What to Do About
Obstructive Urosepsis

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Sepsis has been described as the systemic inflammatory response to infection.[1] A set of definitions has been published from the consensus conference of the American College of Chest Physicians and the Society of Critical Care Medicine (Table 1).[2] Urosepsis implies that the focus of infection causing sepsis arises from the urinary tract. Urinary tract obstruction can occur at any level, and it can be due to congenital or acquired causes (Table 2). When infection becomes associated with an obstruction, the situation can quickly move to urosepsis requiring urgent intervention.

What is the clinical presentation?

Given the systemic response to infection and sepsis, there are several clinical changes seen (Table 3).

The presentation may vary and be very insidious. The classic presentation of fever and chills followed by hypotension may be seen in as little as 30% of patients. One of the earliest signs of sepsis may be an increased ventilatory rate with resultant respiratory alkalosis. There may also be a change in mental status with confusion occurring.

Victor's illness

Victor, 45, presented with a three-week history of intermittent left side flank pain. He was diagnosed with a ureteropelvic junction 1.0 cm stone.

Victor is at home awaiting a urologic referral. He developed a fever of 38.6 C, and was put on oral ciprofloxacin hydrochloride with good results.

After 7 days of antibiotics, Victor developed weakness and a return of his fever. He was admitted to his local hospital where he continued to worsen over a 24-hour period. Despite intravenous fluids and antibiotics, his blood pressure dropped to 90/70 mmHg. Further fluids and dopamine were administered with some response. Victor was then airlifted to a tertiary care centre. His blood pressure on arrival was 80/40 mmHg. Upon arrival, he was conversing, but was weak. His medical history included hypertension, diabetes of a 10-year duration. On examination, Victor was pale, and his extremeties were cool. His abdomen was normal, with slight tenderness left flank.

Laboratory results revealed:

- White blood cells $15x10^9$/L
- Hemoglobin 132 g/L
- Glucose 11.7 mmol/L
- Creatinine 243 mmol/L
- Blood gases on 40% oxygen
  - $P0_2$ 48 mmHg
  - $_PC0_2$ 28.2 mmHg
  - $_pH$ 7.32

Central and arterial lines were put in place in the emergency department, and dopamine was continued. Victor was transferred to the operating room for ureteric stenting under a neurolept anesthesia.

He was admitted to the intensive care unit on pressor agents for 48 hours. His blood cultures grew enterobacter agglomerans.

After his discharge, Victor had delayed extracorporeal shock wave lithotripsy.

Table 1
Current definitions

State	Criteria
Systemic inflammatory response syndrome (SIRS)	Any two of the following: • Temperature > 38 C or < 36 C • Heart rate > 90 beats per minute • Respiratory rate > 20 breaths per minute or $PaCO_2$ < 32 mmHg • White blood cells > 12 x 10^9/L or < 4% or >10% band forms
Sepsis	SIRS plus clinical signs of infection.
Severe sepsis	Sepsis association with organ dysfunction, hypoperfusion or hypotension.
Septic shock	Sepsis, plus hypotension despite adequate fluid resuscitation, plus hypoperfusion changes, such as lactic acidosis, oliguria, or alteration in mental status.

Adapted from: Bone R, Back RC, Cerra FB, et al: Definition for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest 1992; 101(6):1644-55.

Leukocyte response may range from leukocytosis to leukopenia, or may remain normal.

The circulatory system may show tachycardia > 90, increased cardiac output, and decreased systemic vascular resistance. This will clinically show as "warm" shock with hypotension and a febrile flushed appearance. This phase may give the physician a false sense of security, as the patient may be conversing and tolerating the situation quite well. As events progress with further losses of intravascular volume and decreased vascular tone, the patient may soon convert to "cold" shock with lower blood pressure and cooler extremities. This development is ominous and early intervention is a must.

As the disease progresses, other pulmonary changes will occur with increased pulmonary vascular resistance and ventilatory perfusion mismatching. In addition, the permeability of the pulmonary capillaries increases, leading to fluid and protein extravasation into the pulmonary alveoli. The resultant pulmonary edema leads to a clinical picture of adult respiratory distress syndrome.

Other systems may become involved with progressive renal and/or hepatic dysfunction. The coagulation system may also be disrupted with disseminated intravascular coagulation occurring.

Table 2
Causes of urologic tract obstruction

Level	Type	Common causes
Renal	Congenital	• Ureteropelvic junction obstuction, • Polycystic kidney
	Acquired	• Calculi • Transitional cell tumour • Retroperitoneal tumours • Sloughed papillae • Trauma
Ureteric	Congenital	Stricture, ureterocele, ureterovesical reflux, retrocaval ureter
	Acquired	• Calculi • Transitional cell carcinoma • Extrinsic malignancy with compression of ureter • Abcess • Endometriosis • Retroperitoneal fibrosis • Radiation therapy • Trauma • Pregnancy
Bladder and Urethra	Congenital	Phimosis, urethral stricture
	Acquired	• Cancer involving bladder, prostate, urethra, or penis • Bladder stones • Benign prostatic hypertrophy • Neurogenic bladder

Table 3
Clinical changes seen in sepsis

Respiratory
- Tachypnea
- Increased a-a gradient
- Decreased $PaCO_2$
- Alveolar edema
- Adult respiratory distress syndrome

Cardiovascular
- Hypotension
- Tachycardia
- Peripheral vasodilatation
- High cardiac output

Renal
- Decreased urinary output
- Progressive renal failure

Hemotologic
- Coagulation problems
- Disseminated intravascular coagulation

Neurologic
- Confusion
- Decreased level of consciousness

Metabolic
- Increased glucose

Cutaneous
- Vasodilatation (early)
- Vasoconstriction (late)
- Mottling, purpura (late)

Adapted from:
Bone RC, Back RA, Cerra FB, et al: Definition for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest 1992; 101(6):1644-55.

Weigelt JA, Lewis FR Jr, Rice C (eds.): Surgical Critical Care. WB Saunders, Philadelphia, 1996.

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What are the treatments?

With obstructive urosepsis, the immediate goal is to stabilize the patient and intervene as soon as possible to ensure drainage of the obstructed, infected system. Supportive care may be as simple as fluid resuscitation and oxygenation prior to the urologic procedure,

Table 4

General treatment of sepsis and septic shock

Area of Concern	Approach
Ventilation	Oxygenation may deteriorate; patient may require increased FiO_2, consider intubation if persistent decreased O_2, increased CO_2 or ventilatory distress
Circulation	Patient should have crystaloid bolus 1-1.5 L; colloid may be used in lesser amounts; if hemoglobin low, should be brought up to 9-10 gm/dL
Antibacterial	Ensure blood and urine cultures done prior to antibiotics; use appropriate empiric antibiotics until cultures return
Monitoring	Pulse oximetry for oxygen saturation; if pressure is difficult to monitor, or the patient requires inotropes, arterial line should be used; CVP and/or pulmonary arterial line monitoring may be required
Inotropes	May be required if initial fluid resuscitation does not work. • Dopamine 1-50 mcg/kg/min • IV norepinephrine 2-12 mcg/min IV • Dobutamine 2-20 mcg/kg/min

CVP: Central venous pressure IV: Intravenous

Adapted from: Guidelines for the management of severe sepsis and septic shock. Intensive Care Medicine 2001; 27(suppl 1):S1-134.

Weigelt JA, Lewis FR Jr, Rice C (eds.): Surgical Critical Care. WB Saunders, Philadelphia, 1996.

or may require full intensive care unit admission to stabilize the patient prior to intervention. The decision as to how to proceed should be balanced between the need for hemodynamic stability and urologic drainage. One should ensure good vascular access and monitoring prior to intervention, as these patients may deteriorate after manipulation of the infected urologic system.

As with any resuscitation, one should strive for good oxygenation, ventilatory support, and fluid resuscitation. Refractory hypotension may be treated by the use of vasopressors where needed (Table 4).

Alongside the basic therapy, one needs to simultaneously deal with the bacteremia by ordering

Table 5
Antibacterial treatment of urosepsis

Subset	Usual pathogens	Preferred IV therapy	Alternate IV therapy	IV to PO switch
Community aquired **Use gram stain to differentiate**	Entero-Bacteriaceae (gram–ve bacilli)	Quinolone IV or ceftriaxone, 1 g IV every 24 hours for 7 days	Gentamicin for 7 days, or aztreonam 2 g IV every 8 hours	Quinolone for 14 days, or TMP-SMX for 14 days
	Enterococci (E. fecalis) Gr. B Strep (gr+ve cocci)	Ampicillin, 2 g IV every 4 hours	Meropenam, 1 g every 8 hours, or imipenam, 1 g every 6 hours	Amoxicillin, 1 g every 6 hours for 14 days, or quinolone for 14 days
Hospital exposed, previous urologic intervention, indwelling urologic device	P. aeruginosa Enterobacter Klebsiella Serratia	Cefipime, 2 g IV every 8 hours, or ceftazidime, 2 g IV every 8 hours, or cipro, 400 mg IV, every 12 hours	Piperacillin, 4 g IV every 8 hours or aztreonam, 2 g IV every 8 hours for 7 days, or gentamicin, for 7 days	Cipro, 500 mg oral twice daily, or levofloxacin, 500 mg oral, or gatifloxacin, 400 mg oral once a day
	Non aeruginosa pseudomonas (B. cepacia, S. maltophilia)	TMP-SMX, 2.5 mg/kg IV every 6 hours	Meropenam, 1 g every 8 hours, or impenam, 1 g every 6 hours	TMP-SMX for 14 days, or quinolone for 14 days

IV: Intravenous PO: orally

With permission from: Cunha BA: Antibiotic Essentials. Physicians' Press, Michigan, 2002.

appropriate cultures and initiating empiric antibiotic therapy (Table 5). Issues to consider when choosing an antibiotic is whether the infection is community-acquired or whether the patient had exposure to hospital organisms, urologic intervention, or chronic drainage devices. The latter group has an increased risk of having resistant bacteria or associated pseudomonas infection. This may require antibiotics with an expanded spectrum of coverage.

Ampicillin and gentamicin will usually give good coverage for community-acquired infection. However, the use of gentamicin in a situation where there is a risk of progressive renal dysfunction should be monitored carefully. Alternatives include the use of fluoroquinolones or third generation cephalosporins.

Drainage of the obstructed system is based on the level and cause of obstruction. Blockage at the bladder level can be relieved by foley catheter drainage, urethral or suprapubic. Obstruction of the ureter or kidney can be treated by internal stenting or external nephrostomy drainage (Figure 1). Intervention should take place as soon as the patient is stable enough to proceed.

This is a very important point because with initial resuscitation the patient may improve, but without definitive drainage, relapse may soon occur and may be worse than the initial presentation. Also, obstruc-

Figure 1. Nephrostomy tube insertion in the drainage of an affected urologic system.

tion of a kidney with infection tends to lead to accelerated damage of the renal unit, even in the face of appropriate antibiotics. Therefore, delay may lead to long-term renal impairment.[3]

What can be done for prevention?

There is very little that a physician can do in the community-acquired setting, in the way of prevention, as most of these situations occur with little warning. There are, however, some clinical situations that require special mention.

What about patients with renal colic?

Patients with active renal colic disease occasionally present with symptoms or signs of infection that worry the clinician enough to start antibiotics. Common reasons for this are irritative voiding symptoms, pyuria, or mildly elevated white blood cell count. Patients are then discharged on antibiotics, to carry on with their conservative care.

The practice of prophylactic antibiotics in the hopes of avoiding infection should not be implemented unless the patient has developed a fever or significant signs of infection. The patient should then be cultured and treated, and arrangements should be made for immediate urologic intervention.

Discharge on antibiotics prior to intervention may mask underlying infection until it becomes serious, and may possibly lead to a septic shock presentation.

What about urologic intervention?

Patients having urologic manipulation that may cause obstructive urosepsis should have appropriate prophylactic antibiotics and assurance of good drainage of the affected system post-operatively. If this does not occur, these patients may present to the emergency department in some degree of distress. A common scenario involves a post-ureteroscopy patient who develops repeat obstruction post-surgery. If patients present with fever and pain, they should be treated aggressively with antibiotics and urologic drainage. Once again, these patients should not be discharged on antibiotics in hopes that they will improve.

What about my patients who have indwelling urologic devices

Finally, patients who have indwelling external urologic devices (nephrostomies and foley catheters) should not have chronic suppressive antibiotics, as this leads to resistance. If these patients develop symptomatic infections, they should have the device exchanged, in addition to treatment with appropriate antibiotics on a short-term basis. If the devices block or are displaced, early replacement with covering antibiotics should be done. Delay in replacement can lead to progressive infection and sepsis. CME

References
1. Rachow EC: Clinical definition of sepsis and septic shock. In:Sibbald WJ, Sprung CL (eds) New Horizons: Perspectives of sepsis and septic shock. Society of Critical care medicine, 1986, Fullerton, pp 1-9.
2. Bone R, Back RA, Cerra FB, et al: Definition for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest 1992; 101(6):1644-55.
3. Walsh P (ed.): Campbell's urology. Patrick Walsh, Philadelphia, 2002.

Net Reading

1. National Initiative in Sepsis Education: *www.nise.cc*

www.stacommunications.com

For an electronic version of this article, visit: *The Canadian Journal of CME* online.