POSTOPERATIVE INFECTION IN ORTHOPAEDIC SURGERY

An Essay

Sumbitted For Partial Fulfilment of The Master Degree In Orthopaedic Surgery
(M.CH, Orth.)

By

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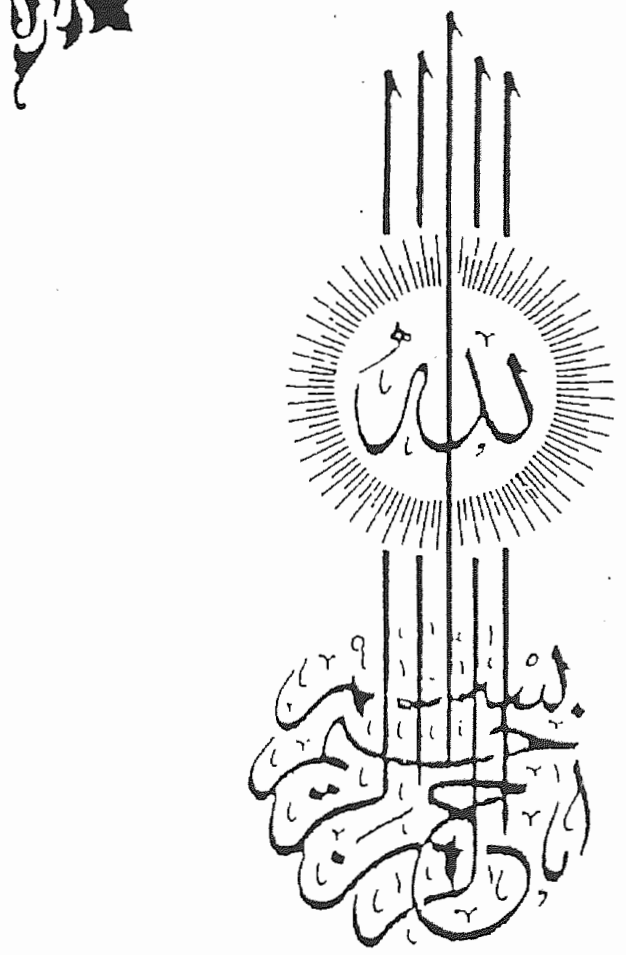

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا
عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ.

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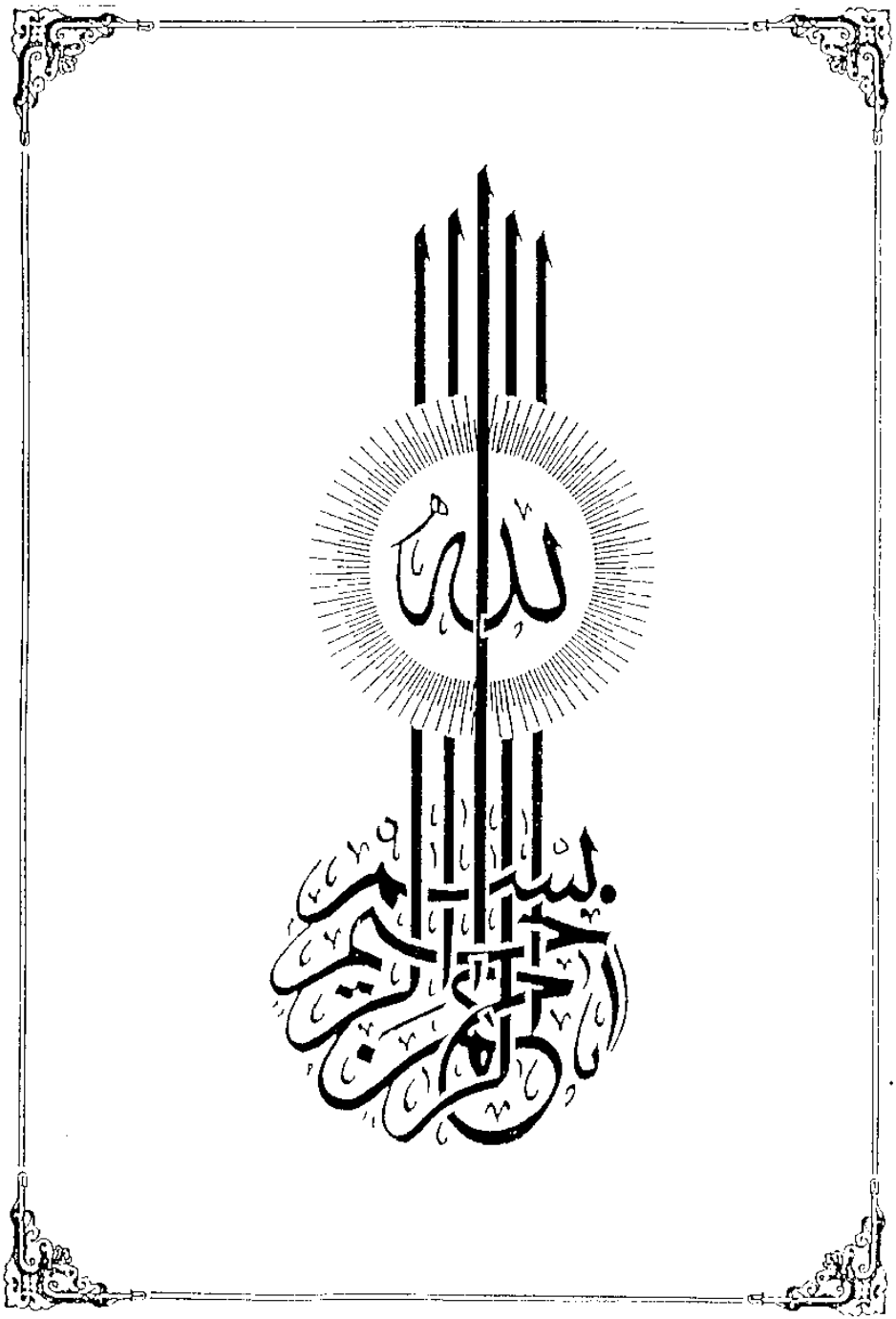

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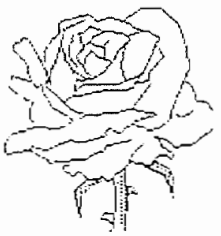

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Alaa Mansour

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Introduction

The spectrum of postoperative infections in orthopaedic surgery varies dramatically from troublesome wound infections to major bone and joint infections.

Major infections after bone and joint operations are usually a devastating event. While in abdominal surgery and much of "general" surgery an infection delays the recovery very significantly, in most cases with good treatment the patient recovers and the end result though delayed is usually good. In much bone and joint surgery, a large proportion of deep operative infections result in long-lived monuments to failure: a joint becomes stiff and painful; a total joint replacement has to be removed and the patient limps and may have to use crtches; a long bone drains and fails to unite for many years.

Certain conditions and circumstances favor the occurrence of postoperative infections. First; bacteria must grow in the wound; the type, their virulence, the size of the bacterial inoculum, the size of the incision, the length of time the wound was exposed-all of these are important factors. Second; there are the local factors in the surgical wound: the dead spaces, hematoma formation, presence of necrotic tissue and foreign bodies, and whether the tissues have an adequate inflammatory response and skin coverage. Third; the status of the patient's local and general resistance to infection, the

reticuloendothelial system, and the immune system (globulins, opsonins) are important considerations.

Before planning for the treatment of postoperative infection, we have to diagnose, this can be done from clinical manifestations and some investigations as the erythrocyte sedimention rate, radiological appearance, bone scan, aspiration of the joint and even biopsy. It is also important to find the causative organism or organsims by cultures and to find the sensetive antibotic against them, as the organism play an important role in the planning of the following treatment of infection.

The criteria for reducing the incidence of infection are rigid restriction of movement in the operating room, carful preparation of the patient and the operating room presonnel and gentle handling of tissues. Besides the use of systemic antibiotics, most recently the use of antibiotic loaded bone cement which provides a higher concentration of antibiotics at the site of the implant.

Aetiology of infection

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BACTERIOLOGY OF INFECTION

Staphylococcus aureus and staphylococcus epidermidis (Staph albus) are the most common wound pathogen. Methicillin - resistant S. aureus may be encountered in tertiary care hospitals. In addition, approximately 30% of nosocomial S. epidermidis are now methicillin resistant. Wounds may also be infected with aerobic gram - negative organisms. If the patient has been in the hospital longer than one week, the incidence of gram - negative pathognes such as the Enterobacteriacea and pseudomonas aeruginosa is increased. (Mader and Calhoun 1990)

TYPE OF INFECTION AND ORGANISMS

The significant muscloskeletal infections that the orthopaedic surgeon encounters include necrotizing and non necrotizing soft tissue infections, joint infections, and osteomyelitis.

The major non-necrotizing soft tissue infections include cellulitis and wound infections. The most common organisms are staph aureus, staph epidermidis and streptococcus pyogenes. Wound may also be infected with aerobic gram - negative organisms.

The major necrotizing soft tissue infections are crepitant anaerobic cellulitis, progressive synergistic gangrene, necrotizing fasciitis, non clostridial myonecrosis and clostridial myonecrosis. They are usually caused by a mixture of anaerobic and aerobic organisms. Aerobic organisms include S. pyogenes, S. aureus, Enterococcus, Enterobacteriaceae and P. aeruginosa. The anaerobic organisms

include clostridium SP., and peptostreptococcus SP. (Mader and Calhoun 1990).

Total joint arthroplasty infections are usually caused by organisms primarily from skin that are introduced at the time of surgery. Clinical infection with these indolent bacteria may occur months later. S. aureus and S. epidermidis are the most common isolates, but streptococci, anaerobic cocci, propionibacterium acnes, corynebacterium species, and gram - negative bacilli may be etiologic agents. (Thompson and Wright 1984).

In a study of 667 infected total hips, the bacteria responsible for the infections were single species in 484 hips (73%) and mixed in 103 (15%) and in 80 hips (12%) No organism could be cultured despite gross signs of infection such as a sinus and raised erythrocyte sedimentation rate. (Buchholz et al, 1981).

Bone infections are usually due to S. aureus which is the most common pathogen. However aerobic gram-negative rods and anaerobic oganisms are often found. Aerobic gram-negative bacilli are infrequent causes of postoperative osteomyelitis. The Enterobacteriaceae (which include E. coil, Klebsiella species, proteus sp. Enterobacter SP. and serratia species) and P. aeruginosa are usually found in the mixed infections causing osteomyelitis in patients with vascular insufficiency. They may occasionally cause postoperative infections. (Thompson and Wright 1984).

Anaerobic microorganisms are almost always recoverable from mixed infections. Those bacteria most frequently isolated include B. fragilis, other bacteroid species, anaerobic streptococci, peptococcus species, and clostridium species.

In a study of 182 patients who were treated at the Mayo clinic during a 28 month period, Traumatic injuries preceded the infection in 27 patients.

Fractures were present in 25 of these patients, and 12 of these fractures were open injuries. (Hall et al 1984)

(Table 1) Relationship Between Fracture Treatment and the Development of Anaerobic Ostemyelitis.

Fracture Type	Initial Treatment	Onset of symptoms
Closed 12 patients	10 patents - opened for open reduction and internal fixation	6 patients - less than 3 month; 4 patients greater than 3 months
	1 patients - opened for vascular repair and fasciotomy	7 days
	1 patient-cast immobilization	16 years
Open 13 patient	4 patient-immediat internal fixation.	less than 2 weeks
	2 patient-delayed internal fixation	less than 2 week after internal fixat
	4 patients-multiple debridements	Continous drainage 10 days, 20 days and 20 years
	3 patients-debridement and delayed wound closure	

Hall et al., 1984)

PREDISPOSING FACTORS

Certain conditions and circumstances favor the occurrence of postoperative infections.

First; Bacteria must grow in the wound; the type, their virulence, the size of the bacterial inoculum, the size of the incision, the length of time the wound was exposed - all of these are important factors.

Second; there are the local factors in the surgical wound; the dead space, hemoatoma formation, presence of necrtic tissue and foreign bodies, and whether the tissues have an adequate inflammatory response and skin coverage.

Third; the status of the patient's local and general resistance to infections, the reticuloendothelial system, the immune system (globuline, opsonins) are important considerations. (Kenmore and Kranik, 1978).

Numerous local and systemic factors may compromise the ability of host defense mechanisms to deal with contamination. (Table 2) Most local factors that predispose to infection relate to adequacy of tissue blood supply. similarly, foreign bodies provide a protected enviornoment for bacterial contaminations. Many systemic illnesses are identified with increased rates of infection. Such as malignancy, diabetes and hepatic cirrhosis. (Polk and Fry 1981).

TABLE 2 : PREDISPOSING FACTORS TO INFECTION

Preoperative Factors

Hypovolemia

Protein - calorie malnutrition

Alcoholism

Chronic corticosteroid use

Remote infection

Extended preoperative hospitalization

Intraoperative Factors

Disregard for asepsis

Poor hemostasis / hematoma

Excess electrocautery

Foreign bodies

Excessive dead space in wounds

Drains through surgical incision

Postoperative Factors

Prolonged Foley catheterization

Prolonged intravenous cannulations

Poor oral hygiene

Inadequate nutritional support.

(Polk, and Fry, 1981)

HIGH-RISK PATIENT

Patients often are elderly and frequently have secondary illnesses that adversely affect their ability to resist infection following bacterial contamination. Old age, obesity, the use of corticosteroids, as well as such conditions as diabetes and rheumatoid arthritis are all apparently associated with an increased post surgical infection rate. Other patients who run ahigh risk of infection are those with existing foci of infection in the skin, lung, or genitourinary tract. the incidence of infection can be three times higher among these patients than among those without persisting infections at the sites listed. (Nelson 1990).

HIGH-RISK SURGERY

Superimposed on the high-risk status of some patients is the unusually high risk of infection inherent in some operations, including surgeries requiring extensive dissection, prolonged surgery and the implantation of metallic and other orthopaedic devices. Dead space is always present in implant surgery, even smallest implant produces some area of dead space and hematoma. Hematoma not only is a nidus for infection but may, if it becomes tense and taut, devascularize the surrounding soft tissue, impede natural defense mechanisms and prevent both antibiotics and antibodies from penetrating the area. (Nelson ., 1990)

INFECTION AND MALNURITION

The malnutrition of orthopaedic surgical patients plays an important role in the development of complications including infection.

There is a whole cascade of events that occurs when significant protein depletion occurs in malnutrition.

These events may directly or indirectly affect wound healing and sepsis. Protein calorie malnutrition decreases the host immune response in a number of ways.

The number of lymphocytes, especially T cells falls and their function is impaired. There is a concomitant decrease in cell mediated immunity. There is a significant delay in the appearance of phagocytic leukocytes at the site of an abscess created in experimental animals that were subjected to moderate and sever protein deprivation. This effect was shown to be reversed by correcting the protein deficiencies by dietary means..

The function and quantity of complement decreases and this change adversely affects the host's ability to respond to infection. Granulocyte function has also been shown to be adversely affected by malnutrition (Smith, 1991).

Zinc, iron, vitamins, and many other trace substances that are vital to one's resistance to infection may either be deficient in quantity or may not be transported where needed because of a lack of transport protein. (Smith, 1991).