In Brief

Acute care for patients with diabetes varies greatly depending on the nature of the patients’ primary illness and physical condition during hospitalization. The following two case studies review common considerations when treating 1) diabetic patients who develop infections; and 2) hyperglycemic inpatients who have had an acute myocardial infarction or cerebrovascular accident.

Case Study: Infections in Diabetes Mellitus

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Presentation

P.F., a 67-year-old man, presented to the emergency room at the Memphis Veterans Administration Hospital with a 5-day history of progressively worsening left-sided facial pain. The pain initially began in his ear. He also noted purulent drainage from the ear. The patient also complained of subjective fevers and chills. His hearing remained normal. He had no cough, sinus drainage, dysuria, nausea, vomiting, rashes, back pain, or cutaneous ulcers.

His medical history was significant for poorly controlled diabetes of 25 years’ duration. He did not follow a meal plan. His hemoglobin A1c concentration measured 2 months previously was 11.8%. He also had a history of nonproliferative diabetic retinopathy and peripheral sensory neuropathy and a 10-year history of hypertension.

Medications at admission included glyburide, 5 mg twice a day, and benazepril, 10 mg daily. He had no allergies. He neither smoked cigarettes nor drank alcohol, and he had no history of substance abuse. His family history was significant for diabetes and hypertension in his father and grandfather.

Physical examination revealed an elderly Caucasian man in obvious discomfort. His temperature was 100.0° F. His pulse was 100, respiratory rate was 19, and blood pressure was 130/70 mmHg.

His left external auditory canal was erythematous and edematous. It was exquisitely tender on examination. Granulation tissue was visible. The tympanic membrane was obscured by debris. The external ear was warm to touch, erythematous, and tender. A 2-cm ring of erythema surrounded the ear. The right external ear, external auditory canal, and tympanic membrane were normal.

The oropharynx had no masses or erythema. Nasal mucosa was normal. Sclerae were nonicteric, conjunctivae were noninjected, and ocular movements and reflexes were normal. Fundoscopic examination revealed some arterio-venous crossing changes of hypertension.

The patient’s neck was supple without lymphadenopathy or thyromegaly. His chest was clear. Cardiovascular and abdominal examinations were normal. Rectal examination revealed a diffusely enlarged prostate without nodules. Stool was brown and heme-negative.

P.F. was awake, alert, and communicative. Cranial nerve examination was normal. Decreased sensation to light touch and pinprick was noted in a stocking distribution in the lower extremities. Reflexes were absent in the ankles.

Laboratory studies revealed a leukocyte count of 9,000 with 30% band forms. Hematocrit was 42. Platelet count was 421. Serum chemistries revealed a sodium of 132 mEq/L, a potassium of 3.8 mEq/L, chloride of 106 mEq/L, bicarbonate of 26 mEq/L, BUN of 38 mg/dl, and a creatinine of 2.3 mg/dl. Serum glucose was 426 mg/dl. Hepatic functions were normal. Urinalysis revealed 1+ protein. Chest X-ray was normal. Electrocardiogram revealed a sinus tachycardia and was otherwise normal.

Commentary

Individuals with diabetes can have any infection that affects the general population. However, people with diabetes are at increased risk of a variety of specific infectious complications. Infections associated with either increased frequency or severity among individuals with diabetes include mucormycosis; cystitis; complicated urinary tract infections, including pyelonephritis; intrarenal abscesses; perinephric abscesses; pneumonia; lower-extremity soft tissue infection, including polymicrobial gangrene; emphysematous cholecystitis; and malignant otitis externa (Table 1).1 Individuals with diabetes also have increased carriage rates of Staphylococcus aureus, which likely translates into increased risk for infection with this organism.2 The pathophysi-
Complications of the infection include cavernous sinus thrombosis, retinal artery invasion, carotid artery thrombosis, and intracerebral abscess and infarction.

Diagnosis is made by a biopsy specimen demonstrating organisms invading tissue. Therapy involves a combination of correction of any DKA, surgical debridement, and treatment with amphotericin B. Some case reports have suggested benefit from adding hyperbaric oxygen to standard therapy.7 In one series, overall mortality from orbital involvement was 33%, with significant improvement being seen in the past two decades.8 Survival has been shown to be dependent on early diagnosis and initiation of treatment.9

P.F. was examined by his admitting physician and otolaryngologist shortly after admission. No suspicious lesions were noted on nasopharyngeal examination. The patient had no cranial nerve, ocular, or sinus symptomatology.

Several studies have linked patients with diabetes, particularly those who inject insulin, to a higher incidence of carriage of Staphylococcus aureus than the general population.10 Other studies have failed to link Staphylococcal carriage to insulin injection but have shown a high carriage rate for both insulin- and noninsulin-using diabetic patients.11 Some investigators have suggested that individuals with diabetes have a higher incidence of both Staphylococcal bacteria and excess mortality.12 However, those studies remain inconclusive.

There does appear to be evidence that individuals with a clear focus of a staphylococcal infection have a higher incidence of infective endocarditis.13 Clearly, patients with renal failure have a high incidence of clinically relevant staphylococcal infection because of infected temporary and permanent access grafts.14 P.F., however, had negative blood cultures, and careful examination failed to reveal a focus of staphylococcal infection.

Urinary tract infections are also more common among patients with diabetes. Women with diabetes are at a particularly increased risk of urinary tract infection.15 Upper tract infection has been shown to be significantly more common in patients with diabetes. E. coli is the most common causative organism, followed by other gram-negative bacteria. Because of the high incidence of often unsuspected upper tract infection, a 7- to 14-day course of therapy has been recommended for treatment of cystitis among patients with diabetes.16

Pyelonephritis is clearly more common in patients with diabetes. It is treated similarly to pyelonephritis in nondiabetic patients. Other renal infections that are more common in individuals with diabetes include renal carbuncles (intrarenal abscesses caused by the hematogenous spread of S. aureus), renal corticomedullary abscesses (intrarenal foci of infection associated with reflux and obstruction caused by the same organisms that typically cause pyelonephritis), and the rare but devastating emphysematous pyelonephritis, associated with gas formation within the kidney.

The latter infection is usually caused by E. coli or other gram-negatives and is typically detected by a routine X-ray of the abdomen. A combination of surgery and medical therapy is usually required. Perinephric abscesses are caused either by the rupture of intrarenal abscesses into tissue surrounding the kidney or by the hematogenous or lymphatic deposition of organisms into that tissue. Gram-negative organisms such as E. coli are the most common reported causative bacteria. However, a wide variety of organisms, such as S. aureus, fungi, anaerobes, and mycobacteria, have been reported as causes.

Diabetes is very clearly associated with these infections. Underlying renal pathology, such as vesicoureteral reflux and obstructive uropathies, are also strongly associated with these abscesses.

Presenting symptoms are quite variable and most commonly include flank pain. Diagnosis is usually made by radiographic studies, such as ultrasound or CT scans, to evaluate flank pain or persistent fever. Appropriate

<table>
<thead>
<tr>
<th>Disease</th>
<th>Organism</th>
<th>Risk Factor</th>
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<tbody>
<tr>
<td>Mucormycosis</td>
<td>Rhizopus Spp, Rhizomucor</td>
<td>Hyperglycemia</td>
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<tr>
<td>Staphylococcal carriage</td>
<td>Staphylococcus aureus</td>
<td>Hyperglycemia</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>E. coli, other gram-negatives</td>
<td>Hyperglycemia, female sex</td>
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<tr>
<td>Pneumonia</td>
<td>S. pneumonia, influenza, fungi</td>
<td>Hyperglycemia, age</td>
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<tr>
<td>Emphysematous cholecystitis</td>
<td>Clostridium perfingens</td>
<td>Hyperglycemia, age, male sex</td>
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<td>Polymicrobial soft tissue</td>
<td>Streptococci, anaerobes, gram-negatives</td>
<td>Hyperglycemia, angiotherapy</td>
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<tr>
<td>infection</td>
<td>Pseudomonas aeruginosa</td>
<td>Hyperglycemia</td>
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Table 1. Infectious Complications of Diabetes Mellitus
therapy consists of a combination of abscess drainage through either surgery or percutaneous drainage and appropriate antibiotic therapy. This patient had no urinary symptoms, no flank discomfort, and his urinalysis revealed no evidence of a urinary tract infection.

Pneumonia has traditionally been described as a major cause of morbidity and mortality among patients with diabetes. An increased incidence of pneumonia from S. aureus secondary to nasal carriage, particularly among recently hospitalized diabetic patients, has been described.\textsuperscript{17} Pneumonia due to both gram-negative organisms and fungi has also been described as being more frequent among diabetic patients.\textsuperscript{18} An increased risk of developing active tuberculosis among diabetic patients with a positive reaction to tuberculin (a positive PPD) has long been described. Streptococcus pneumoniae and influenza have been described as causing more severe infection in people with diabetes than that found in the general population.\textsuperscript{19,20} It is not clear whether the latter organisms cause pneumonia with an increased frequency when diabetes is present or instead cause a more severe pneumonia presentation.

Pneumonia and influenza vaccination have long been advocated for widespread use among people with diabetes. Management of bacterial pneumonia is the same for diabetic patients as for those without diabetes. Antiviral agents are generally recommended for treatment of influenza pneumonia in this population. In P.F.’s case, there was no evidence of pneumonia: he had no respiratory symptoms and a normal chest X-ray.

Emphysematous cholecystitis is a rare but severe infection associated with gas-forming organisms such as Clostridial species and other anaerobes. A significant portion of patients with this illness are men, and 20-30% have diabetes.\textsuperscript{21} Presentation is similar to other forms of cholecystitis, with fever and right-upper-quadrant pain. However, patients with this illness are usually more ill. Diagnosis is often made by the detection of gas in the gallbladder on radiographic imaging of the abdomen. Treatment is with a combination of surgical intervention and antibiotic therapy. In our case above, P.F. had no abdominal symptomatology and a normal abdominal examination.

Soft tissue infections of the lower extremities and gangrene are among the most dreaded complications associated with diabetes. Patients with diabetes clearly have an elevated risk of infected lower-extremity ulceration and subsequent amputation.\textsuperscript{22} Foot ulcers usually occur in patients with sensory polyneuropathy who develop skin breakdown after unrecognized trauma. Infection, usually polymicrobial, then easily occurs in tissue with an inadequate microvascular or macrovascular blood supply. Uncontrolled soft tissue infection can then lead to necrotizing processes and systemic sepsis. Chronic infection, such as osteomyelitis, can also occur in conjunction with cutaneous ulcers. Treatment of these infections involves a combination of early surgical intervention for debridement or amputation and any necessary vascular repair, antibiotic therapy, and local wound care.

Osteomyelitis is usually diagnosed by nuclear studies, such as gallium and bone scanning. The best treatment of these infections is clearly prevention by a combination of proper glycemic control and foot care. In this case, P.F. had evidence of a peripheral neuropathy, but he had no ulcers, erythema, evidence of tissue necrosis, or other signs of lower-extremity infection.

Malignant otitis externa is a potentially severe infection caused almost exclusively by Pseudomonas aeruginosa, which invades the ear and adjacent structures. In the past, most cases were described among elderly patients with long-standing diabetes. Recently, however, cases have been described in patients without diabetes.\textsuperscript{23} Pseudomonas aeruginosa is not a part of the normal flora of the ear. The presence of that organism is thought to be increased in the presence of hot, humid conditions or following irrigation of the ear with nonsterile water.

The organism is thought to penetrate the cartilage in the external auditory canal through the naturally occurring fissures of Santorini. A necrotizing cellulitis exacerbated by microvascular disease then occurs. Infection then involves mastoid air cells and the temporal bone. Subsequently, the base of the skull becomes involved. Complications of this infection include cranial nerve palsies, thromboses of lateral and sigmoid sinuses, extension to the contralateral base of the skull, and cavernous sinus thrombosis.

Symptoms include otalgia, which occurs in more than 75% of patients, and otorrhea, which occurs in more than 50% of patients.\textsuperscript{24} Hearing loss is another common symptom. Trismus and transmandibular joint (TMJ) pain may also occur. Swelling and erythema with a purulent drainage is usually noted on examination. Granulation tissue is often noted, and the tympanic membrane may be perforated. Erythema of the external ear and adjacent tissue may also be found. Ipsilateral cervical and auricular lymphadenopathy may be present. Parotid swelling may occasionally be noted. Cranial nerve palsies may occur with the facial nerve most commonly involved.\textsuperscript{25} The erythrocyte sedimentation rate is uniformly elevated. Laboratory findings are otherwise highly variable and usually not helpful.

CT or MRI imaging studies are helpful to define the extent of disease. The diagnosis is confirmed by the isolation of Pseudomonas aeruginosa from cultures of drainage from the ear in cases in which patients have severe ear pain, with granulation tissue present in the external auditory canal with or without radiographic evidence of disease. Other organisms rarely cause this disease.

Treatment involves a combination of surgical debridement and antibiotic therapy. There is some controversy regarding the appropriate antibiotic choices. Traditionally, standard therapy has been a combination of an extended spectrum penicillin and an aminoglycoside given for 4-8 weeks, depending on the severity of illness. Use of a single drug, such as ciprofloxacin given orally or ceftazidime given intravenously for 6 weeks, has shown success in less severely ill patients.\textsuperscript{26,27} Early initiation of antibiotic therapy and surgical intervention are important for optimal outcomes.

P.F. had cultures from the external auditory canal that were positive for Pseudomonas aeruginosa. He has other findings, including the otalgia, otorrhea, and erythema of the canal, were also typical of malignant otitis externa. CT scan revealed temporal bone erosion. He was treated with debridement and a 6-week course of an anti-pseudomonal penicillin and an aminoglycoside to which the organism was sensitive. He recovered without further complication.
In patients with diabetes mellitus, a variety of common infections, in particular Staphylococcus aureus, may be seen with increased frequency because of alterations in the mechanical barrier of the skin and vascular abnormalities common in people with diabetes. There are also a number of infections as described above that are virtually unique in patients with diabetes. A heightened sense of awareness will lead to the early diagnosis and subsequent treatment of these potentially life-threatening complications of this common metabolic disorder.

References


Case Study: The Recipe for Diabetes Success in the Hospital

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Presentation

N.D., a 48-year-old, obese, African-American man, was admitted to intensive care unit with crushing, substernal chest pain. This was associated with dizziness, nausea, vomiting, and diaphoresis. The electrocardiogram on admission revealed T wave inversions in the anterior and lateral leads. He ruled in for a myocardial infarction (MI) by serial cardiac enzymes. His glucose level on admission was 203 mg/dl with a bicarbonate of 24 mg/dl. A hemoglobin A1c (HbA1c) performed in the hospital revealed a value of 8.1%.

The patient’s father had a history of heart disease and had suffered a heart attack at the age of 52 years. His grandmother had a history of type 2 diabetes controlled with insulin. N.D. stated that for a few months before admission, he had been feeling
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Does controlling hyperglycemia in the hospital really matter?

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ble.

• Realize that morbidity and mortali-

ty from stroke, MI, and bypass

surgery are affected most by glu-

cose levels in the hospital.

Ingredients for diabetes success

• Regardless of whether this patient has “stress hyperglycemia” or

recognized diabetes, treat aggres-

sively with intravenous rather than

subcutaneous insulin coverage.

• Understand that definitive diabetes

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improved outcomes by controlling

glucose as close to normal as possi-

ble.

• Realize that morbidity and mortal-

ty from stroke, MI, and bypass

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cose levels in the hospital.

Does controlling hyperglycemia in the hospital really matter?

The data on the importance of con-

trolling glucose in the hospital span

diverse disciplines of medicine. Studies

in the areas of stroke, MI, bypass

surgery, and wound and nosocomial

infections all point to the tremendous

potential to reduce morbidity and

mortality among hospitalized patients

with hyperglycemia. It is essential that

hyperglycemia is identified from the
time of hospital admission and that

therapy is implemented to achieve and

maintain glucose levels as close to

normal as possible regardless of a

patient’s primary reason for admis-

sion or previous diabetes status.

In the United States, there are more than 4.2 million hospitalizations

annually among people with diabetes.1 Additionally, there are as

many as 1.5 million hospitalized indi-

viduals who have significant hyper-

glycemia but no history of diabetes.2

Identification of and therapeutic inter-

tentions to treat hyperglycemia must

be initiated in tandem with the pre-

senting medical problem rather than
days after admission, when many of

the acute issues have already been

addressed. Existing data strongly sug-

gest that an early and aggressive

approach to the management of

hyperglycemia may reduce mortality,

morbidity, excessive hospital stays,

and added costs.

Diabetes is the secondary, not prima-

ry, problem.

Hyperglycemia is often overlooked

when a hospitalized patient is acutely

ill and facing a life-threatening illness.

A common scenario is that of a

patient admitted with an acute MI or

cerebrovascular accident who is coinci-

dently found to have an elevated

admission glucose value. Often, such

patients have no history of glucose

intolerance.

For patients who do have pre-exist-

ing diabetes, physicians routinely dis-

continue their patients’ previous out-

patient diabetes regimen and initiate

sliding-scale insulin coverage in the

hospital.3 Many physicians consider

this practice the standard of care.

Concerns about precipitating hypo-

glycemia may limit more aggressive

strategies for managing hyper-

glycemia, particularly when many of

these patients are not tolerating regu-

lar meals or their intake is being lim-

ited for a variety of reasons, including

pending surgical procedures or diag-

nostic tests.

Despite the ease and high frequen-

cy of use, sliding-scale insulin cover-

age often results in a deterioration of,

rather than an improvement in,

glycemic control.3 While concerns

about hypoglycemia are warranted,

hyperglycemia, regardless of whether

a previous diabetes diagnosis has been

made, may pose even greater risks by

reducing hospital survival rates

among patients admitted with stroke

or MI.4–6

Is hyperglycemia caused by stress or diabetes? It doesn’t matter—treat it.

There are no unique diagnostic crite-

ria to account for stress in acutely ill

patients, nor are there recommenda-

tions for making a definitive diagnosis of

diabetes in the hospital. Despite the

well-defined pathophysiology of inter-

current illness and surgery on carbo-

hydrate metabolism that may lead to

hyperglycemia, many studies have

also demonstrated that stress may

result in diminished glucose values.7–19

This reduction in glucose seen in times

of stress is frequently attributed to

insufficient administration of exoge-

nous glucose.

Among hospitalized patients with

acute MI, an admission glucose value

of ≥180 mg/dl predicted undiagnosed

diabetes rather than stress hyper-

glycemia in a study in which newly

recognized hyperglycemic individuals

had subsequent glucose tolerance test-

ing performed 2 months after hospital

discharge.4,5 The Diabetes Insulin-Glucose in

Acute Myocardial Infarction (DIGA-

MI) trial demonstrated significant

reductions in mortality when an inten-

sive insulin regimen was administered

to hyperglycemic patients hospitalized

with acute MI.4,5 Subjects in the

DIGAMI study included all patients

with glucose values >198 mg/dl with-

out regard to previous diabetes status.

Nearly 15% of the study population

did not have a history of glucose

intolerance.

Is the hospital really the time to con-

sider diabetes? Yes.

Mortality rates among patients with

diabetes are known to be significantly

higher than those of nondiabetic indi-

viduals.20 The Whitehall Study report-

ded a mortality rate of 12/1,000 per-

son-years for nondiabetic individuals,

a rate of 40 for people with undiag-

nosed diabetes, and a rate of 27 for

people with diagnosed diabetes.21 The

Paris Prospective Study demonstrated

comparable differences between the

mortality rates among patients with

undiagnosed diabetes (23%) versus

those with a definitive diagnosis of

diabetes (20%) and patients without

diabetes (9%).22 In both studies,

60–70% of the deaths were attributed

to cardiovascular disease.23

Where is the best place to find unrec-

ognized diabetes? In the hospital.

It is estimated that 5.3 million

Americans have undiagnosed diabetes.

As many as one-third of the patients

who have significant hyperglycemia
during their hospital admission do not

have a history of diabetes.2 Given the

7- to 10-year delay between the actual

onset of diabetes and the time of diag-

nosis, there is a high likelihood that

patients exhibiting hyperglycemia

without a history of glucose intoler-

ance may indeed have unrecognized

diabetes.20 The beneficial impact of
interventions that improve hyperglycemia and lead to better outcomes is based on the presence of diabetes regardless of whether a physician has made the diabetes diagnosis.

Health care providers should assume that a hyperglycemic patient has diabetes and initiate treatment to control glucose levels as close to normal as possible. Further evaluation of the patient’s diabetes status can occur after hospitalization. Failure to treat and address hyperglycemia in the hospital is a missed opportunity to not only reduce hospital morbidity and mortality, but also initiate interventions that may delay the long-term complications of diabetes.

What if the hyperglycemia is caused by medication? Treat it like diabetes.

Often medications such as steroids and thiazide diuretics, which have been associated with worsening glycemic control, are required in the care of patients with diabetes. Dozens of medications have been described as inducing diabetes, yet there has been poor documentation of the glycemic status of patients using the offending drugs before these drugs were initiated.

Decades ago, corticosteroids were studied as a means of unmasking impaired glucose tolerance. When evaluating the impact of corticosteroids on normal control subjects, only 3% had positive glucose tolerance tests when pretreated with corticosteroids.

Other studies among corticosteroid-treated individuals have found that fewer than 20% of steroid-treated individuals develop diabetes. This indicates that hyperglycemia in the setting of the hospital should be assumed to be diabetes, even when medications that potentially produce hyperglycemia are required to treat another medical problem. In such cases, treatment of hyperglycemia should be initiated.

Is there a diagnostic role for HbA1c? Maybe.

Many clinicians have advocated the use of HbA1c measurement in the diagnosis of diabetes. But although an elevated HbA1c measured when hyperglycemia is first noted can help determine that the hyperglycemia existed before hospitalization, a normal HbA1c concentration does not preclude the diagnosis of diabetes. In one study, normal HbA1c concentrations measured during hospital admission did not exclude the diagnosis of diabetes when glucose tolerance testing was performed after discharge.

As more laboratories adopt the standardized methodologies for performing HbA1c, as established by the National Glycohemoglobin Standardization Program (NGSP), it will be easier to establish guidelines for the diagnosis of diabetes based on elevated HbA1c concentrations. Laboratories certified by the NGSP all have equivalent HbA1c assays and can be compared nationally regardless of location or laboratory performing the test. When the NGSP’s norms and ranges for HbA1c are adopted universally, the HbA1c assay may become a more useful tool for establishing the pre-existence of hyperglycemia before a hospital admission. Normal HbA1c concentrations in the hospital setting still will not preclude the diagnosis of diabetes, however, and such patients will still need follow-up to evaluate diabetes status.

Diabetes isn’t the reason for admission, so why treat it? Hyperglycemia DOES impact the primary medical problem.

Ninety percent of hospitalizations among patients with a known diagnosis of diabetes are for reasons other than diabetes. Approximately 75% of hospital admissions for people with diabetes are attributable to cardiovascular disease. When hyperglycemia is not addressed until after the presenting medical problems have been treated, the length of hospital stay can be significantly longer than that of nondiabetic patients with similar primary diagnoses. Addressing diabetes along with other acute problems results in not only improved outcomes, but also potentially shorter hospital stays.

Shouldn’t the MI be managed first? Treat the hyperglycemia aggressively and sequentially with the MI.

Diabetes has been demonstrated to be an independent risk marker for morbidity and mortality among patients who have suffered an MI. Soler and Frank observed that patients with the highest glucose values following an acute MI also had the highest mortality rates.

The DIGAMI study underscores the importance of early and aggressive interventions designed to bring glucose levels into the normal range regardless of a patient’s prior diabetes status. This large, randomized, prospective trial enrolled 620 patients with admission glucose values of >198 mg/dl. Hyperglycemic individuals were randomized to receive either conventional diabetes care or intravenous insulin followed by four insulin injections daily.

One year after admission, there was a 30% reduction in mortality among the intervention patients. The greatest benefits from intensive insulin therapy were seen in the subgroup that included patients without a history of diabetes, who had a 58% risk reduction in hospital mortality and a 52% risk reduction in mortality when followed for 1 year when compared to conventionally treated patients.

When outcomes were tracked for a mean of 3.4 years, intervention patients had a 25% lower death rate. The DIGAMI study demonstrated that for every nine patients receiving intensive glucose control, one life was saved.

Summary and clinical keys

Inpatient studies have been designed to evaluate the impact of potentially correcting the pathophysiological changes that accompany hyperglycemia. Studies among patients with MI suggest that treatment of hyperglycemia can potentially affect morbidity and mortality, and similar benefits may apply to controlling hyperglycemia regardless of whether patients have a prior diagnosis of diabetes.

- When patients present with an acute illness and hyperglycemia, it is often difficult to differentiate stress hyperglycemia from previously undiagnosed diabetes.
- The lack of a definitive diagnosis of diabetes should not preclude aggressive glycemic management, especially in patients with suspected MI.
- Hyperglycemia accompanied by an elevated HbA1c concentration suggests previously undiagnosed diabetes.
- The DIGAMI study demonstrated that for every nine patients receiving intensive glucose control regardless of their baseline diabetes status, one life was saved.

References

1. U.S. Center for Health Statistics: 1997 National Hospital Discharge Survey (Public Use Data


