ORIGINAL ARTICLE

Assessment of Humoral Response in Acute Haematogenous Osteomyelitis

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Abstract

The Immunoglobulin levels (IgA, IgM, IgG) in 53 patients suffering from acute hematogenous osteomyelitis were compared with 32 controls of comparable age and sex. IgA levels were significantly decreased in stage I and stage II, as compared with controls, while IgM levels were increased in stage I compared to control and in stage II there was decline in IgM levels. IgG levels showed an increase in stage I and a further increase in stage II as compared to control group, thereby sharing an increase in IgG levels with improvement in disease conditions.

Key Words

Immunoglobulins, Osteomyelitis

Introduction

Osteomyelitis is a general term which refers to any inflammatory lesion involving cancellous bone, but when used without qualification it is generally taken to mean that any form of pyogenic infection which is secondary to blood infection. It is universal fact that human body is constantly in intimate contact with members of various groups of microorganisms known as bacteria. During life coexistence results in a number of interactions, between the human body as host and bacteria as invading parasites which as a variety of diseases are grouped in the large generic term as "infection". The determinants of infection are microorganisms producing the infection, the environment in which the infection takes place, and the host defense mechanism i.e. systemic response to established infection. There is a continuous interaction between these 3 factors. The host defense mechanism include humoral (antibody response, complement, phagocytic cells) and the cell mediated immune system. These constituents of host defense rarely act singly but rather interact in a co-ordinate manner to control infection (1). Acute haematogenous osteomyelitis is the pyogenic infection of cancellous tissue of the bone, which is haematogenous in origin occurring more frequently in children and infants. Host response to bacterial infection is largely governed by characteristics of bacterial surface, which play a major role in the initiation of infection i.e. adherence of bacterial cells to the epithelial or endothelial cells of the host .The components of the bacterial surface are involved either directly or indirectly in host injury. Interaction of bacterial surface with specific cells and humoral elements of the host determine the nature of host defense. The inflammatory process itself, a fundamental aspect of the host response to bacterial invasion, depends upon the ability of the host to "recognize" bacterial surface components (2).

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Alterations in the level of serum immunoglobulins have been described in several disease states and in some patients, this may be a helpful diagnostic aid. Also, a primary or secondary decrease in the serum levels of immunoglobulins, either singly or in combination, may be associated with clinical features of antibody deficiency, such as increased frequency and severity of infections.

Material and Methods

The present study was conducted on 85 patients, 53 of haematogenous osteomyelitis and 32 normal control group.

Group 1 : This group comprised mainly of 32 normal healthy children between age groups of 4-15 years of age of both sexes. This control group was matched as closely as possible to study group with regard to age, sex, social status and place of residence whether rural or urban (Table I).

Table I

Age and Sex distribution of normal control group

Age in Years	No. of patients		Total
	Male	Female	
4-6	9	5	14
7-9	5	2	7
10-12	4	2	6
13-15	3	2	5
Total	21	11	32

Group II : This group consisted of patients of acute haematogenous osteomyelitis of mainly femur, tibia, humerus of 4-15 years, having onset of illness within one week. These patients were studied for immunoglobulin estimation at 1st and 3rd week of disease (Table II).

Table II

Age and Sex distribution of Acute Haematogenous Osteomyelitis

Age in Years	No. of patients		Total
	Male	Female	
4-6	14	7	21
7-9	5	3	8
10-12	7	3	10
13-15	10	4	14
Total	36	17	53

Methodology

1. A detailed clinical history of each patient was taken regarding duration of onset of symptoms, history of trauma and allergies or any other infection preceding the illness, site of involvement, progress of disease and details of any treatment already given. Age, sex and socioeconomic status of the patient were also noted.
2. Complete physical examination was done. Examination for localized tenderness and range of movements of adjacent joints was noted. The presence of associated infection and complication if any were recorded .

Haematological investigations: As soon as the clinical diagnosis was made, before administration of any antibiotic, blood was drawn for blood culture and for various haematological investigations like haemoglobin estimation, total and differential counts, peripheral blood film, ESR, CRP, PCV.

Bacteriological investigations: This consisted of isolating the etiological agent from the pus drained from osteomyelitic lesion and blood culture from these patients.

Serological investigations : This included serum immunoglobulin estimation.

Observations

Eighty-five patients were studied for levels of serum immunoglobulin IgG, IgA and IgM, which were divided into two groups.

Group I comprised of 32 apparently healthy children between 4-15 years of age. These included 21 males and 11 female children. Group II comprised of 53 patients of comparable ages and sex suffering from acute haematogenous osteomyelitis. There were 36 males and 17 females in this group. Group II were studied within

1st week and at 3rd week of illness labeled as stage I and stage II respectively.

Pain was the most frequent symptom in these patients. The next common was fever and restriction of movements. Restriction of movement was present in 50% of patients. Twenty-four (45.2%) patients had history of trauma preceding the onset of disease. Twenty-three patients had antecedent infection like boil, scabies, upper respiratory tract infection, and pyrexia of unknown origin. Tenderness, fever, local heat were constant signs present in these patients. Local swelling was present in 73% of patients. In all the patients temperature was recorded at the time of admission, 50 patients had fever, highest temperature recorded was 104°F., 3 of the patients were afebrile. Pulse rate of the patients was high and varied between 100-140 /minute (Table III-VI).

Table III

Symptoms in patients of acute haematogenous osteomyelitis

Symptom	No. of patients	Percentage
Pain	53	100%
Fever	50	94.3%
Disability (Inability to use particular part	49	92.4%
History of antecedent infection	23	43.3%

Table IV

Physical signs

Signs	No. of patients	Percentage
Tenderness	51	96.2%
Fever	52	98.1%
Local swelling	39	73.5%
Local heat	48	90.5%

Table V

Site of lesion

Bone involved	No. of patients	Percentage
Tibia	22	41.5%
Femur	16	30.1%
Humerus	7	13.2%
Radius	4	7.5%
Fibula	3	5.6%
Ulna	1	1.88%

Table VI

Investigations

Haemoglobin

Conc. (gms.)	No. of patients	Percentage
8-9.5	23	43.3%
9.6-10.5	15	28.3%
> 10.5	15	28.3%

Leukocyte count

Total counts (thousands / mm)	No. of patients	Percentage
7-10	11	20.7%
11-15	26	49.0%
16-22	16	30.1%

Differential count

Polymorphonuclear (percent)	No. of patients	Percentage
65-70	23	43.3%
71-85	30	56.6%

ESR

mm. Ist Hr.	No. of patients	Percentage
45-50	8	15%
51-70	21	39.6%
80-90	17	32%
90-110	7	13.2%

Packed cell volume: It ranged from 32-46% with a mean of 35%

Peripheral blood film

Type of RBC	No. of patients	Percentage
Hypochromic microcytic	38	71.1%
Dimorphic	12	22.6%
Normochromic normocytic	3	5.6%

Pus culture

Organism isolated	No. of patients	Percentage
Staph. Aureus	49	92.4%
Strep. Pyogenes	3	5.6%
Pseudomonas aerogenosa	1	1.8%

Blood culture:

No. of cultures	Positive results	Percentage
53	20	37.9%

Table VII shows various immunoglobulin levels in stage I and stage II as compared with 32 normal (control group). IgA levels were significantly decreased in stage I and stage II when compared with control, however,

there was not much difference statistically between stage I and stage II. IgM levels were increased in stage I compared to control and in stage II there was decline in IgM levels showing a statistical significance between stage I and stage II. IgG levels showed an increase in stage I and a further increase in stage II when compared to normal control group, thereby again showing an increase in IgG levels with improvement in disease condition.

Table VII

Serum Immunoglobulin levels in normal control group and disease group in stages I and II.

	Stage I	Stage II	Control
	n=53	n=52x	n=32
	Mean + S.D	Mean + S.D	Mean + S.D
IgA	1.81+ 0.69*	1.75 + 0.6*	2.53 + 0.53
IgM	3.02 + 0.43 *■	2.09 + 0.52 ■	2.23 + 0.40 *
IgG	13.12 + 2.41 *■	14.34 + 1.98 *■	11.57 + 2.13

Stage I/Stage II V/S Control * P value < 0.05

Stage I V/S Stage II ■ P value < 0.05 x – One case was lost in follow up.

Discussion

The immunoglobulins are a family of proteins, which may be identified in plasma or serum by immunochemical methods. Three main components have been identified, viz. IgG, IgA & IgM. It has been observed that the concentration of gammaglobulins in plasma of newborn infant is equal to or greater than that of their mothers because of relative transfer across the placenta. After birth the level falls and the level is minimum between 3-6 months of age. The concentration then rises again to normal adult levels between first and 2nd year of life (3).

Reports have appeared on study of immuno-globulins in malnourished children. Brown and Katz reported fall in IgG fraction in cases of kwashiorkor (4). Najjar *et. al.* found uniform rise in all three fractions in cases of marasmic children between 3 and 6 months of age (5).

A subdued clinical response to infection is common in immunodeficiency. Bone and joint infections during the first year are often characterized by such a reaction that both the constitutional and regional signs fail to reflect the severity of the underlying cause. This may delay the diagnosis and the initiation of appropriate treatment, with the result that bone destruction is excessive and permanent disability follows (6,7). The mechanism responsible for inflammatory effects of infection includes antibody, complement and phagocytes, which are also important for immunity to septicaemic illness. The usual route of bone infection is by blood stream and IgM is thought to be of special relevance in controlling septicaemic illness (8). Serum levels of 3 immunoglobulins were found in general to rise above the normal in presence of infection. Furthermore, the levels did not show significant variation with the clinical parameters. These findings suggest that there is intrinsically subdued immune response to osteomyelitis in most of the patients, partly confirming the suspicion of an immune deficient state (9). Eid *et. al.* studied immunoglobulin levels in 90 patients with varying duration and activity and in 100 control subjects (10). They concluded on the whole, that a majority of the patients suffering from primary osteomyelitis may have depression of their normal immune response to the infection.

In our study, we observed that IgA level dropped in both stages of disease and were lower than the control group. IgG showed an increased trend with progress of the disease while as IgM levels showed an increase in the 1st stage of disease, which declined at 2nd stage of disease. This could be explained by the fact that IgM antibody is utilized in the early stage of disease for controlling the infection.

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