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NOSOCOMIAL INFECTIONS: A NEED FOR CONTINUED SURVEILLANCE

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Abstract: **Whenever a nosocomial infection (NI) occurs, the hospital, instead of serving as an institution where patients get cured of their illnesses, becomes a threat to a patient's life. Thus, with the objective of determining the occurrence of NI's among paitents admitted to the pediatric wards, pediatric intensive care unit (PICU) and nursery intensive care unit (NICU) of a tertiary hospital, this one-year prospective epidemiologic study was conducted. Sensitivities of all isolates were done using the disk diffusion method. NI rates were as follows - 17% each for the two pediatric wards, 18% for PICU and 14% for NICU. Except for NICU where cases of necrotizing enterocolities (NEC) ranked second, the top three diseases were sepsis, pneumonia and urinary tract infection (UTI). Overall, the predominant organisms for sepsis were *Enterobacter spp' Candida* and *Pseudomonas spp*. For pneumonia, as much as 56% had no identifiable pathogen. The rest were gram-negtive organisms. *Candida* comprised a little more than half (51%) of UTI islates. In both sepsis and UTI, only about a quarter of *Candida* was identified as *C. albicans*. The following were the antibiotics which showed favorable sensitivity patters in general - amikacin, piperacillin-tazobactam, imipenem and ciprogloxacin. Strict adherence to infection control measures as well as more prudent and restrictive use of antibiotics should always be practiced if a reduction in NI is to be achieved.**

Keywords: nosocomial infection, nosocomial rate sepsis
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INTRODUCTION

A hospital is supposed to be a place where patients get cured of their illnesses. There is one instance, however, when this very institution becomes a threat to a patient's life. This occurs whenever a NI sets in. A hospital-acquired or nosocomial infection is one that is neither present nor incubating at the time of a patient's admission[1].

As healthcare providers, we are tasked to give the utmost care to the patients, ensuring their safety while in the hospital and making sure they are well on discharge. Several risk factors, both inherent in each patient as well as environmental exposures, will have to be dealt with in order to meet that goal. Among those significantly associated with NI in two local studies were age, number of antibiotics prior to NI, nasogastric and orogastric tube insertions, use of steroids, underlying disease, ventilatory support and even blood transfusion[2,3].

With all these in mind, NI Surveillance in a tertiary care center which caters to a huge bulk of patients daily should be a top priority. Knowing where it occurs, what pathogens are likely to be encountered, and to which antimicrobials they are sensitive to will aid in the early recognition and management of such cases. Only then can the added physical and financial burden placed on the patients and their relatives be addressed.

Thus, the general objective of this study is to determine the occurrence of NI among patients admitted to the two pediatric wards, PICU and NICU. In all the areas concerned, the incidence of NI as well as its frequency by site will be obtained. Finally, the etiologic agents according to the site of NI and their antimicrobial sensitivity patterns will be determined.

METHODOLOGY

This prospective descriptive study will cover a one-year period from January 1, 1999 to December 31, 1999. All patients admitted to the pediatric wards, PICU and NICU diagnosed to have NI will be included in the study. A NI Surveillance Form which includes the definitions of NI by site and computation of NI will be used for each patient (Appendix A). This was formulated in 1994 by the UP-PGH Pediatric Infectious Disease Section (PIDS).

Daily reporting of NI occurrence by way of submission of an Infection Control Committee (ICC) form was done by the residents-in-charge of patients. As a hospital policy, the purchase of restricted drugs, to which the recommended regimens for NI's are included, has to undergo approval by the PIDS. The ICC form was used for this purpose. Counter-checking of data was performed on a weekly basis so as not to miss out on any NI and monthly reports were collated.

All laboratory examinations were done at the central laboratory of the hospital using standard techniques. The sensitivity patterns of the different isolates were determined using the disk diffusion method.

RESULTS

At the end of the one-year surveillance, the following data were gathered. The two general wards, each with an average bed capacity of 45, showed a similar NI rate of 17%. The PICU, which can accommodate 11 patients, had a NI rate of 18%. Meanwhile, the NICY which can admit around 50 to 60 neonates, had a NI rate of 14%. Table 1 reflects the number of NI per area with the corresponding rates.

Table 1. Nosocomial Infection Rates per Area

Area	Nosocomial Infection Rate
Ward 9	295 / 1752 (17%)
Ward 11	295 / 1743 (17%)
PICU	107 / 582 (18%)
NICU	238 / 1752 (14%)

Overall, there was a total of 935 NI's (Table 2). The leading causes were sepsis (45%), pneumonia (29%), and UTI (15%). This general trend was also observed in the pediatric wards and PICU. It was only in the NICU where cases of NEC ranked second. Gastrointestinal tract (GIT) infections included gastroenteritis, cholecystitis, peritonitis and infected choledochal cyst. The central nervous system (CNS) infections were meningitis, ventriculitis, shunt infection and subdural empyema. The other infections were soft tissue infections, conjunctivitis and measles.

Table 2. Nosocomial Infections by Disease Entity per Area

Disease	Ward 9		Ward 11		PICU		NICU		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Sepsis	117	40	122	41	37	35	142	60	418	45
Pneumonia	92	31	103	35	44	41	31	13	270	29
Urinary tract Infection	43	15	61	21	18	17	19	8	141	15
GIT Infections	22	7	5	2	5	5	36	15	68	7
CNS infections	15	5	2	0.5	1	1	6	2	24	2.5
Others	6	2	2	0.5	2	1	4	2	14	1.5
Total	295		295		107		238		935	

Tables 3 to 7 summarize the organisms isolated by disease entity. Gram-negative isolates predominated except in the case of UTI where Candida comprised a little more than half of all isolates (51%). Overall, the distribution of etiologic agents is shown in Table 8. As much as 20% of all NIs have no identifiable pathogen. This figure has also been observed for GI infections. On the other hand, more than half of pneumonia cases (56%) were without isolates.

Table 3. Isolates from patients with sepsis

Isolates	No.	%
Enterobacter spp.	111	26
Pseudomonas spp.	73	17
Candida spp.	65	16
Klebsiella spp.	32	8
Candida albicans	21	5
Acinetobacter spp.	20	5
Pseudomonas aeruginosa	16	4
No isolate	22	5
Others	58	14
Total	418	

Table 4. Isolate from Patients with Pneumonia

Isolates	No.	%
No isolate	150	56
Pseudomonas aeruginosa	37	14
Klebsiella spp.	33	12
Pseudomonas spp.	14	5
Acinetobacter spp.	13	5
Enterobacter spp.	12	4
Others	11	4
Total	270	

Table 5. Isolate from Patients with UTI

Isolates	No.	%
Candida spp.	54	38
Klebsiella spp.	20	14
Candida albicans	18	13
Pseudomonas aeruginosa	13	16
E. coli	12	9
Enterobacter spp.	7	5
Others	17	12
Total	141	

Table 6. Isolate from Patients with GIT Infections

Isolates	No.	%
No isolate	14	21
E. coli	13	19
Klebsiella spp.	9	13
Pseudomonas aeruginosa	8	12
Enterobacter spp.	5	7
Pseudomonas spp.	5	7
Others	14	21
Total	68	

Table 7. Isolate from Patients with CNS

Isolates	No.	%
Enterobacter spp.	6	25
Acinetobacter spp.	4	16.7
Klebsiella spp.	4	16.7
Pseudomonas aeruginosa	4	16.7
Others	6	25
Total	24	

Table 8. Overall distribution of all nosocomial Infections Isolates

Isolates	No.	%
No isolate	189	20
Enterobacter spp.	146	16
Candida spp.	122	13
Klebsiella spp.	99	10
Pseudomonas spp.	96	10
Pseudomonas aeruginosa	82	9
Acinetobacter spp.	44	5
Candida albicans	41	4
E. coli	34	4
Others	82	9
Total	935	

The antimicrobial sensitivity patterns of the top five isolates are shown in Table 9. Among the aminoglycosides, amikacin exhibited more favorable results. The gram-negative isolates in general were sensitive to piperacillin-tazobactam, imipenem and ciprofloxacin. Ceftazidime demonstrated low sensitivity rates for Klebsiella spp. and Acinetobacter spp. Since the newer drugs, cefepime and meropenem, have just been recently introduced, susceptibility trends will have to be re-assessed after several more months.

Table 9. Antimicrobial Sensitivity Patterns of the Top 5 Isolates: No. (%)

Antibiotic	*Enterobacter* (n=168)	*Klebsiella* (n=105)	*Pseudomonas* (n=82)	*P. aeruginosa* (n=72)	*Acinetobacter* (n=43)
Aminoglycoside					
Gentamicin	1/17 (6)	8/14 (57)	9/18 (50)	5/30 (17)	2/7 (29)
Netilmicin	29/71 (41)	21/54 (39)	22/47 (47)	18/52 (35)	13/22 (59)
Amikacin	51/67 (76)	30/41 (73)	29/49 (59)	28/44 (64)	14/23 (61)
Piperacillin-tazobactam	70/78 (90)	38/58 (67)	31/34 (91)	23/42 (55)	14/20 (70)
Cephalosporins					
Ceftazidime	44/64 (70)	10/38 (26)	48/52 (92)	36/45 (80)	2/11 (18)
Cefepime	14/15 (93)	31/31 (100)	7/8 (88)	17/28 (61)	7/13 (54)
Carbapenems					
Imipenem	99/99 (100)	62/62 (100)	46/55 (84)	31/54 (57)	14/22 (64)
Meropenem	10/10 (100)	—	—	5/5 (100)	4/8 (50)
Ciprofloxacin	46/49 (94)	34/39 (87)	25/32 (78)	25/40 (62)	13/14 (93)

DISCUSSION

Considering the great impact, both physically and financially, of NI's in a patient's hospital stay, it is a must that some form of surveillance should exist in order to devise ways to curb this problem. Surveillance, as defined by the Centers for Disease Control and Prevention, represents an "ongoing, systematic collection, analysis and interpretation of health data essential to the planning, implementation and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know"[4]. The year 1970 saw the birth of the National Nosocomial Infection Surveillance (NNIS) System which is the only source of national data on the epidemiology of nosocomial infections in the United States[4].

To date, there has been no locally published long-term prospective surveillance of NI. A 3-month study at another tertiary pediatric referral center showed an overall NI incidence of 22.2% with varying rates according to service[3]. An earlier study at the UP-PGH pediatric wards documented it to be 31%[2]. The present study has an overall NI incidence of 16%. Strictly speaking, these rates can not be compared since different methodologies and definitions of NI were utilized. The data at hand can thus serve as baseline information for future comparison of rates in this particular institution.

The problem that is NI is universal and our hospital is not an exception. Since 1994, the PIDS has adapted its own set of NI definitions which was based on the NNIS System. Ideally, the said system requires an active, patient-based, prospective surveillance. This present study thus attempted to conduct such as undertaking. This was in contrast to the practice of previous years which made use of a laboratory-based approach.

In order for a disease to manifest, there has to be an imbalance between the host's defenses and a pathogen's virulence. Being a referral center, the hospital takes care of a considerable number of complicated cases. The advancement in medical technology in the form of new therapies and invasive procedures has brought with it a major disadvantage, that is, the increased risk of NI as borned by several studies [2, 3, 5, 6, 7, 8, 9]. The rates obtained from the four areas in the study were more or less comparable. This is in contrast to other observations is the fact that the hospital's PICU can only accommodate 11 patients at a time and so critical patients are also being managed in the wards. There is also so much traffic in the wards, in the form of relatives and hospital personnel, the hospital being a training facility.

The three most common disease states, namely sepsis, pneumonia, and UTI are in accordance with the findings of other studies[2, 6, 11]. Necrotizing enterocolitis, which is strictly not infectious in etiology, accounted for 15% of NI in the NICU. This finding can be expected since sick newborns have an immature gastrointestinal tract, coupled with other insults that promote the overgrowth of microorganisms.

As to the pathogens, gram-negative organisms, notably members of the Enterobacteriaceae family, headed the list as was noted in a 3-year review of nosocomial isolates at the pediatric wards[12] Even in the top three disease states, gram-negative organisms played a major role. However, in approximately half the pneumonia cases, isolation of an etiologic agent may be difficult even when aggressive diagnostic work-ups are performed[7]. The present study likewise achieved a similar isolation rate.

Once regarded as human saprophytes, infections due to *Candida* have slowly but steadily increased in number. From its number four position in 1994, it is now the second most commonly isolated organism[12]. Half of all UTI isolates were *Candida*. What is more alarming is that around three-fourths were species other than *C. albicans*. With a limited armamentarium of anti-fungal drugs that are available and affordable to the indigent patients, this finding should be a cause of great concern. The identification of Candida species as well as anti-fungal susceptibility testing are not always available due to financial constraints.

Analyzing the sensitivity patterns of the top five isolates, one can note that among the aminoglycosides, there is increased resistance to both gentamicin and netilmicin. Only amikacin performed relatively well. Nosocomial epidermidis due to multiresistant bacteria have resulted in increasing problems worldwide[13]. With extensive and sometimes irrational use of antibiotics, one is bound to expect the emergence of resistant strains and this fact may been observed in the case of ceftazidime. At present, piperacillin-tazobactam and imipenem are being recommended as therapy for NI's in the Department. Ciprofloxacin is used on a compassionate basis only when there is no other alternative drug. In time, however, these first-time drugs may no longer prove benegicial if the continuing problem of NI is not addressed properly.

CONCLUSIONS AND RECOMMENDATIONS

In summary, this one-year NI Surveillance has noted almost similar rates for the general wards and PICU, at 17% and 18%, respectively. NICU rate was lower at 14%. By site, the leading causes of NI were sepsis, pneumonia and UTI. This trend was also observed in both the general wards and PICU. What was quite unique to NICU was the occurrence of more cases of necrotizing enterocolitis.

The nosocomial pathogens were mostly gram-negative organisms. Since the start of the NI Surveillance of the section, Candida has increasingly gained importance. In 56% of hospital-acquired pneumonia, no organism can be isolated.

Based on the sensitivity patterns, the antibiotics to which most of the top five isolates were susceptible included amikacin, piperacillin-tazobactam, impenem and ciprofloxacin. The performance of the newer antimicrobials, cefepime and meropenem, will have to be determined after several more months of use.

Gathering all these data is just the beginning of a true surveillance. The next step is to ensure proper dissemination of such findings in order to review existing infection control practices. A monthly, active form of surveillance is thus recommended. Each caregiver, especially health personnel, has a role in minimizing the spread of nosocomial infections, if not totally eradicating it.

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BRAIN ABSCESS IN CHILDREN AT THE PHILIPPINE GENERAL HOSPITAL: A PROSPECTIVE EPIDEMIOLOGIC STUDY

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Abstract: **Even with the advances in microbiology and radioimaging studies, intracranial abscesses remain to pose a threat to the pediatric population, particularly in those with known predisposing factors in developing countries. Twenty one patients less than 18 years of age who were diagnosed to have brain abscess by CT scan, were seen at the Philippine General Hospital from February to September 1999. Seventy six percent were less than 10 years old (25% were 2 years of age). The most common presenting symptoms were fever, weakness, vomiting and headache with 67% presenting with focal neurologic deficit on admission. Ten (47.6%) had cyanotic congenital heart disease as their predisposing condition, the most common of which was due to Tetralogy of Fallot. Chronic suppurative otitis media was only seen in 28.6%. Eight (44.4%) of the 18 patients who underwent surgery yielded no growth on both aerobic and anaerobic cultures but half of these patients had previous antibiotic intake. A microbiologic diagnosis was established in 55.5% and only one patient grew an anaerobic organism (Bacteroides spp.) on culture of the brain abscess. There was no specific organism associated with certain predisposing factor although gram negative bacteria were more commonly seen in patients with CSOM (*Proteus vulgaris, Proteus mirabilis, Acinetobacter anitratum, Morganella morgagni*). *Staphylococcus aureus* was isolated in 2 patients with no known predisposing factor. All aerobic gram negative organisms and *Streptococcus viridans* isolated were sensitive to chloramphenicol and Penicillin G, respectively. All *staphylococcus aureus* isolated were sensitive to oxacillin. Thus, the empiric antibiotics of choice remain to be penicillin G and chloramphenicol or metronidazole in the treatment of brain abscess. In cases of chronic otitis media wherein gram negative aerobes are usually implicated, a third generation cephalosporin or an anti-pseudomonal antibiotic is recommended. Although antimicrobial therapy may play a major role in the treatment of brain abscess, surgical evacuation, either by aspiration, tube drainage or excision is essential for optimum management.**

INTRODUCTION:

Brain abscess is considered an uncommon yet serious and life threatening infection in children[5]. With the advent of more effective antibiotic regimen and

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