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Research Article

The Yield of Blood Cultures Drawing among Discharged Patients from Emergency Departments with Positive Blood Cultures

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Abstract

Introduction

Occult blood stream infection (OBSI) is unnoticed in adults. The clinical relevance of OBSI was examined in few studies while all of them showing no cost effectiveness in withdrawing blood cultures from patients discharged from emergency departments(ED's).We investigated the characteristics and outcome of patients who were discharged from ED and have positive blood cultures.

Material and Methods

All files of patients with positive blood cultures in one ED seeing 170000 patients a year between 2011-2013 were screened. The main outcomes examined in our retrospective study were : mortality in 28 days among patients discharged from ED with positive cultures, the readmission rate in first week and the rate of change in the antibiotic treatment policy by the ED team or the community health services.

Results

During the three years, 157 patients who were discharge from ER had positive blood cultures. 39% had true clinical significance (Group A) and 61% of the positive blood cultures could be considered as contaminated (Group B).There were no difference between those two groups according to mortality rate in 30 days, demographic characteristics , the vital signs in applying ED , laboratory results . We found that the rate of true cultures were significant higher among patients with comorbidities as diabetes mellitus and cancer and among patient with poly- pharmacy treatment.

Conclusion

The results may indicate that there is a worse prognosis for patients discharged from ED with true positive cultures and due to careful management of these cultures results and preventive strategies such as, high rate of changing the antibiotic treatment policy , high rate of re-admission, and high rate of hospitalization ,the dangers were abolished. In our research co-morbidities such as diabetes mellitus, cancer and poly-pharmacy were found to be predicting factors for positive blood cultures, but they had no prognostic value.

Keywords: Emergency Medicine Department; Blood Cultures; Discharge; Bacteremia

Introduction

Fever is one of the common complaints among patients attending emergency departments (EDs),but published guidelines do not clearly state when blood cultures (BCs) should be drawn. There are different policies for BCs drawing in EDs ranging from a liberal policy drawing from any patient admitted with fever and leukocytosis to a restricted one drawing BCs only from patients suspected to be in sepsis and in need of hospitalization. Bacteremia in critically ill patients is associated with a mortality rate of 14-37% [1]. Many studies have showed low rates of bacteremia in pneumonias, urinary tract infections and soft tissue infections, with low clinical significance. The low sensitivity of blood cultures restricts their diagnostic use except in special conditions such as endocarditis, meningitis and severe sepsis. Counter to this entity, occult blood stream infections (OBSIs) in adult patients being sent home from EDs are less investigated in comparison to their prevalence in pediatrics (2-3%) . Eisenberg [2] showed low cost effectiveness for blood culture drawing among patients who were discharged to community health system treatment. The main question is the clinical relevance of positive blood cultures in discharged patients. Few studies investigated outcomes in patients with positive cultures which included mortality rate and the influence of change in antibiotic treatment. In Epstein's study[3] there was no change in mortality rate 42 days after discharge from EDs. Nevertheless, the positive results directed the beginning of treatment in 56% of patients, and a change in treatment in 11%. Their conclusion was that except in a few cases, the clinical yield of positive blood cultures was low. Similar conclusions were found in other studies [4-6]. Lupland et al [7] tried to evaluate predisposed factors to positive cultures in 3,102 patients .It was found that the patients with positive cultures were older more than 10 years, and were treated for a longer period (6 days vs. 2 days). The leading sources of bacteremia in the positive culture group were genitourinary (26%) and lung infections (14%) [8]. Cisnerous [9] showed that diabetes and severe sepsis were independent factors for positive blood cultures while Roque[10] isolated four independent significant factors: pulse rate above 100, patient during chemotherapy treatment, chronic renal failure and hypokalemia below <3.5 meq/lit. The negative predicting factor was 91%.

Our ED is the most crowded one in Israel. Our existing policy is to draw BCs from every febrile patient during the first hour of stay by nurses, even before being seen by a physician. More than 50% of these patients are discharged at their end of their evaluation, yet sometimes we need to contact them a few days later with positive results of their BC. This policy has raised questions regarding our clinical conduct, the relevance of the positive cultures accepted several days after the patient has been discharged, risk management and quality control. These concerns were the primary motivation for our research.

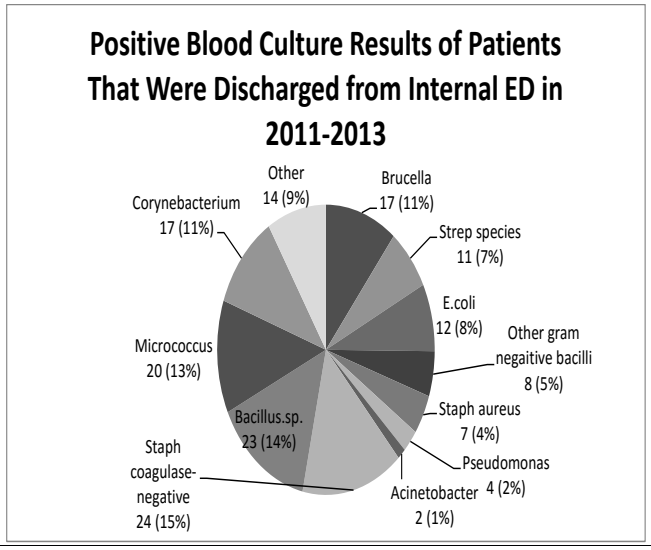
Material and Methods

We screened all positive results of blood cultures taken from patients who visited a single emergency department with 170,000 adult admissions per year between 2011-2013. The main outcomes examined in our retrospective study were : The prevalence of predisposed factors for positive cultures , mortality in 28 days among patients discharged from ED with positive cultures, re-admission rate in the first week, and rate of change in antibiotic treatment policy. All patient characteristics, clinical background, vital signs during application, and laboratory results during their ER visit were collected .We used an electronic data base to screen the main outcomes: mortality in 28 days, re -admission to ED in the first week after first admission, hospitalization in the first week after discharge and change in antibiotic treatment in first week after discharge from ED.

The clinical investigation ethics committee of Soroka University medical center of Ben-Gurion University of the Negev approved the study with data analyzed using SPSS version 19 (IBM Corp), Continuous variables were described, discrete variables using values and percentages in means and SD, while logistic regression was preformed to find independent variables for prediction of true positive blood cultures.

We used the callback policy during the entire study. Every positive culture for a discharged patient was informed to our team .Every patient received a call and at the end a clinical decision was made whether to call the patient back to the ED. A change in antibiotic treatment during the first week of treatment could be done by our ED team by phone, during the re-admission visit ,or by the family physician . The data were extracted by a common computerized knowledge system existing in hospital and community medicine.

Figure 1. Distribution of the microorganism in the positive blood cultures.



Results

During the three year study, 157 patients who were discharged from the ED found to have positive blood cultures. 61% of the positive blood cultures could be considered as contaminated, while only a minority of 39% had true clinical significance. The main contaminated pathogens were coagulase negative staphylococci- 15%, bacillus sp- 14% ,micrococcus -13% and cornyobacterium- 11% .In the positive true cultures group, the most frequent bacteria were brucella- 11% ,Escherichia coli- 8%, streptococcus species -7%,other gram negative bacilli -5% ,staphylococcus aureus- 4% , pseudomonas -2% and acineto-bacter -1% (Fig. 1).

Table 1 summarizes the demographics, comorbidities, and clinical data during application the ED of all patients included in the cohort.

We divided the research population into two groups according the significance of the blood culture results. The first group with the true bacteremia (61 patients)-we designated as Group A and the second with the contaminated cultures (96 patients) as Group B. These patients in this group were treated in ED as they had negative cultures.

Table 1. Characteristics of patients discharged from ED with positive blood cultures in 2011-2013 (n=157).

Age, years (±SD)	50.8 ± 20.0
Male, no. (%)	80 (51%)
Jews, no. (%)	90 (57.3%)
Nursing home residents, no. (%)	6 (3.8%)
Baseline co-morbid conditions	
Diabetes, no. (%)	36 (22.9%)
Coronary artery disease, no. (%)	16 (10.2%)
Heart failure, no. (%)	12 (7.6%)
Prosthetic valve, no. (%)	3 (1.9%)
Chronic kidney disease, no. (%)	18 (11.5%)
Cancer, no. (%)	22 (14.0%)
Peptic ulcer disease, no. (%)	5 (3.2%)
Chronic liver disease, no. (%)	10 (6.4%)
IV drug users, no. (%)	3 (1.9%)
Dementia, no. (%)	6 (3.8%)
Bedridden, no. (%)	8 (5.1%)
Laboratory values	
Hemoglobin, mean (±SD)(Gr%)	12.7 ± 1.7
White blood cells, mean (±SD)	8.6 ± 3.3
Platelets, mean (±SD)	218.0 ± 92.4
Creatinine, mean (±SD)	0.95 ± 0.88
Urea mean (±SD)	37.1 ± 26.0
Glucose, mean (±SD)	131.1± 58.6
Sodium, mean (±SD)	136.0 ± 3.7
Vital signs	
Systolic blood pressure, mean (±SD)-mmHg	125.1 ± 24.5
Diastolic blood pressure, mean (±SD)-mmHg	67.7 ± 11.9
Mean arterial blood pressure, mean (±SD)-mmHg	86.3 ± 17.3
Pulse, mean (±SD)	95.9 ± 17.3

O_2 saturation, median (I.Q range)(%)	95.7 (95.0-98.0)
Discharge time	
Morning shift (8-16), no. (%)	28 (17.8%)
Night shift (16-8), no. (%)	91 (58.0%)
Diastolic blood pressure, mean (±SD)	67.7 ± 11.9
Mean arterial blood pressure, mean (±SD)	86.3 ± 17.3
Hospitalization in the previous three months, no. (%)	25 (15.9%)
Poly-pharmacy, no. (%)	35 (22.3%)

Table 2. Clinical visit characteristics of patients discharged from the ED with positive blood cultures (n=157).

	GROUP A Positive for true pathogens* (n=61)	**GROUP B Positive for contaminated pathogens** (n=96**	**P value**
Laboratory values			
Hemoglobin, mean(±SD)	12.4 (±1.7)	12.8 (±1.8)	0.274
White blood cells, mean(±SD)	7.8 (±3.1)	9.1 (±3.4)	0.014
Platelets, mean (±SD)	198.5 (±66.6)	230.5 (±104.2)	0.034
Createnine, mean(±SD)	0.90 (±0.70)	0.99 (±0.70)	0.552
Urea , mean (±SD)	37.4 (±22.7)	36.9 (±28.1)	0.907
Glucose, mean (±SD)	134.6 (±72.8)	128.9 (±45.7)	0.546
Sodium, mean (±SD)	135.2 (±3.1)	136.5 (±3.9)	0.025
Vital signs			
Systolic blood pressure, mean (±SD)	121.4 (±20.3)	127.6 (±26.7)	0.127
Diastolic blood pressure, mean (±SD)	66.9 (±10.4)	68.2(±12.8)	0.524
Mean Arterial bloodpressure, mean(±SD)	83.7 (±16.3)	88.0 (±17.2)	0.128
Pulse, mean (±SD)	97.4 (±15.7)	95.0 (±18.3)	0.383
O_2 Saturation, median (I.Q range)	96.2 (95.0-98)	95.5 (95-98)	0.274
Infection source on ED presentation			
Fever, no. (%)	15 (24.6%)	22 (22.9%)	0.352
Respiratory tract, no. (%)	8 (13.1%)	19 (19.8%)	
Urinary tract, no. (%)	12 (19.7%)	9 (9.4%)	
Gastro intestinal, no. (%)	6 (9.8%)	11 (11.5%)	

Antibiotics prescribed on discharge			
None	17 (30.9%)	22 (34.4%)	0.973
Penicillins	7 (12.7%)	8 (12.5%)	
Cephalosporines	12 (12.8%)	12 (18.8%)	
Tetracycline	7 (12.7%)	6 (9.4%)	
Quinolones	5 (9.1%)	8 (12.5%)	
Combination	7 (12.7%)	8 (12.5%)	
Discharge time from the ED			
Morning shift (8-16), no. (%)	9 (19.6%)	19 (26.0%)	0.508
Night shift (16-8), no. (%)	37 (80.4%)	54 (74.0%)	
Mortality in 28 days	1 (1.6%)	0(0%)	0.308
Re admission in 7 days	21(33%)	9(9.3%)	>0.001
Hospitalization in 7 days	10(16.4%)	6(6.3%)	0.002
Change of treatment in 7 days	12(19.6%)	2(2.2%)	>0.001

*Streptococcus pneumoniae, group A streptococci, Enterobacteriaceae, Haemophilus influenzae, Pseudomonas aeruginosa, acinetobecter, brucella and other gram negative bacilli.

**Corynebacterium species, Bacillus species, coagulase-negative staphylococci, micrococcus and other gram positive species.

We compared the groups according to patient characteristics, clinical picture on admission and clinical outcomes (Table 2) .There were no differences between those two groups according to patients demographic characteristics, vital signs during applying to the ED , laboratory results and according the estimated source of the febrile disease. While examining the main outcomes, mortality during 28 days, the rate of antibiotic prescribed on discharge, return rate in the first week, and hospitalization in first week ,we found no difference between the two groups .There was one unexpected mortality in the true cultures and no mortality in the contaminated cultures. A few significant differences between groups were found, first in the rate of antibiotic changing in the first week after ED discharge according to the blood culture results (33% vs. 9.3%) second ,a higher hospitalization rate in the first week was higher in Group A (16.4% vs. 6.3%) and the third in rate of antibiotic treatment change which was significantly higher in group A (19.6% vs. 2.2%) .

Logistic regression was done for clinical outcomes of patients in group A (Table 3) .

We found that the rate of true cultures were significant higher among patients with comorbidities as diabetes mellitus and cancer and among patient with poly- pharmacy treatment.

The clinical picture of urinary tract infection was significantly higher among Group A. The independent variables, hospitalization in the previous three months ,respiratory symptoms on admission, cancer history such as diabetes mellitus were shown to be significantly related hospitalization during the following week of patient in Group A.

Discussion

OBSI in adults, counter to pediatric OBSI, is less reported in the medical literature [11-14]. Del Vecchio [15] found the incidence of true bacteremia was 3 in 10000 admissions to the ED almost the same as in Fu report of 759 episodes of true occult OBSI in adults during a 10- year period [16].

However the clinical significance of positive BCs in ED patients has been evaluated in few studies and consistent results show no clinical significance in drawing BC's from discharged patients with febrile disease in comparison to those admitted to hospital patients with true positive cultures [15-16]. The difference in clinical outcomes between true positive cultures and contaminated ones among patients who were discharged from the ED has not been evaluated due to our literature search. The two groups are resembled in their demographic characteristics.

Table 3. Logistic regressions for clinical outcomes of patients discharged from the ED with positive blood cultures *.

Clinical outcomes	Independent Variables	P value	Odds ratio	C.I 95%
"True" positive blood culture	WBC	0.024	0.877	0.783-0.983
	Urinary tract symptoms on admission	0.047	2.709	1.013-7.244
	Poly-pharmacy	0.020	0.359	0.151-0.853
Reapplying to the ED during the following week	HB	0.051	1.265	0.999-1.601
	Respiratory symptoms on admission	0.072	0.429	0.171-1.077
	Poly-pharmacy	0.096	2.124	0.875-5.154
Hospitalization during the following one week	Diabetes	0.025	2.954	1.147-7.607
	Cancer history	0.007	4.734	1.528-14.665
	Respiratory symptoms on admission	0.027	0.324	0.120-0.880
	Hospitalization in the previous three months	0.005	4.220	1.548-11.503

*Adjusted for age, gender and ethnicity

There were no differences in mortality rate in 28 days nor in antibiotic prescription rate. Nevertheless, the return rate to ED in the first week and in hospitalization rate in first week after discharge was much higher in Group A. This result was expected due group B was being treated as negative cultures. The second reason for these data is the "callback" protocol accepted in our ED which was responsible for the readmissions to EDs .Almost half of patients who were called back were hospitalized.

The main finding in our research is the fact that the change in treatment policy in Group A, the high readmission rate and as a consequence the higher hospitalization rate, did not influence the mortality rate. These results apparently reinforce our assumption that there is no clinical significance to BCs drawing for patients being sent home from an ED, and its significance is the same as for those patients with contaminated cultures or negative cultures. Nevertheless, the significant difference between groups in changing antibiotic treatment policy raises the suspicion that without using the "callback" protocol which is a protective approach we would probably see a higher mortality rate.

Predictable risk factors for OBSI have been studied elsewhere [17,18]. In a prospective study, Lee [19] concluded that several factors are independently associated with community-onset BSI, including age more than 65 years, presence of rigors, fever higher than 39.9ºC,blood urea nitrogen more than 20mg/dL, and a high blood urea nitrogen/ creatinine ratio. The independent risk factors that were found in our research among the patients with true cultures, included comorbidities such as: diabetes mellitus ,cancer, ascending urinary infections in admission and poly -pharmacy. The finding that poly -pharmacy treatment is an independent variable for positive true blood cultures, is directly associated to more comorbidities and higher sensitivity to infectious diseases. All these predictors directly influence the decision- making process of physicians in the ED and result a higher tendency for hospitalization.

An interesting finding in our results is the high prevalence of brucella in blood cultures (11%) .This finding is unique to our population consist of 28 % Bedouines .Brucellosis is common among this population because of their custom of using lamb's milk which is produced without pasteurization. It has been shown that brucella bacteremia does not indicate a worse outcome or more severe clinical presentation [20].This finding does not implicate different attitudes to treat this infection.

There are major limitations to our research, the cardinal limitation being the methodology of the trial. This was a retrospective cohort trial comparing two unmatched groups, and we did not use a matched control group for Group A and B.

Conclusion

The results of our research may indicate that there is a worse prognosis for patients discharged from an ED with true positive cultures and due to careful management of these culture results and preventive strategies such as, high rate of changing the antibiotic treatment policy , high rate of re-admission, and high rate of hospitalization ,the dangers were abolished. In our research co-morbidities such as diabetes mellitus, cancer and poly-pharmacy were found to be predicting factors for positive blood cultures, but they had no prognostic value or influence on the treatment strategy. A prospective trial is needed to estimate the effect of a callback strategy on readmission, hospitalization and mortality rates of patients with OBSI.

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