

Second edition – November 2003

Promoting a better understanding of **SEPSIS**

Produced by the International Sepsis Forum



The International Sepsis Forum is a volunteer organization dedicated to the advancement of the treatment of sepsis. The organization promotes the education of both physicians and laypersons in understanding sepsis

WHAT IS SEPSIS?

Sepsis can be defined as the body's response to an infection. An infection is caused by microorganisms or "germs" (usually bacteria) invading the body, and can be limited to a particular body region (e.g., a tooth abscess) or can be widespread in the bloodstream (often called "septicemia" or "blood poisoning").

WHO IS AT RISK?

Although everybody is at potential risk of developing sepsis from minor infections (e.g., 'flu, urinary tract infections, gastroenteritis, etc.), sepsis is most likely to develop in people who:

- Are very young (e.g. premature babies) or very old
- Have a weakened ("compromised") immune system, often because of treatments such as chemotherapy for cancer, steroids (e.g. cortisone) for inflammatory conditions, etc.
- Have wounds or injuries, such as those from burns, a car crash, or a bullet
- Have certain addictive habits, such as alcohol or drugs
- Are receiving certain treatments or examinations (e.g., intravenous catheters [a small tube for dripping fluids into the vein], wound drainage, urinary catheters [a small tube inserted into the bladder])
- Are more prone to develop sepsis than others because of genetic factors (or their "genes")



Patients who are admitted to the hospital with serious diseases are at the highest risk of developing sepsis because of:

- Their underlying disease
- Their previous use of antibiotics
- The presence of drug-resistant bacteria in the hospital
- The fact that they often require an intravenous tube, urinary catheter, or wound drainage

The infection leading to sepsis can be acquired outside the hospital (known as “community-acquired”) or in the hospital (known as “nosocomial”). Hospital-acquired infections are generally more difficult to manage than those acquired in the community, because:

- The infecting microorganism is more dangerous to the patient
- The patient is often already sick
- The microorganism may be resistant to common treatments due to the widespread use of antibiotics in hospitals

■ IS THE OCCURRENCE OF SEPSIS INCREASING OVER TIME?

Yes, sepsis is becoming more common, especially in the hospital, as a result of:

- Medical and technological advances associated with treatments
- The increasing number of elderly or debilitated people, and patients with underlying diseases such as cancer, who require therapy
- The widespread use of antibiotics, which encourages the growth of drug-resistant microorganisms

■ ARE THERE MANY FORMS OF SEPSIS?

Sepsis occurs in three different forms or stages, called:

- Uncomplicated sepsis
- Severe sepsis
- Septic shock

The disease progresses in some people through all three stages. Despite optimal (best or most favorable) care, some patients may not respond to treatment, and may develop multiple organ disease and eventually die.

■ UNCOMPLICATED SEPSIS

Uncomplicated sepsis, such as that caused by ‘flu and other viral infections, gastroenteritis, or dental abscesses, is very common and is experienced by millions of people each year. The majority of these people will not need hospital treatment.

SEVERE SEPSIS

We estimate that more than 750,000 individuals develop severe sepsis in North America each year, with similar estimates for Europe, and all need to be actively treated in the hospital. Severe sepsis arises when sepsis occurs in combination with problems in one or more of the vital organs, such as the heart, kidneys, lungs, or liver.

Because of problems with their vital organs, people with severe sepsis are likely to be very ill and are more likely to die (in 30–35 % of cases) than those with uncomplicated sepsis.

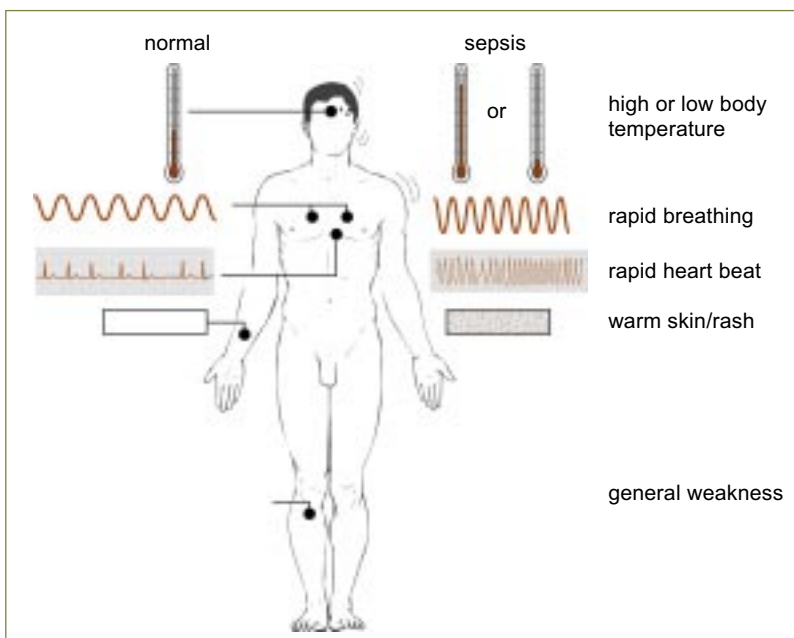
SEPTIC SHOCK

Septic shock occurs when sepsis is complicated by low blood pressure that does not respond to standard treatment (fluid administration) and leads to problems in one or more of the vital organs as described above. The condition means that the body does not receive enough oxygen to properly function and drugs called vasopressors are used to raise the blood pressure. Septic shock patients are very ill and need rapid emergency admission to the hospital intensive care unit (“ICU”). Despite active treatment in the ICU, the death rate is around 50%.

HOW DOES SEPSIS SHOW ITSELF?

All three forms of sepsis can be identified by general signs, symptoms, and biological alterations, including those specific to the source of infection.

GENERAL SIGNS AND SYMPTOMS IN SEPSIS



Sepsis patients generally have the following symptoms:

- Fever (i.e., high body temperature), often associated with shaking chills, especially in the early phase. However in some cases there is no fever, and patients may even have an abnormally low body temperature (“hypothermia”), especially if they are young or old
- Difficulty with breathing (“hyperventilation” or rapid breathing), that may result in shortness of breath
- Warm skin, sometimes associated with a skin rash
- Rapid heart beat (“tachycardia”)
- General weakness

■ INFECTION SITE-SPECIFIC SIGNS AND SYMPTOMS OF SEPSIS

Some of the symptoms of sepsis also depend on the source of the infection, as shown by the following examples:

- With lung infection, there may be a shortness of breath and/or pus-like (known as “purulent”) sputum (“phlegm”)
- With urinary tract infection, the patient may have painful urination and/or smelly urine
- With a central nervous system infection like meningitis, the patient may have a severe headache, reduced tolerance to light, and a stiff neck
- With abdominal infections, e.g., appendicitis, patients may have abdominal pain

■ BIOLOGICAL ALTERATIONS IN SEPSIS

Sepsis leads to alterations in the normal biological state of our bodies, such as:

- Altered white blood cell count – usually the number of white blood cells is increased in sepsis, reflecting the infection-fighting properties of these blood cells. However, in some severe cases the white blood cell count may actually be abnormally low
- Bacteria or other microorganisms identified in biological fluids, such as blood, urine, phlegm, using laboratory tests

■ SIGNS OF ORGAN DYSFUNCTION IN SEVERE SEPSIS AND SEPTIC SHOCK

In severe sepsis and septic shock, the performance of any vital organ may be reduced, regardless of the source of infection.

■ The respiratory system

■ Sepsis patients often have serious respiratory problems (breathing difficulties) and these can sometimes lead to lung injury. Many patients require oxygen therapy, some may require insertion of a tube into their airway (“tracheostomy” or an “endotracheal tube”), and some may even need help by breathing machines (“mechanical ventilation”)

■ The kidney

■ Alterations in kidney function can occur, and are often associated with a decrease in urine output. In very severe cases, the kidney may sometimes temporarily fail entirely, and the patient's blood will require repeated dialysis and/or continuous filtration using machines (i.e. use of an "artificial kidney")

■ The blood flow and blood clotting ("coagulation") system

■ Abnormalities in the blood clotting system are common and may affect the organs

■ The central nervous system

■ The patient may be disoriented, confused, or have decreased alertness

■ Liver function

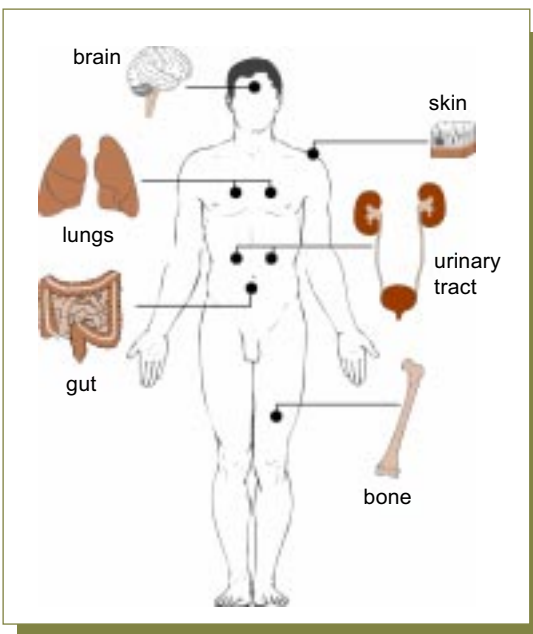
■ Alterations in the liver can occur and may result in jaundice (a yellow discoloring of the skin)

■ Alterations in blood sugar ("hyperglycemia", "hypoglycemia")

■ Alterations in sugar concentrations in the blood may require insulin administration even in non-diabetic patients

People with problems in more than one of their organs are said to have "multiple organ dysfunction or failure"

■ WHAT ARE THE MOST COMMON SOURCES OF SEPSIS?



Sepsis can be caused by an infection in virtually any part of the body, although the following regions are most common:

■ **The lungs**

■ The lungs are the major source of infection in severe sepsis (especially with hospital-acquired infections), with sepsis usually associated with pneumonia

■ **The abdomen (“gut” or bowel)**

■ There are numerous possible sources of infection in the abdomen, e.g., appendicitis, bowel problems, gallbladder infections. When the outer surface of the abdominal organs (called the peritoneum) is involved in the infection, it is called “peritonitis”

■ **The urinary tract (kidney or bladder)**

■ The urinary tract is another common source of infection, particularly in patients needing a urinary catheter. Diabetic patients are also at increased risk of urinary infections leading to sepsis

■ **The skin**

■ Bacteria enter the skin through wounds and skin inflammations; they also enter the skin and blood through an opening provided by intravenous (“IV”) catheters (small tubes for dripping fluids), which are required for the administration of fluids and/or medicines

■ **The bones**

■ Sepsis can be associated with inflammation and infections of the bone, the bone marrow, the sinuses, etc

■ **The central nervous system**

■ Sepsis can be associated with inflammation and infections in the brain (e.g., meningitis or encephalitis) or spinal cord

In some cases (around 20%), the source of the sepsis can never be found.

■ **HOW IS SEPSIS TREATED?**

People with severe sepsis are very sick and typically require ICU treatment.

The treatment of severe sepsis and septic shock may include:

- Antibiotics to treat the infection
- Surgery to control the source of the infection
- Fluids through the intravenous or IV catheter (“drip”) – these fluids may sometimes include nutritional liquids if the patient cannot eat normally
- Drugs to raise the blood pressure or improve the function of the heart
- Specific sepsis treatments that bolster the body’s defenses against sepsis and its effects
- Organ support, such as artificial ventilation for the lungs (“breathing machine”), kidney support (“kidney machine”), etc

Despite the best possible care, some patients may not respond to treatment, and but rather develop further organ failure and die.

Research into better treatment methods continues. Recent studies have shown that survival in some patients with severe sepsis can be improved with medications that alter blood clotting, reduce inflammation, or support the stress response, and by new approaches to support organ function. These treatments are not appropriate in all patients. These therapies may include:

- Activated protein C
- Steroids
- Giving therapy to improve blood flow
- Using modest breath sizes
- Maintaining blood sugar

■ IDENTIFICATION OF THE INFECTION SOURCE

Identifying the source of the infection helps to determine what antibiotic therapy should be used and may reveal an infected site that can be drained. This process requires:

- Careful clinical examination
- Procedures such as chest X-rays, CT scans, urine analysis, etc
- Collection of biological specimens (e.g., wound swabs, sputum samples, urine specimens, blood samples, etc) for bacteriological (or laboratory) analysis or testing to identify the type of microorganism causing the infection

The sooner the infection can be eradicated, the greater the probability of a cure.

■ ANTIBIOTIC TREATMENT

Antibiotic therapy is essential to kill the infective microorganisms. In many cases, the microorganism cannot be identified immediately and a so-called “empiric” antibiotic treatment is given to kill a large range of different microorganisms (broad-spectrum treatment). Once the bacteriological tests show which microorganisms are present, the antibiotics may need to be changed and tailored for the specific microorganism(s). Indeed, continuing broad-spectrum antibiotics when they are not necessary may result in an increased number of drug-resistant bacteria leading to more severe consequences for the patient and other individuals. For severe infections, antibiotics must be administered directly into the vein (intravenously).

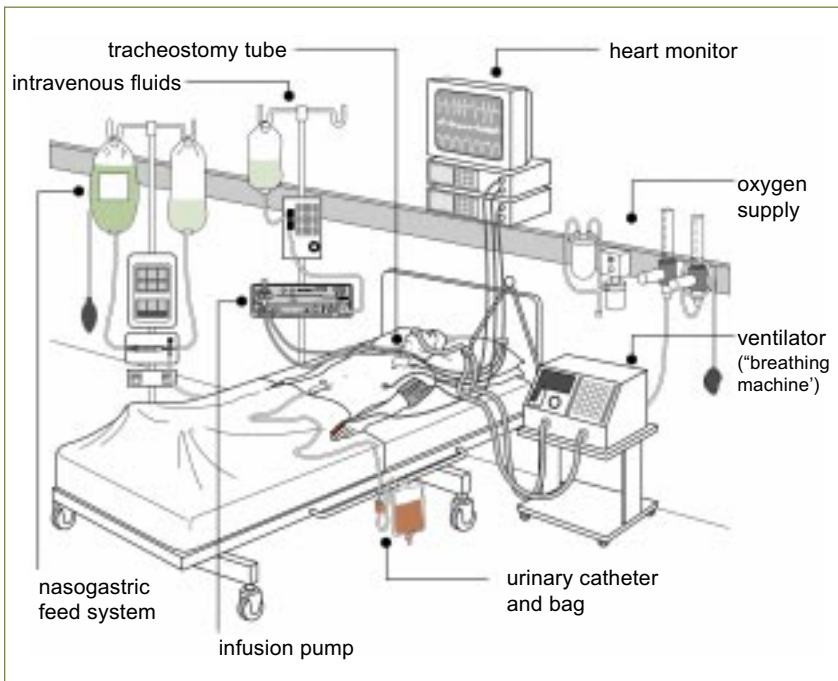
ERADICATION OF THE INFECTIOUS SOURCE

Surgery or a more localized procedure (e.g., one guided by X-rays) may be required to eradicate the source of infection.

Additional treatments

Some patients may also need the following treatments:

- Artificial feeding by a tube connected to the stomach through the nose
- Pain killers and/or sedative medicines
- Tubes inserted into the large vein in the neck
Intravenous catheters, urinary catheters, etc
- Patients in an ICU also often develop so-called “stress ulcers” which cause bleeding in the digestive tract. The doctor will try to prevent these ulcers and bleeding with the use of certain drugs



GLOSSARY OF TERMS

The following terms and meanings have been used in this article:

Abdomen	“Gut” or bowel
Antibiotics	Treatments used for infections
Artificial feeding	Feeding by a tube into the stomach through the nose
Broad-spectrum treatment	Treatment that targets a large number of different microorganisms
Cardiovascular	Heart and circulatory
Coagulation	Blood clotting
Community-acquired infection	Infection caught outside the hospital
Compromised	Weakened
Cortisone	A steroid drug
Dialysis	Artificial kidney
Empiric treatment	Broad-based antibiotic treatment based on prior experience of the microorganism
Fever	High body temperature
Gastroenteritis	Inflammation of the stomach and intestine or “gut”
Hyperglycemia	Abnormally high levels of blood sugar
Hyperventilation	Abnormally rapid breathing
Hypoglycemia	Abnormally low levels of blood sugar
Hypothermia	Low body temperature
ICU	Intensive care unit
Intravenous catheter	Small tube for dripping fluids into the vein
IV	Intravenous

Jaundice	Yellow discoloring of the skin
Mechanical ventilation	Breathing machine
Microorganism	Infecting germ
Multiple organ disease, dysfunction, or failure	Disease involving more than one of the vital organs, such as the heart, lungs, kidney, liver
Nosocomial infection	Infection caught within the hospital
Optimal	Best, most favorable
Peritonitis	Infection of the gut wall
Purulent	Pus-like
Sepsis	The body's response to an infection
Septicemia	Blood poisoning
Sputum	Phlegm
Tachycardia	Rapid heart beat
Tracheotomy	Insertion of tube directly into the trachea by a hole made through the skin
Urinary catheter	Small tube inserted into the bladder. Also called a Foley catheter
Vasopressor	Drug used to increase blood pressure

ADDITIONAL READING

www.sepsisforum.org
www.ards.org

Produced by the International Sepsis Forum, a volunteer organization dedicated to the advancement of treatment of sepsis, and to improving physicians' and the public's understanding of sepsis through education.

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