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Current Status of Inpatient Antibiotic Use At The National Hospital of Obstetrics and Gynecology and Solutions

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Abtract
Antibiotics are a group of drugs that play an important role in health care. They are a decisive weapon in the treatment of infectious diseases caused by bacteria. However, this group of drugs is currently the most abused group of drugs. The irrational use of antibiotics leads to many serious consequences, especially the increase in the rate of antibiotic resistance. The increasingly serious level of drug resistance affects the effectiveness of treatment, poor prognosis, high risk of death, prolonged treatment time, increased treatment costs, affecting the health of patients and the community. Using quantitative research methods, based on the database of antibiotic consumption and the number of days of hospitalization of patients in clinical departments and the entire hospital in the period of 01/2022 - 12/2024 stored in the internal software of the Department of Pharmacy and the General Planning Department, National hospital of obstetrics and gynecology (NHOG). The results showed that the parameters have important contributions to pharmacology and clinical pharmacy in Vietnam and are of global significance.

Keywords: *Antibiotic, National hospital of obstetrics and gynecology (NHOG), Clinical Pharmacy*

1. Introduction

According to statistics from the European Medicines Agency (EMA), it is estimated that every year there are about 25,000 deaths due to multidrug-resistant bacterial infections and the economic burden of antibiotic resistance is up to 1.5 billion Euros per year (Agency European Medicines, 2017). In recent years, Vietnam has witnessed the increasing threat of antibiotic resistance due to the irrational use of antibiotics at all levels of the health care system and in the community. In Vietnam, the incidence of infectious diseases is very high, ranking second (16.7%) after cardiovascular diseases (18.4%) (Ministry of Health, 2008).

Faced with this reality, treatment facilities need to have effective strategic solutions to enhance the safe and rational use of antibiotics, especially at present, when many antibiotic regimens recommended in treatment guidelines are no longer appropriate due to the increase in bacterial resistance. One of those solutions is to implement a program to manage antibiotic use in hospitals according to Decision No. 5631/QD-BYT. It provides forms of monitoring the current status of antibiotic use including: Cost analysis (ABC analysis), consumption analysis through defined daily dose (DDD), consumption analysis through antibiotic use time (DOT, LOT) and in-depth analysis

of issues related to antibiotic use.

National hospital of obstetrics and gynecology, formerly Hospital C, was established in 1955. In 1966, it was renamed Institute for Maternal and Child Health. In 2003, it was renamed National hospital of obstetrics and gynecology.

National hospital of obstetrics and gynecology is the highest level specialized hospital in obstetrics and gynecology in the country, playing an important role in reproductive health care in the country. The hospital has a scale of 1,350 planned inpatient beds and 951 actual beds. The hospital's drug list, in addition to the common characteristics, also has the unique features of a final-level obstetrics and gynecology hospital with advanced technology applications in diagnosis and treatment along with specific disease models.

Antibiotic management activities at the hospital: The hospital has established an antibiotic management board with the following main activities:

Develop regulations on antibiotic use in hospitals.

Monitoring antibiotic use and antibiotic resistance in hospitals.

Develop a list of antibiotics that need priority management.

Review antibiotics that need priority management.

Studies on antibiotic consumption and use in hospitals:

Research at the National hospital of obstetrics and gynecology in 2018, the research results showed that the average DDD dose/100 days of hospitalization in 5 years at the hospital was 50.62, with a tendency to increase the consumption of carbapenem and C2G, while reducing the consumption of C3G. In particular, carbapenem tended to increase 7 times during this period. Penicillin combined with beta-lactamase inhibitors and C2G are commonly used antibiotics in the departments. The Department of Obstetrics and Gynecology with Infections is the unit with the largest antibiotic consumption, and the study recorded a trend of increasing carbapenem consumption while reducing the consumption of C3G, 5-nitroimidazole, fluoroquinolone (Nga, 2019).

At the National hospital of obstetrics and gynecology, there have been studies analyzing antibiotic use: "Analysis of antibiotic consumption trends at the Central Obstetrics Hospital in the period of 2017 - 2021", "Survey of antibiotic use in the treatment of post-operative infections in obstetrics and gynecology at the Central Obstetrics Hospital". However, there has not been an overall analysis of antibiotic use in the entire hospital, as well as analysis after 2021. Data analyzing the current situation and forecasting antibiotic consumption trends will be the basis for assessing antibiotic consumption in the following years and is one of the activities to monitor antibiotic use at the Hospital.

Research at the Central Maternity Hospital in 2022, in the period 2017 - 2021, the penicillin + beta-lactamase inhibitor group of antibiotics was most commonly used in most years, and at the same time, consumption tended to increase. The cephalosporin group was also one of the most commonly used antibiotic groups over the years, but consumption tended to decrease. The remaining antibiotic groups were consumed at low and quite stable levels (Hang, 2022).

2. Research overview, theoretical basis

A study of 53 countries in 2015 found that the top 3 antibiotics prescribed were penicillin + beta-lactam inhibitor, mainly amoxicillin with beta-lactamase inhibitor (11.4%) and piperacillin with

beta-lactamase inhibitor (7.7%). The second and third most commonly prescribed antibiotics were C3G (mainly ceftriaxone) and fluoroquinolones (mainly ciprofloxacin and levofloxacin). Carbapenems were most frequently prescribed in Latin America, West and Central Asia (Versporten et al., 2018).

According to a study at Beni Suef University Hospital in Egypt in 2020, total antibiotic consumption increased by 16.3% compared to 2019. In 2020, there was a decrease in fourth-generation cephalosporins (-30%), third-generation cephalosporins (-29%), and combination penicillins (-23%). In contrast, antibiotics that were consumed more in 2020 than in 2019 included Linezolid (74%), vancomycin (66.6%), and carbapenems (7%). Linezolid was the only antibiotic in the Reserve group in the hospital formulary. Antibiotic use in the Access group decreased by 17%, while antibiotic use in the Watch and Reserve groups increased by 3% and 74%, respectively (Hussein et al., 2022).

In Vietnam: According to the report on antibiotic use and antibiotic resistance in 15 hospitals in Vietnam Global Antibiotic Partnership Project GARP Viet Nam, 2009), the cost of C3G group accounted for the highest proportion: 39.5%, followed by carbapenem: 12.3%, C2G: 11.8%, penicillin + beta-lactamase inhibitor: 6.7%, fluoroquinolone: 6.5%.

A recent study at Military Hospital 345 (2017) showed that antibiotics accounted for 24.75% of the total drug value at the hospital, worth nearly 20 billion VND. Of which, the beta-lactam group accounted for the largest value (56.47% of the total value), followed by quinolone antibiotics (30.15% of the total value). In particular, in the beta-lactam group, C3G accounted for more than 50% of the value (the most used active ingredient is cefoperazone), and penicillin antibiotics accounted for 23.96% (Trung, 2019).

This result is quite similar to the research results at Quang Nam Central General Hospital in 2013. Antibiotics used accounted for 45% of the total drug cost, of which beta-lactam antibiotics accounted for the highest proportion with 66% of the total antibiotic value, of which cephalosporins accounted for 82% of the total cost of betalactam antibiotics, Ceftriaxone was the antibiotic with the largest proportion in terms of value (Tuan, 2015).

In another descriptive study at the Vietnam - Cuba Hospital in 2016, it was shown that the antibiotics used were mainly C3G, especially Ceftriaxone (Mai, 2017).

General characteristics of studies on antibiotic use in hospitals in Vietnam: antibiotics are the group of drugs with the largest proportion of value, the most used group of antibiotics are cephalosporins, especially third generation cephalosporins.

Studies on antibiotic use at a given time in the world and in Vietnam

A study of antibiotic use rates in hospitals in 41 hospitals in Thailand showed that. From March to May 2021, a total of 8958 inpatients were counted; 4745 inpatients received antibiotics on the survey date and 6619 antibiotic prescriptions were written. The antibiotic use rate was 53.0% (95% CI 51.1% - 54.0%), ranging from 14.3% to 73.4%. The highest antibiotic use rate was 57.1% (95% CI 55.3% - 58.9%) in adults > 65 years old. Of the 6619 antibiotic prescriptions, 68.6% were used for treatment of infections, 26.7% for prophylaxis, and 4.7% for other or unknown indications. Overall, the three most commonly used antibiotics were third-generation cephalosporins (1993; 30.1%), followed by first-generation cephalosporins (737; 11.1%) and carbapenems (703; 10.6%).The most frequently used antibiotics for community-acquired infections were third-

generation cephalosporins (36.8%), followed by β-lactam/β-lactamase inhibitors (11.8%) and carbapenems (11.3%), while for patients with hospital-acquired infections, the most commonly used antibiotics were carbapenems (32.7%), followed by β-lactam/β-lactamase inhibitors (15.7%), third-generation cephalosporins (11.7%) and colistin (11.7%). First-generation cephalosporins were the most commonly used antibiotics (37.7%) for surgical prophylaxis. 70% of patients received surgical prophylaxis for more than 1 day after surgery. (Al Matar et al., 2019; Anugulruengkitt et al., 2023; Ministry of Health, 2018).

Survey of antibiotic use in 26 Saudi hospitals in 2016. A total of 3240 doses of antibiotics were administered to 2182 patients, representing 46.9% of all eligible patients. Of those receiving antibiotics, 510 (24%) were in the intensive care unit (ICU), 646 (30.4%) were treated medically, and 972 (45.7%) were in surgical departments. The most commonly prescribed antibiotic class was third-generation cephalosporins (17.2%), and the most common indication was respiratory tract infections (n = 597; 18.2%). Antibiotics for surgical prophylaxis accounted for 23.4% of all antibiotic doses. Of these, 78% were administered for more than 24 hours. Compliance with antibiotic use guidelines was 48.1%. Antibiotic prescription was not recorded in patient notes for 51.1% of prescriptions (Al Matar et al., 2019).

Survey of antibiotic use in hospitals in Latin American countries. From December 2018 to August 2019, 5444 patients in 33 hospitals in 5 countries were included in the study (10 hospitals in Cuba, 7 hospitals in Paraguay, 6 hospitals in El Salvador, 5 hospitals in Mexico and 5 hospitals in Peru). Of these patients, 54.6% received at least one antibiotic, with variation between hospitals and within countries. Antibiotics were used more frequently in ICUs (67.2%), SURs (64.5%), and MEDs (54.2%), with 51.2% of antibiotics prescribed for community-acquired infections (CAIs), 22.9% for healthcare-associated infections (HAIs), 11.1% for surgical prophylaxis, and 6.1% for unknown reasons. Adherence to guidelines was observed in 68.6% of cases (72.8% for CAI, 72.4% for HAI, and 44.3% for prophylaxis). Third-generation cephalosporins were the most frequently used antibiotic class (26.8%), followed by carbapenems (10.3%) and fluoroquinolones (8%). Targeted therapy was achieved in 17.3% of cases (Levy Hara et al., 2022).

3. Research methods and models

Research object

Research Object 1 (Consumption Analysis)

Data on antibiotic consumption and number of hospital days of patients in clinical departments and the entire hospital from January 2022 to December 2024 are stored in the internal software of the Pharmacy Department and the General Planning Department, National hospital of obstetrics and gynecology.

Study 2 (Point-in-Time Usage Analysis)

Medical records of patients admitted to the hospital in the previous ward and at 08:00 on the survey date, expected in November 2024.

Research design

The study was described through data collection on antibiotic consumption in 12 departments, including: Obstetrics Department; On-demand Treatment Department; Department of Surgery, Anesthesia and Resuscitation; Department of Emergency Resuscitation; Center for Pelvic Floor Surgery; Center for Assisted Reproduction; Department of Oncology; Department of Gynecology

and Gynecology; Department of Pathological Obstetrics; Department of Infectious Obstetrics; Department of Normal Obstetrics.

Research sample

The data in the research sample was collected using the total sampling method. It is all data on inpatient antibiotic consumption in hospitals during the period from January 1, 2022 to December 31, 2024.

Data collection method

Step 1: Extract information from the hospital's internal network system, including:

- Number of inpatient antibiotics in the entire hospital from 01/01/2022 to 31/12/2024.
- Number of inpatient days in the entire hospital from 01/01/2022 to 31/12/2024.

Data source:

- Hospital drug list from 2022 - 2024, from which collect: brand name, active ingredient name, route of administration, concentration - content.
- Report on drug use of the entire hospital from 2022 - 2024 by the Finance and Accounting Department, from which to collect: list of drugs used, quantity.
- Detailed drug export report for each department from 2022 - 2024 of the pharmaceutical retail warehouses: tube retail warehouse, pill retail warehouse, infusion warehouse. From there, collect the quantity exported for each department, filter the data of antibiotics, obtain a research sample including the list of antibiotics used from 2022 - 2024 at the National hospital of obstetrics and gynecology with the unit of measurement and quantity exported for each department.
- The medical examination and treatment report from 2022 - 2024 of the General Planning Department collects data on the total number of hospital days per year of all departments, excluding the neonatal department.

Step 2: Look up DDD/WHO dose on website https://www.whocc.no/atc_ddd_index

Step3: Calculate DDD of each antibiotic and DDD/100 hospital days.

Method for analyzing the current status of antibiotic use at a given point in time

Research design

Cross-sectional study using patient management software and paper medical records.

Sample size and sampling method

The sample size is calculated based on the actual number of inpatient beds. The total number of actual beds in the hospital is 951. According to WHO guidelines, for hospitals with more than 800 inpatient beds, the sample size is 1/3 of the number of beds. Therefore, the expected sample size is 320 patient records.

Sampling method

Step 1: Make a list of patients who meet the selection criteria on the day of the survey by department/room.

Step 2: Randomly select the first three patients on the list as the starting point for sampling.

Step 3: From this random starting point, select every third patient on the list until the list is exhausted.

Step 4: If a selected patient does not have a medical record available, select the next patient on the list.

Data collection method

Use the Patient Survey Forms in the WHO PPS toolkit to collect data.

IV. Research results

Characteristics of antibiotic consumption

Analysis of antibiotic consumption characteristics at the Central Maternity Hospital based on analysis of antibiotic use characteristics in the entire hospital and characteristics of DDD/100 hospital days of antibiotics by clinical department in the period 2022-2024.

Antibiotic consumption level in the entire hospital in the period 2022-2024.

Consumption levels by antibiotic group

The results of DDD/100 hospital days of antibiotic groups across the hospital in the period 2022-2024 are presented in Figure 3.1

During the period 2022–2024, the hospital-wide antibiotic consumption gradually decreased over the years, from 69.97 DDD/100 hospital days in 2022 to 61.61 in 2023 and 52.91 in 2024. The antibiotics with the highest consumption were Penicillin (28.19-33.83 DDD/100 hospital days) and cephalosporin (18.08-30.69 DDD/100 hospital days). Ranked second was Imidazol with DDD/100 hospital days of 2.19-2.56.

Consumption level of each antibiotic

During the survey period, the four antibiotics with the highest consumption were ampicillin + sulbactam, amoxicillin + clavulanic acid, cefaclor and cefuroxime, with DDD/100 hospital days of 18.25; 12.59; 12.39 and 7.87, respectively. The total consumption of the four antibiotics above accounted for about 85% of the total antibiotic consumption of the hospital. Antibiotics with almost negligible consumption levels included cefoperazone + sulbactam, cefotaxime, sulfamethoxazole + trimethoprim, meropenem and vancomycin.

Consumption trends of the 3 antibiotic groups with the highest consumption

The DDD/100 hospital days of the cephalosporin group fluctuated significantly, with the highest being 64.65 in August 2022 and the lowest in February 2022 with negligible consumption. The penicillin group also had unstable consumption characteristics, with the DDD/100 hospital days peaking in October 2023 at 53.88 and the lowest being 4.54 in August 2022. For the imidazole group, the consumption level was much lower than the other two groups and fluctuated less, with the highest in May 2024 with the DDD/100 hospital days being 3.19 and the lowest in January 2023 with negligible consumption. The Mann-Kendall test results showed that the consumption of cephalosporin and penicillin tended to increase slightly but was not statistically significant ($p>0.05$), the consumption of imidazole increased slightly but was statistically significant ($p=0.03$).

Consumption levels of cephalosporin subgroups

C2G antibiotics have a consumption level approximately 40 times higher than C3G antibiotics. C3G antibiotics have almost negligible consumption except for 2 months, December 2023 and January

2024, with consumption levels of 2.10 and 5.77 DDD/100 hospital days, respectively. Using the Mann-Kendall test to analyze consumption trends, it was shown that C2G antibiotics have an increasing consumption trend but not statistically significant (Tau = 0.07; p-value = 0.55) while C3G antibiotics have a statistically significant increasing consumption trend (Tau = 0.52 and p-value < 0.001).

Consumption level by AWARE classification

National hospital of obstetrics and gynecology uses antibiotics in the Access and Watch groups, and does not use antibiotics in the Reserve group according to WHO classification. The consumption level of the Access group is about 1.4 times higher than that of the Watch group. The consumption level of the Access group between years is not too different, while the consumption level of the Watch group gradually decreases during the research period.

The consumption rate of non-priority antibiotics accounted for > 90% between years. The consumption rate of group 1 antibiotics was the lowest (1.8%), the consumption rate of group 2 was 2 times higher than that of group 1 (4.2%).

Antibiotic consumption rate by clinical department in the period 2022-2024.

In general, during the period 2022-2024, all departments have a gradual decrease in antibiotic consumption each year. The three clinical departments with the highest antibiotic consumption are the Department of Obstetrics and Gynecology (DDD/100 days of hospitalization in 2022, 2023, 2024 are 14.75; 13.27; 13.02, respectively), the Department of General Obstetrics and Gynecology (DDD/100 days of hospitalization in 3 years are 9.58; 10.53; 7.63, respectively) and the Department of Infectious Obstetrics and Gynecology (DDD/100 days of hospitalization in 3 years are 8.29; 6.42; 6.20, respectively). The National Center for Reproductive Support is the unit with the lowest antibiotic consumption in the entire hospital, respectively 0.27; 0.45; 0.15 DDD/100 days of hospitalization in 3 years.

Consumption rate of each antibiotic group by clinical department

It can be seen that the consumption rate of penicillin and cephalosporin groups accounts for the majority in all departments and centers of the hospital. In particular, most clinical departments consume more penicillin than cephalosporin, except for the Department of Endocrinology and the Department of Oncology, which have higher consumption rates of cephalosporin.

Consumption of each antibiotic in departments with the highest consumption

In the Department of Obstetrics and Gynecology, the antibiotic with the highest consumption was cefaclor, followed by amoxicillin + clavulanic acid and ampicillin + sulbactam, with DDD/100 days of hospitalization being 4.29; 3.98 and 3.25, respectively. The total consumption of the above 3 antibiotics accounted for 85% of the antibiotic consumption of the Department of Obstetrics and Gynecology.

In the Department of General Obstetrics and Gynecology, the 2 antibiotics ampicillin + sulbactam and amoxicillin + clavulanic acid had the highest consumption, followed by cefaclor. The total consumption of these 3 antibiotics accounted for 81.2% of the antibiotic consumption of the Department of General Obstetrics and Gynecology.

In the Department of Infectious Obstetrics and Gynecology, ampicillin + sulbactam was the most consumed antibiotic, followed by levofloxacin and imipenem + cilastatin with DDD/100 days of hospitalization being 1.82; 1.11 and 0.82, respectively. The total consumption of these 3 antibiotics accounted for 55% of the antibiotic consumption of the Department of Obstetrics and Gynecology.

Antibiotic consumption levels in departments according to AWARE classification

In general, most departments and centers had higher antibiotic consumption in the Access group than in the Watch group, except for the Department of Endocrinology, the Department of Oncology, and the Department of Obstetrics and Gynecology. In both the Access and Watch groups, the Department of Obstetrics and Gynecology had the highest antibiotic consumption. Meanwhile, the National Center for Reproductive Support had the lowest antibiotic consumption. The Department of Surgery, Anesthesia, and Resuscitation had the highest difference in consumption between the Access and Watch groups, specifically, the Access group consumed nearly 3 times more antibiotics than the Watch group.

Antibiotic consumption levels in departments according to management priority classification

All departments and centers consumed the most non-priority antibiotics according to the classification of the Ministry of Health. The Department of Obstetrics and Gynecology with Infections had the highest consumption of Group 1 and Group 2 antibiotics, at 0.93 and 1.62 DDD/100 days of hospitalization, respectively. The Department of Emergency Resuscitation ranked second, at 0.07 and 0.34 DDD/100 days of hospitalization, respectively. Most of the remaining departments and units had insignificant consumption of Group 1 and Group 2 antibiotics.

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