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Assessment of Effective Clinical Pharmacy Clerkship as an Emerging Programme on Drug Related Problems in Pediatric Ward- A Single Centre Study from North West Part of Pakistan

Gowhar Ali[a,*], Saniya Hashim Khan[a], Shabnam Nazir[a,b], Abuzar Khan[a], Muzaffar Abbas[a,c], Samiullah[a], Fazli Khuda[a], Ihsanullah[a], Rehmat Shah[a]

[a]Department of Pharmacy, University of Peshawar, Peshawar, Pakistan
[b]Institute of Pharmaceutical Sciences, Kohat University of Science and Technology, Kohat 26000, Pakistan
cDepartment of Pharmaceutical Sciences, South Dakota State University, College of Pharmacy, Brookings, U.S.A.

Running title: Evaluation of effective clinical pharmacy clerkship as an emerging programme

*Correspondence: Dr. Gowhar Ali, Lecturer of Pharmacology
Department of Pharmacy, University of Peshawar, Peshawar. Pakistan.
Email: gohar.pharmacist@gmail.com

Abstract

Objective: The current study was designed to evaluate effective clinical pharmacy clerkship as an emerging programme in pediatric ward of tertiary care hospital setting to identify actual and potential drug related problems (DRPs) and provide suitable suggestions with references sources.

Methods: Already designed proforma was used to enter the collected data regarding selected typical patients cases of pediatric infectious diseases including meningitis, pneumonia, acute gastroenteritis and malaria in the form as; patient's information, chief complaints, medication history, history of present illness, past medical history, past surgical history, family history, personal history, allergies, review of systems, physical examination, clinical laboratory tests, daily progress report, treatment at hospital and discharge medications.

Results: A total of twenty typical cases, five cases per disease were observed, documented and analyzed completely. Patients included in the study were infants 30%, children 60% and adolescent10%, including 70% male and 30% female. Findings of this study showed that in twenty typical cases, total DRPs identified were sixty two. Among total DRPs, major findings were untreated conditions (25.80%), improper drug selection (19.35%), drug interactions (9.67%), therapeutic duplication (1.61%), drugs without indication (11.29%), non-compliance (4.83%), cost related problems (20.96%) and use of narrow therapeutic index drugs without monitoring (6.45%).

Conclusions: The present study suggests that DRPs significantly impact existing national health system and effective clinical pharmacy clerkship programme can play an important role in clinical settings by providing patient safety through identification of actual and potential DRPs and promotion of rational drug utilization concept.

Key words: Effective clinical pharmacy clerkship programme (ECPCP), Drug related problems (DRPs), Doctor of pharmacy (Pharm. D.), Pediatric infectious diseases

Introduction

Effective clinical pharmacy clerkship (ECPC) is basically a health training programme in clinical settings where pharmacy graduates get clinical training, skills needed for rational drug utilization with particular emphasis on detection of actual and potential DRPs, after case analysis and then to suggest appropriate management of patient drug therapy in conjunction with other health care professionals. Pakistan is a developing third world country with inadequate health resources resulting in high post partum deaths of mothers and high neonatal death rate during first year of life[1]. As more than seventy percent population of the country lives in rural areas and lack of basic health services to both mothers and babies causes high mortality and morbidity rate[1].

A number of studies have been conducted already which predict that pediatric is a risky population to be affected easily by DRPs, as dynamic and kinetic behavior of drugs in this population usually different than adults[2]. Currently pediatric infectious diseases is a serious public health problem and associated with high mortality and morbidity rate including meningitis[3-5], pneumonia[6], acute gastroenteritis[7-9], and malaria[10-11]. Drug induced pediatric hospital admission is a major public health issue[12-13]. It is therefore necessary to strictly control this issue and ECPCP is a step toward to contribute in resolution of this issue.

Medicine management is an important tool in the prevention and treatment of pediatric infectious diseases and health complaints but the increasing number of available drugs and drug users as well as more complex drug regimens leads to more DRPs and complicates follow-up[14]. Drug-related problems are prevalent and lead to substantial morbidity and mortality[15-16], increased health care expenditure, which in turn affect both patient quality of life and society[17]. Nursing homes, hospitals and general practices have a high prevalence of such problems, therefore, systematic review of patients total drug use, in the light of clinical information, is an effective method to identify DRPs and start interventions.

Now in Pakistan, ECPCP is an integral part of the clinical pharmacy and is also required for the partial fulfillment of the requirements for the degree of Doctor of pharmacy (Pharm-D.). It has been reported that Pharm.D students positive interventions as a member of health care professional can improve proper drug utilization in health care settings[18]. Most of the work during clinical pharmacy clerkship comprised by noting patient histories with special emphasis on medication histories. It is a matter of common observation that patient medication histories are not properly documented. Discrepancies have been observed between physician acquired medication histories and comprehensive medication histories at the time of hospital admission.

The current study was targeted to evaluate effective clinical pharmacy clerkship as an emerging programme on DRPs regarding selected clinical disorders of meningitis, pneumonia, acute gastroenteritis and malaria in pediatric ward of tertiary care setting, Hayatabad Medical Complex (HMC), Peshawar, Pakistan, in order to recommend appropriate suggestions in collaboration with other health care professionals, doctors and nurses and to establish the impact of ECPCP on existing national health system (NHS).

Methodology

A specially designed proforma based on standard pharmacotherapy case book[19], designated as complete patient profile, was used for collection of patient data. Complete patient's profile include all the informations collected by health care professionals by asking specific questions, with the aim of obtaining information useful to diagnose the diseases and to identify health related problems of the patient. It includes patient's information, chief complaints, history of present illness, past medical history, past surgical history, family history, personal history, socioeconomic history, allergies, medication history, review of systems, physical examina-

tion, clinical laboratory tests, daily progress report, treatment at hospital and discharge medications. The study was approved by medical superintended of the teaching hospital and concern head of the ward, in order to get services of at least one Doctor (Assistant Professor or SR, or JR or Senior TMO).

The proforma designed for current study in order to record complete patient profile as shown below.

see Table 1 - 7.

Results

The current data was documented and analyzed by describing the case specific indications of prescribed medications, marking the DRPs check list, identifying the management plan for drug related problem using suitable format. Results of collected data were prepared in the tabulated form and presented as Table 8; frequency of drug related problems in individual disease (Fig. 1A; meningitis), (Fig. 1B; pneumonia), (Fig. 1C; acute gastroenteritis) and (Fig. 1D; malaria), Table 9; relative length of stay (days) of patients in hospital (Fig. 2), Table 10; gender of the patients included (Fig. 3), Table 11; age of the patients included in study (Fig. 4), Table 12; area-wise prevalence of individual diseases selected (Fig. 5 and 6), Table 13; therapeutic classes of drugs prescribed for selected diseases (Fig. 7), Table 14; list of chemotherapeutic agents prescribed for twenty patients (Fig. 8), Table 15; Summary of drug related problems detected in all 20 cases (Fig. 9).

see Table 8 - 15.

Discussion

Drug related problems whether actual or potential, usually occur in health care setting especially in hospitals and can be a source of significant morbidity and mortality [20]. Therefore, it is important that medication errors must be monitored so that similar incidents can be prevented in the future. No useful data regarding ECPCP is available in most of the developing countries of the world including Pakistan, to identify actual and potential DRPs. This study will be helpful for health care professionals to identify and manage relevant DRPs through effective use of ECPCP in clinical settings. ECPCP provides the means by which the clinical pharmacists can extend their clinical knowledge and skills. The clinical attachment with the consultant in the ward and outpatient department presents numerous opportunities for learning. The clinical pharmacist fully uses these opportunities to gain maximum benefit from the program and to progress satisfactorily in the field. Within ward, the clinical pharmacist require to produce a detail evaluation of a wide range of patients; evaluate critically drug therapy and increase the effectiveness of the ECPCP input to the ward. This programme prepares graduates with the competency for managing drug therapy (pharmaceutical care) in partnership with patients, doctors and other health care professionals.

The present study was carried out in pediatric ward of tertiary care setting, Hayatabad Medical Complex (HMC), Peshawar during session of 2010-2011. Patients included in the study were infants (1month-1yr) 30%, children (1yr-12yrs) 60%, adolescent (12yrs-18yrs) 10%, (Table 11 and Figure 4) including 70% male and 30% female (Table 10 and Figure 3) and residents of North West part of Pakistan that is Peshawar, Mardan, Charsadda, Hangu, Kohat and Nowshera city (Table 12 and Figure 5). Patients were admitted for treatment of meningitis, pneumonia, acute gastroenteritis and malaria with relative length of stay was more than three days (Table 9 and Figure 2).

Twenty typical cases per five diseases were collected in the form of patient history from medical charts, medical records, participation in rounds and contact with physicians, patients and patient attendant. Literature survey that is introduction, etiology, pathophsiology, clinical features, complications, investigations and management of the diseases, was conducted from different text books like Dipiro pharmacotherapy-a pathophysiologic approach, Dipiro pharmacotherapy hand book, Pharmacotherapy case book, a patient-focused

approach, Harrison principles of internal medicines, Kumar and Clark clinical Medicine and Current medical diagnosis and treatment. For case analysis the standard books like BNF-56, A to Z drug facts, Drug manual and Drug interactions analysis and management were used.

A total of 20 typical cases were observed, documented and analyzed completely for DRPs. Our findings reveal that major DRPs observed relatively in meningitis, pneumonia, acute gastroenteritis and malaria were; untreated conditions [8%, 15%, 34%, 0%], improper drug selection [4%, 5%, 0%, 25%], drug interactions [30%, 20%, 8%, 0%], therapeutic duplication [7%, 15%, 25%, 12%], drug without indications [11%, 5%, 8%, 0%], problems related to cost of drugs [22%,20%,17%, 38%], use of narrow therapeutic index drugs without monitoring [4%, 5%, 0%, 0%], excessive dose [7%, 10%, 0%, 25%] and sub therapeutic dose [7%, 5%, 8%, 0%] (Table 8 and Figure 1A, 1B, 1C, 1D). It is depicted in (Table 8 and Figure 1A, 1B) that the total frequency of DRPs noted in meningitis, pneumonia, acute gastroenteritis and malaria were 27, 20, 12, and 8 relatively.

In case of meningitis and pneumonia major DRP observed was drug interactions (30%, 20%) while in acute gastroenteritis, untreated conditions (34%) and in malaria, problems related to cost of drugs (38%) was the major DRPs as depicted in Figure 1A, 1B, 1C and 1D. Table 13 and Figure 7, indicates that different therapeutic classes of drugs like chemotherapeutic agents/antibiotics, NSAIDs, paracetamol, amoebicides, bronchodilators, vitamins, corticosteroids, anti-ulcer, infusions/electrolytes, antifungal, benzodizepenes/ barbiturates and antimalarial were prescribed for selected diseases with maximum prescription of chemotherapeutic agents (Table 14 and Figure 8). Total sixty two drugs related problems were identified and total drug classes prescribed were thirteen. Among total drug related problems in twenty typical cases (Table 15 and Figure 9), major findings were untreated conditions (25.80%), improper drug selection (19.35%), drug interactions (9.67%), therapeutic duplication (1.61%), drug without indication (11.29%), non-compliance (4.83%), problems related to cost of drugs (20.96%) and use of narrow therapeutic index drugs without monitoring (6.45%).

The present study suggests that drug related problems can exists to a greater extend and significantly impact existing national health system and effective clinical pharmacy clerkship programme can play an important role in clinical settings by providing patient safety through identification of DRPS and promotion of rational drug utilization concept.

Effective clinical pharmacy clerkship programme activities at the hospital were include participation in medical rounds, patient medication reviews, ensuring rational drug therapy (safe, appropriate and cost-effectives use of medicines), prescription monitoring and screening, medication history taking and recording, detecting, interpreting, correcting and properly documenting various drug-related problems, patient attendant education and counseling on safe, appropriate and effective use of medicines and various healthcare products, provision of drug information to physicians and other healthcare professional whenever needed or requested and various other activities. Various medical terminologies used in ward, various diagnostic tests, their interpretation and use of drugs in special population were also learnt.

During clerkship indication specific prescribing practice was observed with the use of appropriate dosage form but dosage adjustment was not observed in this population. Use of multiple drugs was also observed in some patients who increased the risk of drug interactions, which were common as no specific protocol was followed for drug prescribing. Clinical management of drug interactions should include prospective and concurrent patient, disease and drug-monitoring measures that are sensitive enough to alert the pharmacist or healthcare provider to monitor specific patient, disease or drug-therapy. Follow-up monitoring of a patient's therapy and making appropriate adjustments in the drug regimen can circumvent potentially significant drug interactions. Therefore, when a new drug is added or discontinued patients at

high risk for drug interactions should be closely monitored. Cost related problems were more commonly observed due to unawareness of prescribers about the availability of cheaper and effective brands which can help to make the drug therapy cost effective.

As to prevent these DRPs, effective clinical pharmacy clerkship programme can focus on monitoring of the quality improvement program drug utilization review program that should include a system for monitoring, reviewing, and reporting medication errors to assist in identifying and eliminating causes of errors and preventing their recurrence. Ensuring the proper use of both prescription and over the counter (OTC) drugs is one of the basic responsibilities of the clinical pharmacist within the health care system needs to be more fully recognized through regulations. Pharmacist should monitor the DRPs on spot, to counsel the patient and check compliance and thus serious medication errors can be minimized.

In summary, the effective clinical pharmacy clerkship programme shows that drug related problems significantly impact existing National Health System. This study has shown that ECPCP in the clinical setting is well suited to identify DRPs thereby preventing harm to the patients. Suggestion is that there should be a legally qualified [Doctor of pharmacy (Pharm.D)] and professionally competent pharmacist in every ward/unit of hospital that is unit based clinical pharmacist that is specialist for each unit so that the problems associated with the use of drugs are resolved and prevented. In addition to the development of educational programs based on such study, efficient strategies and supporting instruments are needed for a more systemic, simplified and economical approach to the obvious prerequisite for overall awareness and there for improved prevention.

Statistical analysis

The data were analyzed using MS Excel and graph pad prism version 5.

Acknowledgement

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Conflict of Interest

We declare that we have no conflict of interest.

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CASE NO:_____ DISEASE:_____

Patient Name:_____ Ward:_____

Gender:_____ _____ Address:_____

Age:_____ Bed#: _____ Weight:_____ Height:_____

DOA:_____ DOD:_____

DOA: Date of admission; DOD: Date of discharge

Table 1: Patient's information

Chief Complaint(s): (C/C), ----- History of Present Illness: (HOPI), ----- Past Medical History: (PMH), ------ Past Surgical History: (PSH) ----------. Personal history: (PH), --- Socioeconomic History---- Allergies, ----.

Disease	Tick mark	Tick mark	Tick mark	Tick mark
Diabetes	Father [yes/No]	Mother [yes/No]	Sister [yes/No]	Brother [yes/No]
Heart problem	Father [yes/No]	Mother [yes/No]	Sister [yes/No]	Brother [yes/No]
Kidney problem	Father [yes/No]	Mother [yes/No]	Sister [yes/No]	Brother [yes/No]
Cancer	Father [yes/No]	Mother [yes/No]	Sister [yes/No]	Brother [yes/No]
Hypertension	Father [yes/No]	Mother [yes/No]	Sister [yes/No]	Brother [yes/No]
Asthma	Father [yes/No]	Mother [yes/No]	Sister [yes/No]	Brother [yes/No]
Poor conditioning	Father [yes/No]	Mother [yes/No]	Sister [yes/No]	Brother [yes/No]
Autoimmune disease	Father [yes/No]	Mother [yes/No]	Sister [yes/No]	Brother [yes/No]

Table 2: Family History: (FH)

General	Gastrointestinal tract	Respiratory system
☐ Fever ☐ Convulsions ☐ Depression ☐ Depression ☐ Headache ☐ Dizziness ☐ Insomnia ☐ Nervousness ☐ Loss of weight ☐ Chills ☐ Fatigue	☐ Diarrhea ☐ Liver problem ☐ Rectal problem ☐ Constipation ☐ Nausea ☐ Vomitting ☐ Stomach pain ☐ Anorexia ☐ Jaundice ☐ Dyspepsia	☐ Chest pain ☐ Chronic cough ☐ Dyspnoea ☐ Spitting blood ☐ Pneumonia ☐ T.B ☐ COPD
Cardio Vascular ☐ Ankle swelling ☐ Hypertension ☐ Tachycardia ☐ Hypotension ☐ Bradycardia ☐ stroke	Skin / Allergies ☐ Sensitive skin ☐ Dryness ☐ Eczema ☐ Hives/urticaria ☐ Itching	Musculoskeletal system ☐ Backache ☐ Spinal curvature ☐ Foot problem ☐ Swelling joints ☐ Stiff neck

Table 3: System review:

GENERAL: VITAL SIGNS: TEMP: _____BP: _____

PULSE RATE: _____ANAEMIA: _____

DATE- WISE DAILY PROGRESS REPORT (DPR) & RESPONSE ASSESSMENT									
Vital Sign	Date/Time								
T(F)									
BP(mmHg)									
PR (per min)									
FBS (mg/dl)									

Table 4: Date wise daily progress report and response assessment

Clinical laboratory tests		
TESTS	REFERENCE	RESULTS
ESR	M:<15mm/h F:<20mm/h	
RBC	M:4—6x 10^6/ul F:3.5---5x 10^6/ul	
Hb	F:12-16g/dl,M:14-18g/dl	
MCHC	33—35g/dl	
MCV	76—96fl	
MCH	27—33pg	
WBC/TLC	4000--11000/ul	
Neutrophils	40—75%	
Lymphocytes	20—45%	
Monocytes	2—10%	
Eosinophils	0—6%	
Basophils	0—1.5%	
PLT	150—450x10 3/ul	
PT	11—15sec	
APTT	17—27sec	
Cr_s	M:0.6—1.5mg/dl F:0.5—1.1ng/dl	
BUN	8—18mg/dl	
Na	135--145 mmol/L	
Cl_{cr}	M:85—125ml/mint F:75—115ml/mint	
Mg	0.75—1.25 mmol/L	
Cl	95--105 mmol/L	
K	3.5--5 mmol/L	
HCO_3/CO_2	22—32 mmol/L	
RBS	<140mg/dl	
FBS	60—110mg/dl	
Ca	Total.2.1—2.6 mmol/L	

Table 5: Clinical Laboratory tests: The patient's laboratory values and diagnostic data.

Results of other relevant Tests (Chest X-Ray, ECG, U/S ABD, CT-Scan, MRI)

HOSPITAL TREATMENT				
Start Date	Brand, Dosage-Form, Generic &Strength	DOSE,	Frequency & Duration	Stop Date
DISCHARGE MEDICATIONS				

Table 6 Hospital treatment

The patient's medication history should include the medication's name, strength, dosage form route, and dates of administration

Drug Related Problems: (DRPs)	Date and frequency			
Excessive dose				
Improper Drug Selection				
Drugs without Indications				
Untreated conditions				
Sub therapeutic Dose				
Improper duration				
Drug Interactions				
Adverse Drug Reaction/Intolerance				
Requiring Dose Adjustment in Hepatic Impairment				
Requiring Dose Adjustment in Renal Impairment				
Therapeutic Duplication				
Inappropriate Dosage-Form/ Route of administration				
Pregnancy/Lactation Related problems				
Use of narrow Therapeutic Index Drugs without monitoring				
Cost Related Problems:				
Non-compliance				

Table 7: Patient Medication Therapy Review in the Ward and DRP_S Checklist

Management plan for each DRP(use of subjective, objective, assessment, plan (SOAP), finding, assessment, resolution and monitoring (FARM) or other relevant format).

S.NO	MAJOR DRP's	FREQUENCY OF DRP's IN 20 PATIENTS							
		Meningitis		Pneumonia		AGE*		Malaria	
01	Untreated Conditions	2	8%	3	15%	4	34 %	0	0%
02	Improper Drug Selection	1	4%	1	5%	0	0%	2	25%
03	Drug Interactions	8	30%	4	20%	1	8%	0	0%
04	Therapeutic Duplication	2	7%	3	15%	3	25 %	1	12%
05	Drug Without Indication	3	11%	1	5%	1	8%	0	0%
06	Problems related to Cost of drugs	6	22%	4	20%	2	17 %	3	38%
07	Use of NTI Drugs (W/O Monitoring)	1	4%	1	5%	0	0%	0	0%
08	Excessive dose	2	7%	2	10%	0	0%	2	25%
09	Sub therapeutic dose	2	7%	1	5%	1	8%	0	0%
Total		27		20		12		8	

Table 8: Frequency of Drug Related Problems in individual diseases
AGE*: Acute Gastroenteritis; DRPs*: Drug Related Problems

S.NO.	STAY AT HOSPITAL (Days)	NO. OF PATIENTS (n=20)	%AGE
1	3	4	20
2	4	6	30
3	5	4	20
4	6	2	10
5	7	2	10
6	8	2	10
Total	33	20	100

Table 9: Relative length of stay (days) of patients in hospital

S.No	GENDER	FREQUENCY	%AGE
01	Males	14	70
02	females	06	30
Total		20	100

Table 10: Prevalence of gender included in the study

S.NO	AGES	FREQUENCY	%AGE
1	Neonates (1day-1mnth)	00	00
2	Infants (1mnth-1yr)	06	30
3	Children (1yr-12yrs)	12	60
4	Adolescent (12yrs-18yrs)	02	10
Total		20	100

Table 11: Age of patients included in the study

S.NO	AREA	FREQUENCY			
		Meningitis	Pneumonia	AGE*	Malaria
01	Peshawar	1	1	1	2
02	Mardan	2	1	1	0
03	Charsadda	1	1	0	0
04	Hangu	0	1	1	1
05	Kohat	0	0	1	1
06	Pabbi	1	1	0	0
07	Nowshera	0	0	1	1

Table 12: Area-wise prevalence of individual diseases selected
AGE*:Acutegastroentritis

S.NO	DRUG CLASS	NO. OF PATIENTS	%AGE OF PATIENTS RECEIVING THE DRUG
1	Chemotherapeutic agents/Antibiotics	20	100
2	NSAIDs	04	20
3	Paracetamol	07	35
4	Amoebicides	07	35
5	Bronchodilators	02	10
6	Vitamins	03	15
7	Corticosteroids	09	45
8	Anti ulcer	02	10
9	Infusions/Electrolytes	07	35
10	Antifungal	01	05
11	Benzodizepenes/ Barbiturates	02	10
12	Anti-Malarial	05	25
13	Miscellaneous	07	35

Table 13: Therapeutic classes of drugs prescribed for selected diseases

S.No	Chemotherapeutic agents/antibiotices	Frequency	%age
1	Cephalosporins	19	95
2	Penicillins	3	15
3	Anti-ameobic	6	30
4	Anti-Malarial	5	25
5	Aminoglycosides	2	10
6	Quinolones	2	10
7	Macrolides	6	30

Table 14: List of chemotherapeutic agents prescribed for 20 patients

S.NO	DRPs	FREQUENCY	%AGE
1	Untreated Conditions	16	25.80
2	Improper Drug Selection	12	19.35
3	Drug Interactions	6	9.67
4	Therapeutic Duplication	1	1.61
5	Drug Without Indication	7	11.29
6	Non-Compliance	03	4.83
7	Problems related to Cost of drugs	13	20.96
8	Use of NTI* Drugs W/O* Monitoring	04	6.45
Total		62	100

Table 15: Summary of drug related problems detected in all twenty typical cases
NTI*: Narrow therapeutic index; W/O*: without

List of figures

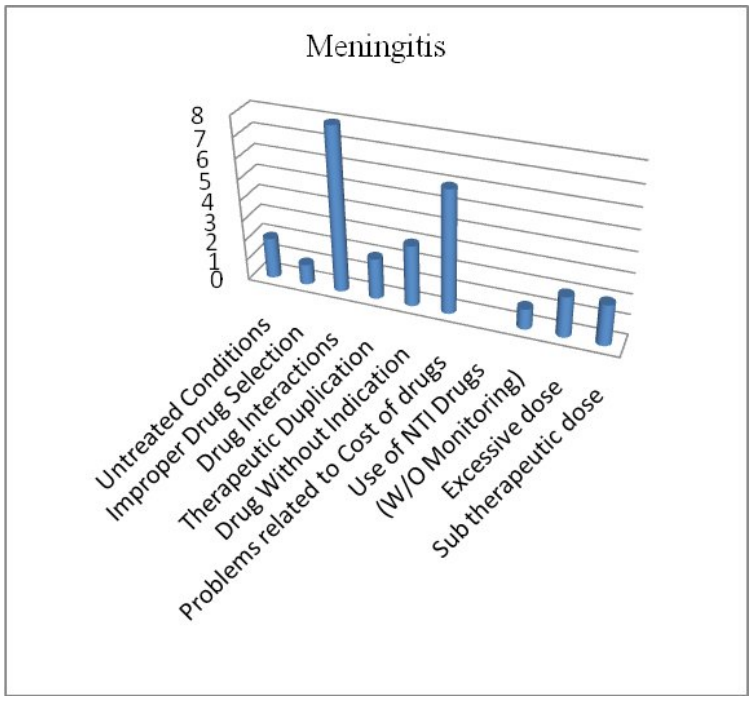

Fig. 1A Frequency of drug related problems in meningitis

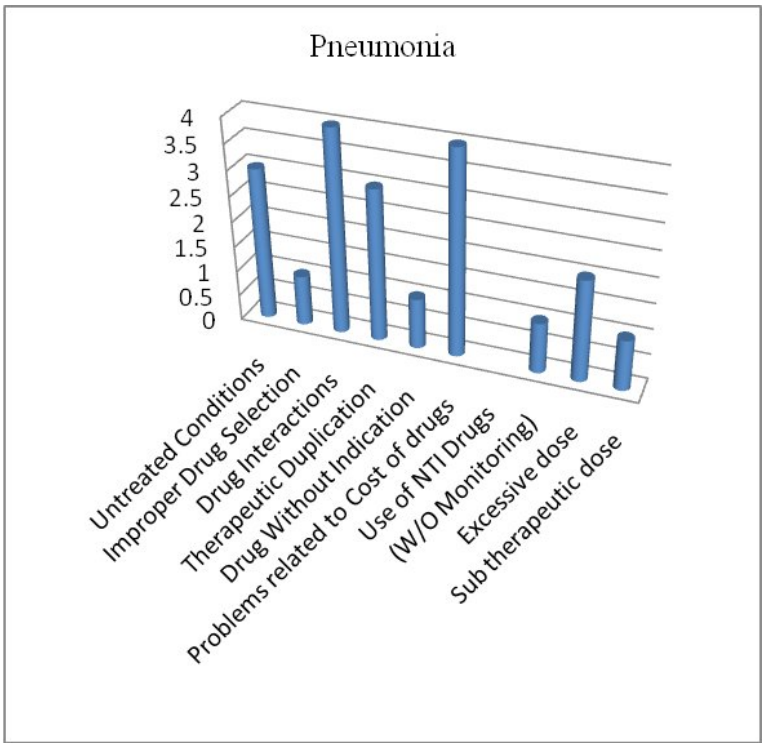

Fig. 1B Frequency of drug related problems in pneumonia

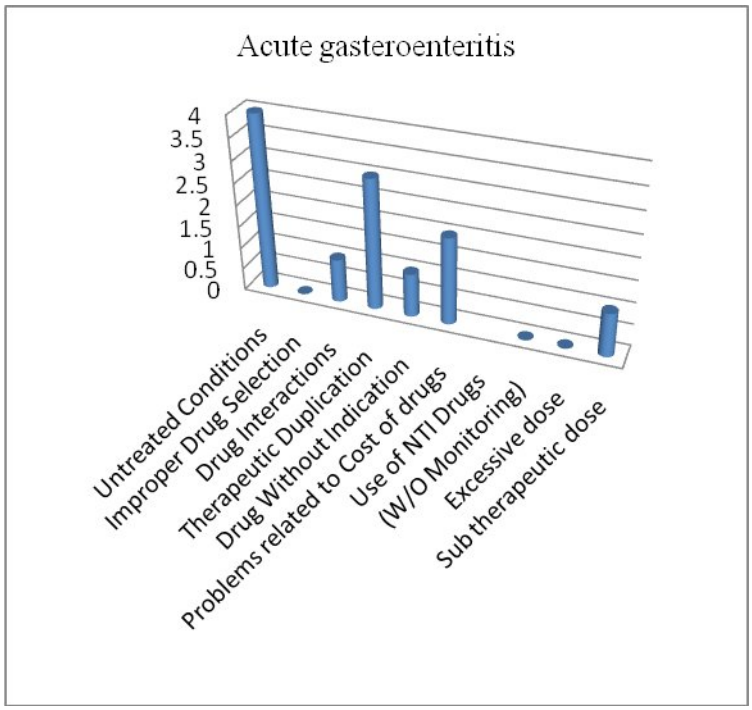

Fig. 1C Frequency of drug related problems in acute gastroenteritis

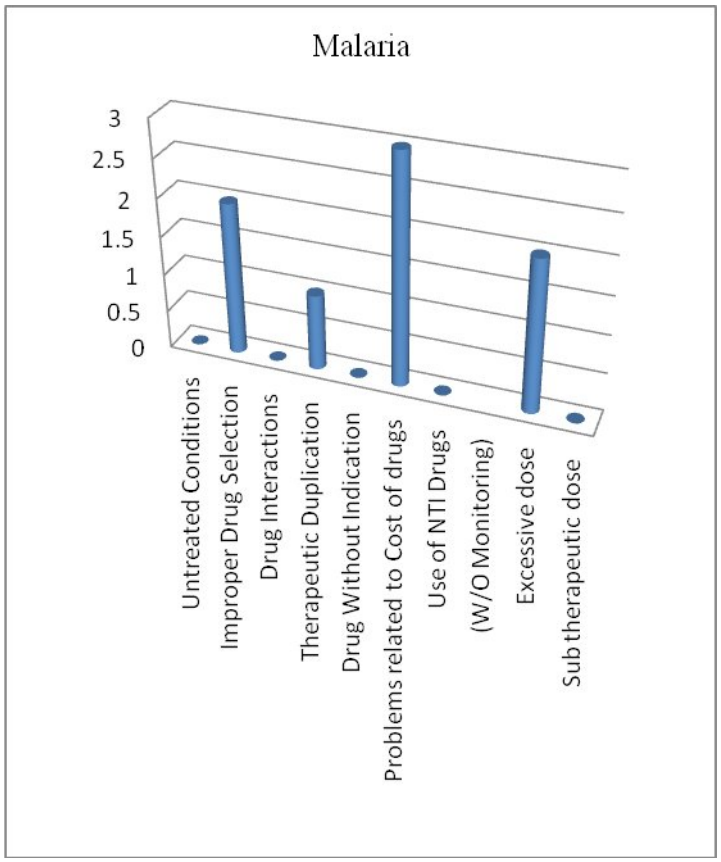

Fig. 1D Frequency of drug related problems in malaria

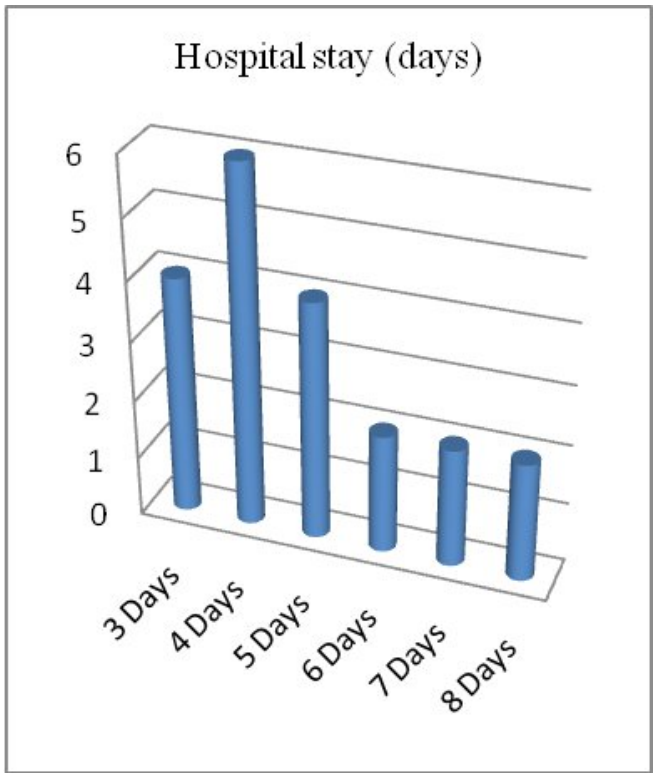

Fig. 2 Relative length of stay of patients

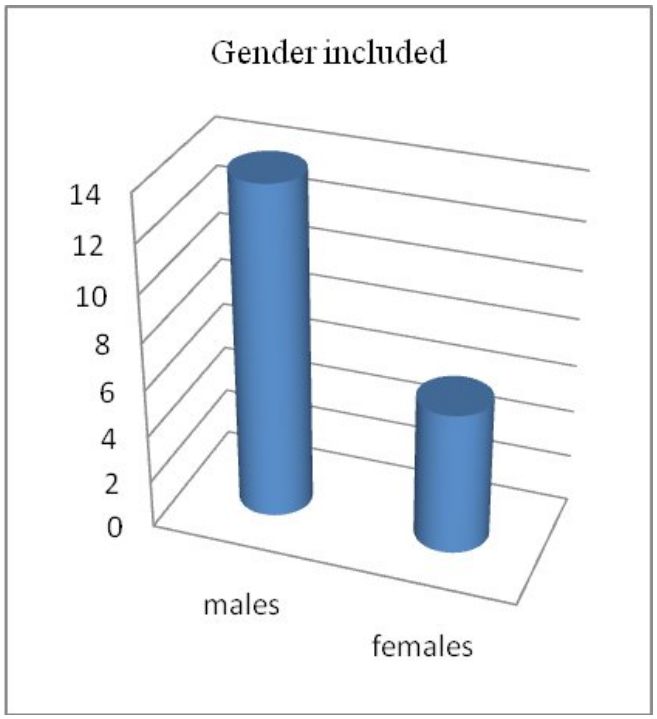

Fig. 3 Gender included in the study

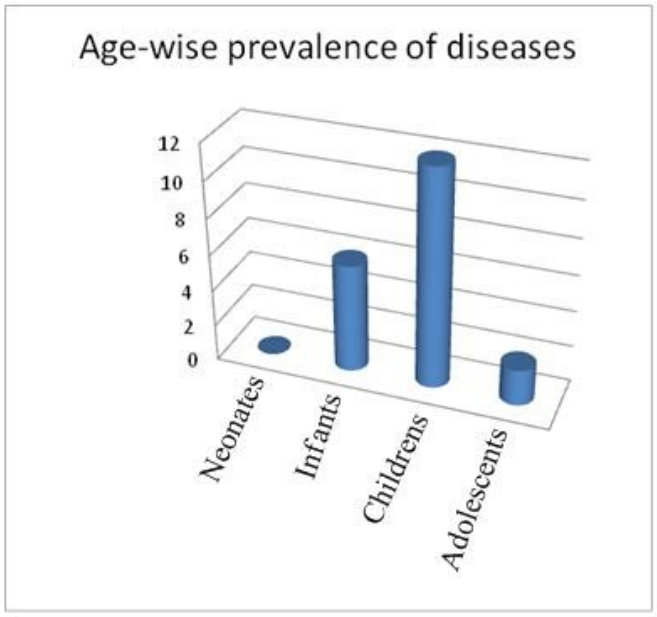

Fig. 4 Age-wise prevalence of diseases

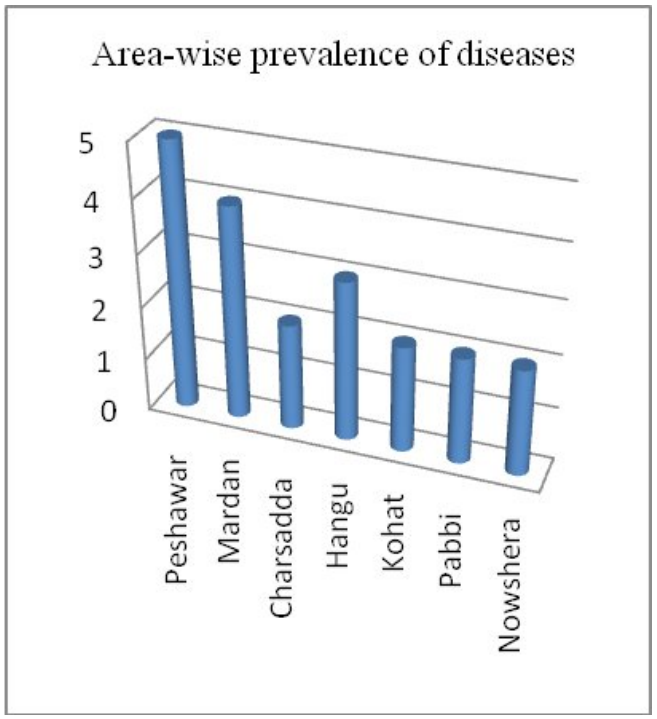

Fig. 5 Area-wise prevalence of diseases

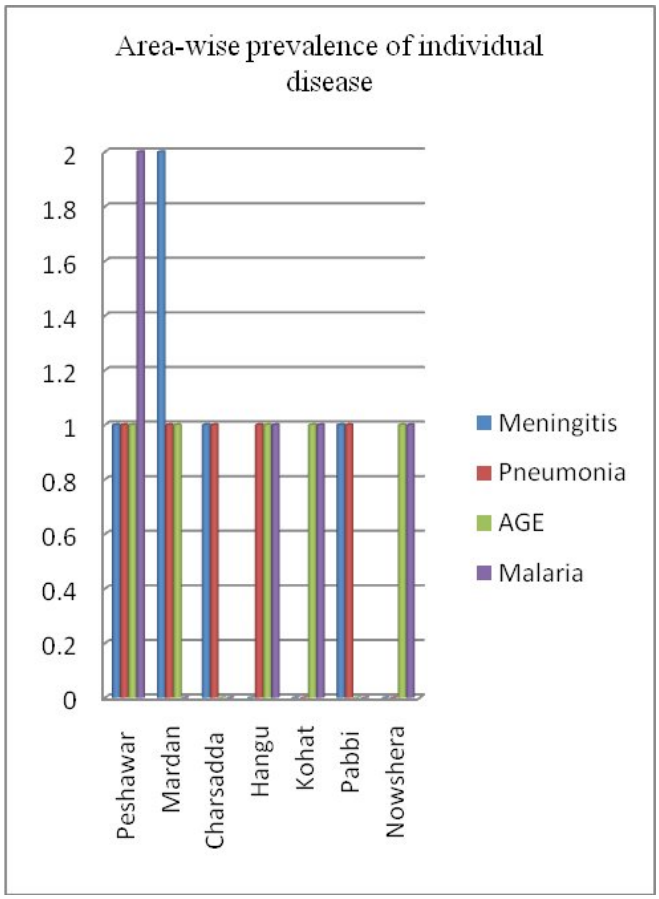

Fig. 6 Area-wise prevalence of individual disease

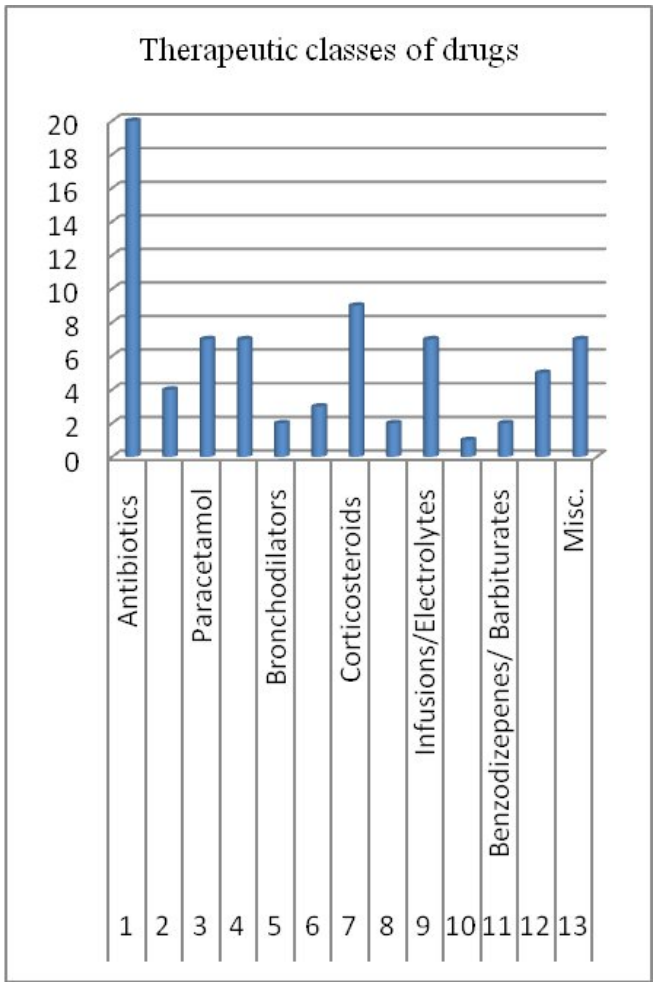

Fig. 7 Classes of drugs prescribed

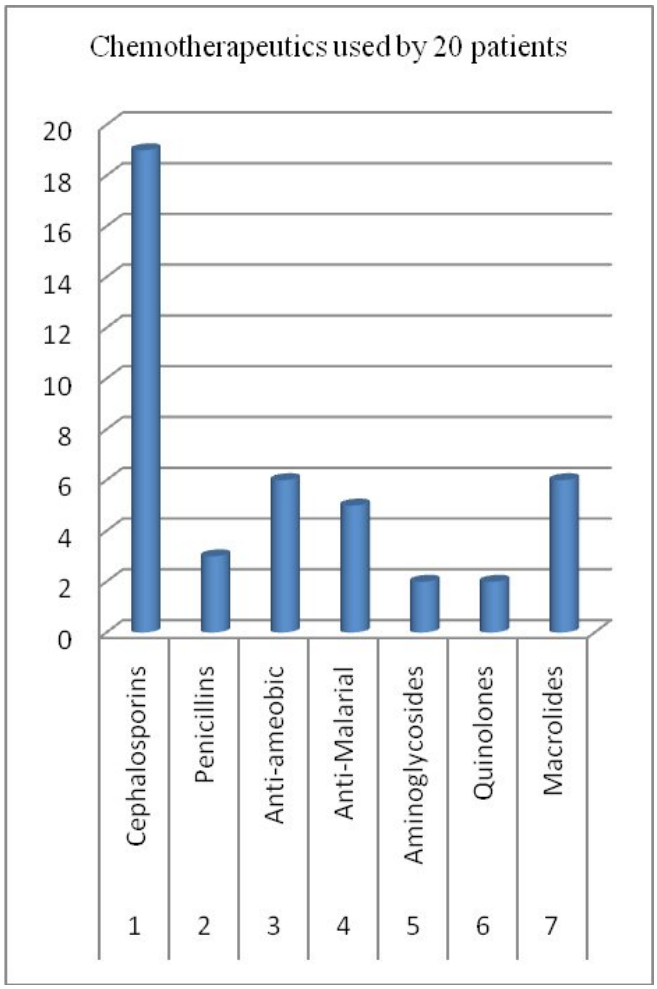

Fig. 8 Chemotherapeutic agents used by 20 patients

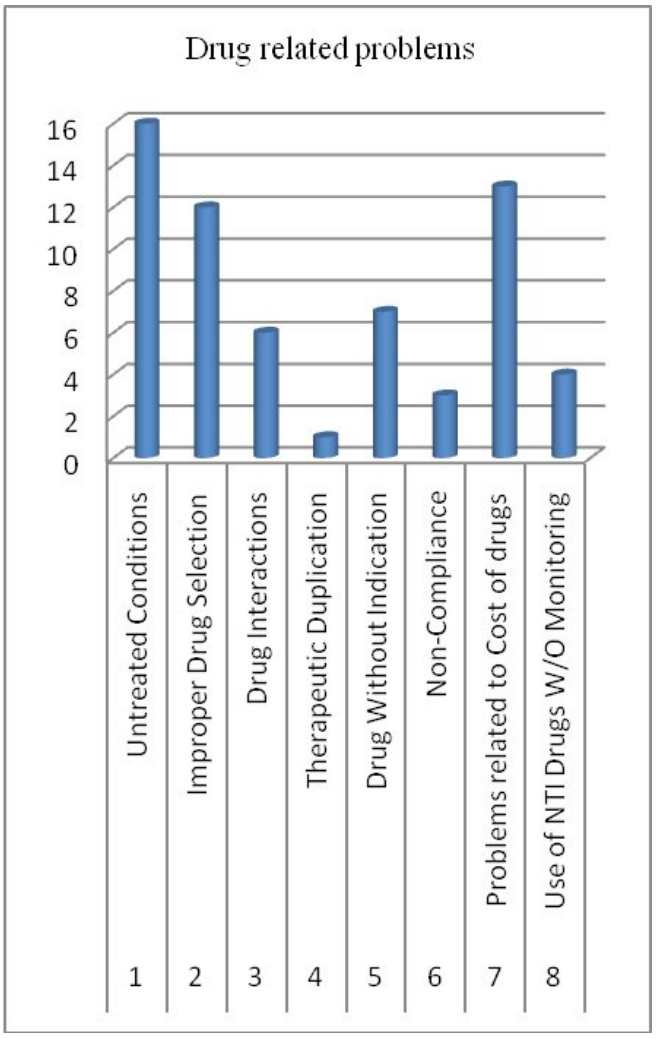

Fig. 9 Drug related problems detected in all 20 cases