Immunocompromised patients: Review of the most common infections happened in 446 hospitalized patients

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Background: Immunodeficiency is a heterogenous group of diseases affecting different components of the immune system. Patterns of infection, etiology and organ involvement are not similar in this risky population. This study was conducted to determine the prevalence of congenital and acquiring immunodeficiencies and also recognizing the most common infections and affected organs. **Materials and Methods:** In a retrospective, cross-sectional survey, during 2006-2012, we reviewed all hospital records with any kind of immunodeficiency admitted in, all departments of university referral hospital, Isfahan, Iran. **Results:** Various immunodeficiencies, sorted by prevalence, were as below: Primary immunodeficiency diseases (PIDs) 122 (27.4%), lymphohematogenous malignancy (LHM) 105 (23.5%), solid cancer 56 (12.6%), human immunodeficiency virus/acquired immunodeficiency syndrome 64 (14.5%), non-cytotoxic immunosuppresion 94 (21%), and splenectomy 5 (1.2%). Common sources of infection were blood, lungs and buccal cavity. **Conclusion:** The most frequent type of immunodeficiency was PIDs and LHM. Infection continues to be a major problem in all variety of immunodeficiency.

Key words: Immune system, immunocompromised host, infection

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INTRODUCTION

Among patients, who are, admitted because of infection, some may have a kind of immunodeficiency. Immunodeficiency is classified as primary, acquired and iatrogenic. Primary immunodeficiency diseases (PIDs) comprise a genetically heterogeneous group of disorders, mainly childhood disorders that affect distinct components of the innate and adaptive immune systems leading to serious complications.[1,2] The most common immunodeficiencies are acquired after birth and are not clearly traceable to a genetic basis.[3] Acquired immunodeficiency syndrome (AIDS) was first reported from the United States among homosexual men, caused by human immunodeficiency virus (HIV), which induces progressive $CD4^+$ T cell depletion.[4] This syndrome is now a major public health challenge throughout the world, with over 25 million persons already dead and 30-40 million living with HIV/AIDS most are without access to sufficient therapy.[4,5] Malignancies, particularly hematopoietic and lymphoid malignancies, result in immune dysfunction by causing a deficiency in immune effector cells or dysfunction of such activities as antibody synthesis.[6] The most common causes of immunodeficiency are iatrogenic and result from the widespread use of old and new therapies that modulate the immune system.[7] Suspicion about immunodeficiency is usually raised on the basis of frequency, severity or identification of a special organism insufficient grounds for presuming the probability of an underlying immune defect.[3] Infection is a major cause of morbidity, mortality, and seeking medical help in immunodeficient patients. The aim of this study was to determine frequency, site and kind of infection in patients with confirmed immunodeficiency disease, at a referral university hospital (Alzahra Hospital, Isfahan, Iran).

MATERIALS AND METHODS

In a retrospective, cross-sectional survey, during the period of 2006-2012, we reviewed all hospital records with an underlying disease that is usually associated with a kind of immunodeficiency in, all departments of Alzahra hospital, Isfahan, Iran. The study was approved by the Ethics Committee of Isfahan University of Medical Sciences (research project number: 389014).

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Then we classified the patients to PIDs, HIV/AIDS, non-hematologic cancers, hematologic and lymphatic malignancies, Iatrogenic and other immunodeficiency. We also determined the most common sites of infection [Table 1].

RESULTS

Various immunodeficiencies, sorted by prevalence, were as below: PIDs 122 (27.4%) including common variable immunodeficiency (CVID) 58 (47.6%) (23 male, 35 female, median age 21 years), chronic granulomatous disease (CGD) 32 (26.2%) (27 male, 5 female, median age 7 years) and inherited complement deficiency (ICD) 32 (26%) (12 male 20 female, median age 25 years), lymphohematogenous malignancy 105 (23.5%) including acute lymphocytic leukemia (ALL) 61 (58%) (32 female, 29 male, median age 12 years), acute myelogenous leukemia (AML) 27 (25.7%) (17 male, 10 female, median age 55 years), and Hodgkin lymphoma (HL) 17 (16%), solid cancer 56 (12.6%) (30 male, 26 female, median age 57 years), HIV/AIDS 64 (14.5%) (55 male, 9 female, median age 38 years), non-cytotoxic immunosuppression 94 (21%) (54 female, 40 male, median age 45 years), and splenectomy 5 (1.2%) (4 male, 1 female median age 18 years). Common sites of infection in different immunodeficiency are showed in Table 1.

Table 1: Frequency of immunodeficiency and site of infection

Type of immunodeficiency	Number (%)	Common sites of infections
Primary immunodeficiency	122 (27.4)	
CVID	58 (13)	Pneumonia, AOM, bloodstream
CGD	32 (7.2)	Cellulitis, pneumonia, bloodstream
ICD	32 (7.2)	Pneumonia, bloodstream, UTI
Lymphohematologic malignancy	105 (23.5)	
ALL	61 (13.7)	Bloodstream, UTI, pneumonia
AML	27 (6)	Bloodstream, buccal cavity, pneumonia
HL	17 (3.8)	Bloodstream, pneumonia, buccal cavity
Solid cancer	56 (12.6)	Bloodstream, pneumonia, UTI
HIV/AIDS	64 (14.5)	Lung, gastrointestinal tract, skin
Non-cytotoxic Immunosuppression	94 (21)	Bloodstream, pneumonia, UTI
Splenectomy	5 (1.2)	Bloodstream, pneumonia, cellulitis
Total	446 (100)	

CVID = Common variable immunodeficiency; CGD = Chronic granulomatous disease; ICD = Inherited complement deficiency; ALL = Acute lymphocytic leukemia; AML = Acute myelogenous leukemia; HL = Hodgkin lymphoma; AOM = Acute otitis media; UTI = Urinary tract infection; HIV/AIDS = Human deficiency virus/acquired immunodeficiency syndrome

DISCUSSION

In our survey, PIDs including CVID, CGD and ICD, is the most common cause of hospital admission due to infection. Lower respiratory tract infection was the most common site of infection followed by skin, bloodstream, urinary tract system and acute otitis media. Oksenhendler *et al*. showed that more than half of patients with CVID had presented with at least one episode of pneumonia and recurrent upper and lower respiratory tract infections should lead to systematic evaluation of serum immunoglobulin.[8] CGD patients have a deficient function of the reduced nicotinamide adenine dinucleotide phosphate, which is responsible for the respiratory burst and the generation of phagocyte hydrogen peroxide.[3] In this type of immunodeficiency pulmonary, cutaneous, lymphatic, and hepatic infections are frequent.[9] ICD are clinically manifested as recurrent systemic bacterial infections. Pneumonia is common in the early classic pathway (C1, C4, C2) and alternate pathway (factors I and H, properdin, C3).[10] In our study, lymphohematologic malignancies (ALL, AML, HL) were the second cause of admissions for infection therapy with no definite site of infection in the majority of patients, but these patients had at least a positive blood culture. In the minority respiratory system, urinary system, and buccal cavity were diagnosed as a source of infection respectively. Despite significant advances in supportive care, infection remains a major cause of death in oncology patients.[11] Many factors predispose this patient population to infection, including local factors due to tumor – specific deficiencies in host defense mechanisms due to malignant process and cytotoxic chemotherapy.[12] Dix *et al*. in their study found that in pediatric AML, infection, sepsis, and infectious death were associated with corticosteroid use, and corticosteroids should be avoided when possible for this population.[13] In a clinical study of 300 consecutive adult patient with HD, bacteremia was the most frequent microbiologically documented serious infection.[14] Cancer and its treatments lead to profound suppression of innate and acquired immune function. In this population, infections are common and may rapidly lead to overwhelming sepsis and death.[7] In our survey sepsis, pneumonia and urinary tract infection were common respectively. Multiple factors escalate their susceptibility disruption of tissue integumentary, foreign devices, nutritional deficiencies and pre-existing or newly acquired comorbidities.[15]

Infection with HIV causes progressive dysfunction of the cell-mediated system. HIV – related immunosuppression significantly increase the risk for acquiring opportunistic infection.[16] In our survey, patients with AIDS mostly came with lung and gastrointestinal tract problems. Ghate discovered pulmonary tuberculosis as the most common opportunistic infection in one population.[17] Non-cytotoxic

drugs such as corticosteroids, T-cell inhibitors, hormonal agents, immunomodulators and interferons are also immunosuppressant. In our study, majority of patients with this type of immunosuppression had positive blood culture. Lymphoid tissue of spleen, including splenic macrophages and early production of immunoglobulin M is important in the acute clearance of pathogens from the bloodstream. Overwhelming post-splenectomy infection has a mortality rate range from 50% to 70%, respectively.[18] In our survey, the patient recovered from infections and discharged from the hospital.

CONCLUSION

Infection continues to be a major problem in all variety of immunodeficiency, consequently, starting appropriate therapy is essential and keeping preventive methods are logical for such a risky population.

AUTHORS' CONTRIBUTION

All authors have contributed in designing and conducting the study. MM, RSh, and KT collected the data and AEN and MR did the analysis. All authors have assisted in preparation of the first draft of the manuscript or revising it critically for important intellectual content. All authors have read and approved the content of the manuscript and are accountable for all aspects of the work.

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