a leak is suspected, to provide aggressive, current, evidence-based non-surgical management of the subsequent severe sepsis syndrome that may evolve.

As well-described in a recent article, few other syndromes require the level of on-site physician expertise and multidisciplinary coordination as does SSS and septic shock. The role of the intensivist is to provide airway management, adequate central intravenous access and aggressive volume resuscitation (to a central venous pressure of 8-14 mmHg), as well as using vasopressors if needed (keeping the MAP >60-65 mmHg), sending off appropriate cultures of blood, sputum and urine, and initiating broad-spectrum intravenous antibiotic therapy. At the same time, the surgical team can decide what studies should be obtained to assess the patency of the anastomoses and determine if the patient must be returned to the operating theatre.

An area of confusion regarding the use of APC is the role of the various severity-of-illness scoring systems when considering the use of this drug. Some examples include the APACHE II, MODS (Multiple Organ Dysfunction Score), SOFA (Sequential Organ Failure Assessment), SAPS (Simplified Acute Physiology Score) II, and LODS (Logistic Organ Dysfunction Score) systems. The APACHE II score was used in the PROWESS trial (as it has been used in most Critical Care trials) to demonstrate that the group who received the intervention was approximately as ill as the control group. This somewhat cumbersome scoring system takes into account vital signs, oxygenation, acid-base and electrolyte status as well as white-cell count, hematocrit, mental status, patient age and history of chronic illness (http://www.sfar.org/scores2/apache22.html). As

| SIRS Criteria | T | HR | RR | WBC (X1000/mm³) | Organ dysfunction | APACHE II score |
|---------------|---|----|----|-----------------|-------------------|-----------------|
| Case 1        | + | +  | +  | 14.6            | CV, renal, hematologic, metabolic | 26              |
| Case 2        | + | +  | +  | 18.7            | CV, respiratory, hematologic, metabolic | 28              |
| Case 3        | + | +  | +  | 22.2            | CV, respiratory, renal, hepatic | 35              |

*SIRS: Systemic Inflammatory Response Syndrome. Sepsis: infection plus ≥2 SIRS criteria (see Table 1). T: core temperature ≥38 °C (100.4 °F) or ≤36 °C (96.8 °F). HR: heart rate ≥90. RR: respiratory rate ≥20 or PaCO₂≤32 mmHg. WBC: white cell count. The “+” sign indicates that our patient met that SIRS criteria. CV=cardiovascular dysfunction. Hepatic dysfunction= liver enzymes > 2x the upper limit of normal. APACHE II=Acute physiologic and chronic health evaluation score. Patients considered high risk of death if APACHE II score is ≥25.
part of their approval process, the FDA performed a retrospective post hoc analysis of the data, and found that although the mortality for the entire population decreased from 31% to 25% with the use of the drug, if the data was broken down by APACHE II score, the group of patients with an APACHE II score of <25 received no benefit from the drug, while mortality decreased from 44% to 31% if the APACHE II score was ≥25. This led to the FDA approval of the drug for patients with SSS and a high risk of death as evidenced by an elevated APACHE II score. Many considered this to be a controversial move as there was no precedent for using such a scoring system to select patients for novel therapies.\(^3\) In addition, the APACHE II score can be very dynamic with interobserver and intraobserver variability as high as 10 to 20%.\(^{32}\)

The SOFA scoring system was used by Vincent et al\(^{33}\) in their analysis of secondary endpoints of the PROWESS trial data. This system grades organ dysfunction from 0 (no dysfunction) to 4 (severe dysfunction) and does this for each of five systems (cardiovascular, respiratory, renal, hematologic, and hepatic). In this study, his team was able to demonstrate faster resolution of cardiovascular and respiratory dysfunction with the use of APC in the PROWESS trial. As of yet, however, there is no clear role for SOFA scores for the practicing clinician when attempting to use APC.

Individual institutions have multiple options for determining what constitutes high risk of death in their patients with SSS. In the FDA analysis of the PROWESS trial data, high risk of death was determined to be an APACHE II score ≥25 (associated with a 25% mortality).\(^ {17}\) However, in most large sepsis trials, the requirement for vasopressors or presence of two-organ dysfunction was associated with an elevated (>25%) mortality and as such can be considered appropriate markers of an increased risk of death.\(^ {34}\)

One of the major concerns regarding the appropriate use of APC is cost-effectiveness. Two important recent pharmacoeconomic studies both concluded that when used in the appropriate patient population (severe sepsis with high risk of death), the drug was cost-effective, particularly in younger adults.\(^ {35,36}\) Other authors are less convinced by the cost-effectiveness data.\(^ {37,38}\) It is clear from these studies, however, that APC is at least as cost-effective as other well-accepted interventions, such as the use of thrombolysis for acute myocardial infarction and air bags in automobiles.

Another concern is the risk of hemorrhage associated with APC, as it is known to have anticoagulant properties. The rate of significant hemorrhages during the PROWESS study was 2% in the placebo group and 3.5% in the APC group, a difference that was not statistically significant.\(^ {39}\) Most hemorrhages occurred during the infusion of the agent itself, and were associated with bedside procedures (such as central line placement or chest tube thoracostomy). Active internal bleeding is the primary contraindication to the use of this agent. In addition, APC infusions should be stopped for a full 12 hours after major surgery.

Regarding the dosing of the agent in the obese, the currently available data shows that the clearance increases linearly with weight.\(^ {40,41}\) As such, it is recommended that the standard dosing regimen (24 mcg/kg/hr X 96 h) be used in bariatric patients with maximum dosing weights of between 150 and 175 kg, to strike a balance between therapeutic efficacy and cost-effectiveness (G. Bernard and E.W. Ely, Vanderbilt University, personal communication). Currently, a pharmacokinetic trial of APC is underway for patients weighing >135 kg (M.D. Williams, Eli Lilly and Company, personal communication), that will help to determine the optimal dosing weight for patients with severe sepsis syndrome and an elevated BMI.

When managing the bariatric septic patient, the clinician should be aware of certain unique problems that must be addressed. These patients often require large absolute amounts of narcotics, sedatives, vasopressors, and fluids compared with nonobese patients. In addition, given their body habitus, they may have high peak airway and plateau pressures during mechanical ventilation. This is often due to a stiff chest wall rather than noncompliant pulmonary parenchyma, but nevertheless remains a concern given the possibility of barotrauma. The large amount of adipose tissue in these patients may act as a reservoir for certain drugs. For this reason, the critical care pharmacist must carefully evaluate the medications used in the bariatric patient. Because of pre-existing steatosis, these patients may be at higher risk for liver dysfunction. None of our patients had pre-existing liver disease,
although the patient in case 3 did develop “shock liver” after the onset of sepsis. Finally, as in all patients with SSS, the importance of rapid and definitive source control of infections in bariatric patients with SSS cannot be overemphasized.

In conclusion, although every precaution is taken to prevent SSS in the bariatric patient, it is critical to be able to recognize it when it does occur and use an aggressive, multidisciplinary approach to prevent irreversible organ dysfunction and death in SSS. The best option for a successful outcome in bariatric patients who develop SSS is the close interaction between surgeons and intensivists to rapidly apply appropriate, evidence-based therapies in a coordinated and integrated fashion. Only then will bariatric patients have the greatest chance to survive this often deadly surgical complication.

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