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Original Research Article

Pharmacological Interventions Practiced in Various High Risk Pregnancy Conditions and Their Appropriateness Compared to Standard Treatment Guidelines in a Tertiary Care Hospital

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Abstract

Introduction: Evaluating qualitative aspects of drug use against established standards helps to identify specific areas of problem which in turn helps to plan focused interventions to facilitate rational use of drugs. Presence of high risk condition during pregnancy is most important determinant of drug use during pregnancy.

Material and Methods: This prospective, observational study included 290 pregnant women with high risk condition admitted to a tertiary care government hospital. Demographic data and data regarding pharmacological interventions during entire hospital stay were retrieved from medical records and by enquiring with health care professional and patients whenever deemed necessary.

Results: Anaemia and hypertensive disorders of pregnancy were most common high risk conditions seen in 214/290 (73.79%) and 125/290 (43.1%) women respectively. More than 90% of patients with anaemia were treated appropriately with oral iron ± parentral iron ± packed cell volume according to severity of anaemia. Hypertensive disorders were treated with single antihypertensive (nifedipine or methyldopa or labetalol) in 108/125(86.41%) patients, while remaining patients required combination of two (30/125, 23.43%) or three (3/125, 2.4%) antihypertensives. Nearly one third (85/290, 29.31%) patients received antimicrobials.

Conclusion: Majority drugs were used according to standard guidelines. The important problems identified were inappropriate use of antimicrobials, prolonged tocolysis, use of progesterone for prevention of miscarriage and use of sublingual nifedipine for hypertensive disorder of pregnancy.

Keywords: Drug utilization review, Anaemia, Hypertensive disorder of pregnancy, Progesterone

1. Introduction

Rational use of drugs is as important as discovery of new drugs. Drug utilization research defined as "The marketing, distribution, prescribing and use of drugs in society, with special emphasis on medical, economical and social consequences," [1] is an essential tool for identifying areas of irrational use and suggest appropriate measures for improving drug use. The scope of drug utilization research is not only limited to quantitative indicators but also includes qualitative aspects of drug usage. Evaluation of qualitative aspects of drug use against established standards of use can be extremely useful as it helps to identify specific areas of problem which in turn helps to plan focused interventions to facilitate rational use of drugs.[1]

High risk pregnancy is potentially dangerous for mother and unborn child. Recent estimates suggest that about one-third pregnancies are complicated by presence of high risk condition.[2,3] Effective and timely management of these high risk pregnancy conditions with appropriate medications is crucial for reducing maternal and fetal morbidity and mortality. It is estimated that about eight percent of pregnant women need drug treatment due to various chronic diseases and pregnancy related complications.[4] The literature search shows that drug utilization during pregnancy is common and varies from region to region and within the region over time.[5-9] Moreover, introduction of newer and better therapeutic agents in practice leads to increased exposure of pregnant women to these drugs.[10,11] Consequently, drug utilization evaluation in a given region needs to be an ongoing, continuous process. Despite this, there is paucity of drug utilization studies in high risk pregnancy in Indian scenario. Hence the present study was undertaken with the aim of knowing pharmacological interventions practiced in

various high risk pregnancy conditions and comparing them with standard treatment guidelines.

2. Materials

This prospective, observational study was conducted in the inpatient department of Obstetrics/ Gynaecology of a tertiary care Government Hospital during January 2014-December 2014. Approval from Institutional Ethics Committee was obtained (Approval No. EC/GMCM/21/2014) and all the participants gave written informed consent to participate in the study.

2.1 Patients

All Pregnant women with high risk pregnancy diagnosed by a senior consulting gynecologist admitted to obstetric ward and willing to give voluntary informed consent were included in the study. High-risk pregnancy was defined as one where pregnancy is complicated by factors that may adversely affect outcome - maternal or perinatal or both.[12] High-risk pregnancy was said to be present when pregnant women presented with one or more of the following conditions: [12]

2.1.1 Pregnant women with medical disorders present before pregnancy:

Heart disease, pulmonary disease, hypertension, kidney disease, seizure disorder, sexually transmitted disease, diabetes mellitus, asthma, autoimmune disorders, thyroid disease, psychiatric illness.

2.1.2 Pregnant women with complications of Pregnancy

Hyperemesis gravidarum, threatened abortion, hypertension in pregnancy, gestational diabetes, preterm labour, Rh incompatibility, polyhydraminos, oligohydraminos, third trimester bleeding, multiple gestations, infections in pregnancy, anaemia.

Anaemia was categorized as mild (Hb 9g/dl-10.9g/dl), moderate (Hb 7g/dl-8.9g/dl) and severe (Hb< 7g/dl)[13]

2.1.3 Problems in previous pregnancy

Recurrent abortions, previous still birth or neonatal death or birth of babies with congenital abnormalities, previous preterm delivery, grand multiparity (previous four or more viable births), previous caesarean section.

All indoor pregnant women without high risk conditions were excluded. Besides following pregnant women with high risk condition were also excluded: (i) Women not willing to give voluntary informed consent, (ii) Women in whom language barrier prevented adequate communication, (iii) Women admitted in labour and (iv) Women discharged in short time before enrollment in the study.

2.1.4 Data Collection

Data regarding demographic characteristics, parity, associated medical, surgical, obstetric and gynaecological illness (i.e high risk conditions) documented in indoor case paper was recorded on the predesigned case record form. The details of drug treatment for high risk conditions during entire hospital stay were retrieved from medical records as well as by enquiring with patients and health care professionals whenever deemed necessary.

2.1.5 Data analysis

Patients enrolled in the study were categorized according to high risk pregnancy conditions. The drug treatment given in each condition was noted and compared with standard current treatment guidelines.

2.1.6 Statistical analysis

Data was entered in Microsoft Excel 2008. Frequency and percentages of study parameters were calculated by using descriptive statistics.

3. Results

Details of inpatients during study period are shown in Figure 1.The demographic data shown in **Table 1** indicates 74.82% (217/290) of women were between 20-30 years of age and were admitted during third trimester of pregnancy. Majority of women (152/290, 52.45%) were multigravida

Trimester-wise distribution of high risk conditions during pregnancy depicted in **Table 2** indicates that anaemia was most common high risk condition seen in 73.79% (214/290) followed by hypertensive disorders namely gestational hypertension, preeclampsia and severe eclampsia together accounting for 43.1%(125/290) cases. As shown in **Table 3**, mild anaemia (Hb 9g/dl-10.9g/dl) was seen in 44.85% (96/214) moderate anaemia (Hb 7g/dl-8.9g/dl) in 41.12% (88/214) while severe anaemia (Hb< 7g/dl) in 14.01%(30/214) patients. About 86.58 % (86/96) of patients suffering from mild anaemia received monotherapy with oral iron. Moderate anaemia was mostly treated with oral iron monotherapy in 57.95% (51/88) while in about 30% (26/88) of patients oral iron as well as parentral iron or packed cell volume was given. About 86% (26/30) of pregnant women with severe anaemia received parentral iron and /or packed cell volume along with oral iron therapy during their hospital stay. About 10 % (21/214) anemic pregnant women suffering from either mild or moderate anaemia received no specific treatment for anaemia.

Among patients with hypertensive disorders of pregnancy **(Table 4)** most (86/125, 68.8%) received single antihypertensive i.e. nifedipine or methyldopa or labetolol. Combination of two antihypertensive mainly nifedipine and methyldopa was used in 17.6% (22/125) patients, while 2.4% (3/125) patients were treated with combinations of three antihypertensives namely nifedipine, labtalol and methyldopa. Adjunctive treatment (results not shown) with 75mg aspirin, mannitol and phenobarbitone was prescribed in 6.4% (8/125), 5.6% (7/125) and 4% (5/125) patients respectively.

Table 5 shows drug treatment of epilepsy. Out of 9 patients of epilepsy, 55.55 % (5/9) were prescribed a single antiepileptic drug either phenobarbitone (1/9, 11.11%), levetiracetam (2/9, 22.22%) or carbamazepine (2/9, 22.22%) while 33.33% (3/9) patients were prescribed a combination of

two antiepileptic drugs like valproate and phenobarbitone or valproate and oxcarbazepine or valproate and levetiracetam.

Table 6 shows drug treatment in oligohydramnios in 10.68% (31/290) patients. Essential amino acids like linoleic acid and linolenic acid were given to 16.12% (5/31) patients. Arginine sachet was prescribed to 6.45% (2/31) patients. A combination of arginine, essential amino acids and vitamin E was prescribed in 35.48% (11/31) patients and a combination of essential amino acids and vitamin E was prescribed in 3.22% (1/31) patients.

Table 7 shows drug treatment in preterm labor. All the patients with preterm labor except one were prescribed dexamethasone. The only tocolytic drug used was betamimetic isoxsuprine in 97.36%(37/38) patients. Antimicrobial drugs were used in 26.31% (10/38,) patients of preterm labor.

Table 8 shows drug treatment in hyperemesis gravidarum. Combination therapy with injectable multivitamin, injection ondansetron, injection pantaprazole and fixed dose combination of oral doxylamine with pyridoxine was prescribed in 20% (2/10) patients. Combination of injection ondansetron and injection pantoprazole was prescribed in 60% (6/10) patients. Combination of injection ondansetron and injection pantoprazole and oral doxylamine with pyridoxine was prescribed in 20% (2/10) patients.

Out of 85 patients (85/290, 29.31%) who received antimicrobial drugs (**Table 9)**, the most frequently used drug was ceftriaxone in 44.7%(38/85) followed by albendazole in 31.76%(27/85) and amoxicillin in 21.17%(18/85). The most common indication for antimicrobial drugs (results not shown) was anthelminthic prophylaxis with albendazole for anaemia in 27/85(31.76%) patients followed by surgical prophylaxis for cervical encirclage(n=11) and laprotomy for twisted ovarian cyst(n=1). The drugs prescribed for surgical prophylaxis were ceftriaxone(n=9), ceftriaxone and amoxicillin(n=2), ceftriaxone and ampicillin(n=1). The antimicrobials were also used for viral fever (ceftriaxone alone in two patients, ceftriaxone with azithromycin in one patient, ceftriaxone,azithromycin, chloroquine and metronidazole in one patient). One patient was empirically treated with ceftriaxone and chloroquine. Urinary tract infection was treated with ceftriaxone (n=2), nitrofurantoin (n=2) and ceftriaxone and amoxicillin (n=1). Typhoid was diagnosed in two patients who were treated with ceftriaxone (n=1) and ceftriaxone with azithromycin (n=1). Diarrhoea was treated with metronidazole (n=1), ceftriaxone (n=1) and ceftriaxone with metronidazole (n=1).

There were five pregnant women with HIV positive status. Out of these, four women receivied anti retroviral therapy (ART) with combination of tenofovir (300 mg), lamivudine (300 mg), and efavirenz (600 mg) while one woman received combination of tenofovir (300 mg), lamivudine (300 mg) and nevirapine(600 mg).

Progesterone was used to prevent miscarriage in twenty five patients (25/290, 8.62%) in first or second trimester of pregnancy **(Table 10)** These included 11 patients of cervical incompetency, 10 patients with pervaginal bleeding, 2 with bad obstetric history and 2 with pain in abdomen.Ten patients with hypothyroidism were treated with levothyroxine. Two of three patients of heart disease, received benzathine penicillin and one digoxin. Patient of asthma received inhalational therapy with formoterol and budesonide as well as injection aminophylline.

Figure 1: Patient Flow Diagram

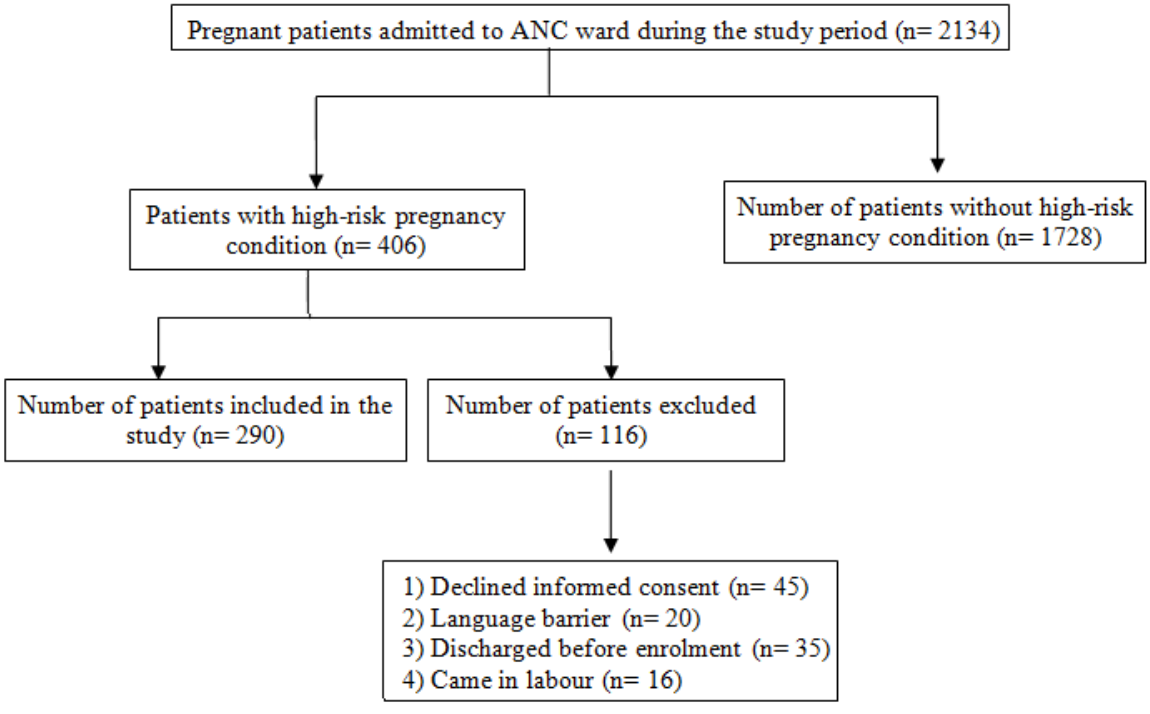

Table1: Demographic data of study population (n=290)

Characteristics	No. of patients	Percentages
Age groups		
<20	65	22.41
20-30	217	74.82
>30	8	2.75
Total	290	100
Mean age± SD	23.31±3.338	
Gravida		
Primigravida	138	47.58
Multigravida	152	52.45
Total	290	100
Trimester		
First	16	5.51
Second	37	12.75
Third	237	81.72
Total	290	100

Table 2: Trimester wise distribution of high risk conditions in pregnancy (n =290)

High risk conditions	1st trimester	2nd trimester	3rd trimester	Total	Percentage*
Anaemia	10	29	175	214	73.79
Gestational hypertension	0	2	62	64	22.06
Preeclampsia	0	1	42	43	14.82
Severe Preeclampsia	0	1	8	9	3.10
Eclampsia	0	0	9	9	3.10
Thereatened Preterm labour	0	2	36	38	13.10
Oligohydramnios	0	2	29	31	10.68
Infection in pregnancy	0	4	20	24	8.27
Hypothyroidism	1	3	15	19	6.55
Cervical incompetency	1	10	0	11	3.79
Hyperemesis gravidarum	8	2	0	10	3.79
Bleeding in pregnancy	5	2	3	10	3.44
Epilepsy	0	1	8	9	3.10
Heart disease	0	0	3	3	1.03
Diabetes in pregnancy	0	1	3	4	1.37
Asthma	0	0	1	1	0.34

**The sum of total percentage exceeds 100 because some patients suffered from more than one high risk condition.*

Table 3: Drug treatment of anaemia according to severity (n=214)

Type of anaemia n/N (%)	Oral iron Monotherapy n/N (%)	Oral iron+ Parenteral iron n/N (%)	Oral iron+ PCV n/N (%)	Oral iron+ Parenteral iron+PCV# n/N (%)	No treatment n/N (%)
Mild anaemia* 96/214 (44.85)	86/96 (89.58)	0/96 (0)	0/96 (0)	0/96 (0)	10/96 (10.41)
Moderate anaemia* 88/214 (41.12)	51/88 (57.95)	21/88 (23.86)	5/88 (5.68)	0/88 (0)	11/88 (12.5)
Severe anaemia* 30/214 (14.01)	4/30 (13.33)	8/30 (26.66)	8/30 (26.66)	10/30 (33.33)	0/30 (0)
Total N=214 (100)	141/214 (65.8)	29/214 (13.55)	13/214 (6)	10/214 (4.67)	21/214 (9.81)

* Classification anaemia: [18] Mild: Hb 9 to 10.9 g/d, Moderate: Hb 7 to 8.9 g/dl, Severe: Hb < 7 g/dl; #*PCV= Packed cell volume*

Table 4: Primary drug treatment of hypertensive disorders of pregnancy [n=125]

Drugs	Number	Percentage
Nifedipine monotherapy	77	61.6
Nifedipine+Methyldopa	22	17.6
Methyldopa Monotherapy	7	5.6
Nifedipine+ Labetalol	6	4.8
Labetalol Monotherapy	2	1.6
Nifedipine+ Labetalol+ Methyldopa	3	2.4
Methyldopa+Labetalol	2	1.6
No antihypertensive	6	4.8
Total	125	100

Table 5: Drug treatment of epilepsy in pregnancy [n=9]

Drugs	Number	Percentage
Carbamazepine	2	22.22
Levetiracetam	2	22.22
Phenobarbitone	1	11.11
Valproate+Phenobarbitone	1	11.11
Valproate+ Oxcarbazepine	1	11.11
Valproate+Levetiracetam	1	11.11
No antiepileptic drug	1	11.11
Total	9	100

Table 6: Drug treatment of oligohydramnios [n=31]

Drugs	No. of patients	Percentage
Arginine+ Essential amino acids+ Vitamin E	11	35.48
Arginine+ Essential amino acids	2	6.45
Essential amino acids	5	16.12
Arginine	2	6.45
Vitamin E+ Essential amino acids	1	3.22
None of the above drug	10	32.25
Total	31	100

Table 7: Drug treatment in preterm labor [n=38]

Drugs	No. of patients	Percentage
Dexamethasone+Isoxsuprine	36	94.73
Dexamethasone	1	2.63
Isoxsuprine	1	2.63
Total	38	100

Table 8: Drug treatment in hyperemesis gravidarum [n=10]

Drugs	Number	Percentage
Injectable multivitamin+ Ondansetron+ Pantoprazole + Oral Doxylamine with pyridoxine	2	20
Injectable Ondansetron+ Pantoprazole	6	60
Injectable Ondansetron+ Pantoprazole +Oral Doxylamine with pyridoxine	2	20
Total	10	100

Table 9: Antimicrobial drugs [n=85]

Drugs	No. of patients	Percentage*
Ceftriaxone	38	44.7
Amoxicillin	18	21.17
Albendazole	27	31.76
Metronidazole	4	4.70
Ampicillin	6	7.05
Azithromyci	4	4.70
Clotrimazole Vaginal pessary	3	3.52
Benzathine penicillin	2	2.35
Chloroquine	2	2.35
Nitrofurantoin	2	2.35
Lamivudine+tenofovir+ Efavirenz	4	4.70
Lamivudine+tenofovir+ Nevirapine	1	1.17

** The sum total of percentage exceeds 100 as some patients received more than one antimicrobial drug.*

Table 10: Use of Progesterone (n=25)

Indication	Number of patients	Percentage
Cervical encirclage	11	44
Per vaginal bleeding	10	40
Bad obstetric history	2	8
Pain in abdomen	2	8

4. Discussion

Drug utilization research comprising qualitative aspects of drug use is essential for identifying specific problems concerning rational use of drugs in a given health care setting. This prospective observational study involving 290 pregnant women with high risk pregnancy has tried to evaluate drug treatment practices in a tertiary care government hospital against established standards.

The demographic data **(Table 1)** indicated that majority of women were under 30 years of age and high-risk pregnancy was seen with somewhat higher frequency in multigravida than in primigravida (52.41% vs. 47.58%). Similar results have been reported by previous studies.[14]

The morbidity pattern observed in the present study with anaemia and hypertensive disorder in pregnancy topping the list **(Table 2)** is similar to morbidity pattern reported by a hospital record based study in Western Uttar Pradesh involving 338 pregnant women[15] and a cross sectional study in women attending antenatal care outpatient department of a tertiary care hospital[16].

4.1 Pharmacotherapy of various high risk conditions in pregnant women

In the present study anaemia was the most commonly encountered high risk condition in 214/290(73.79%) of study population. **(Table 2)** As anaemia during pregnancy has been associated with poor maternal and fetal outcomes [17], screening of all pregnant women for anaemia, universal iron supplementation and appropriate treatment of anaemia is recommended by standard guidelines.[18] In clinical practice the diagnosis of iron deficiency anaemia is often presumptive and it may be reasonable to empirically initiate iron therapy without first obtaining iron test results.[18] Mild to moderate anaemia (Hb 7 to 10.9gm%).[13] is generally treated with oral iron. Besides deworming, treatment of malaria and appropriate dietary practices are also recommended.

For parenteral treatment iron sucrose is preferred over iron dextran due to less likelihood of allergic events and significantly lower fatality rate.[18]

Blood transfusion is recommended for severe anaemia with maternal hemoglobin level less than 6 g/dl for fetal and maternal indications.[18] Overall, management of anaemia in the present study conforms to standard Indian guidelines. All patients of severe anaemia were treated appropriately. But out of 21 patients of mild and moderate anaemia, who did not receive iron therapy 6.54 % (14/214)

patients belonged to second and third trimester and these patients should have received iron therapy.

Helminthiasis is a significant burden during pregnancy and has been associated with various degrees of anaemia during pregnancy.[19] World Health Organization recommends universal administration of antihelminthic such as mebendazole or albendazole after first trimester of pregnancy in endemic areas.[19] In the present study only 12.61%(27/214) of anemic women in their second or third trimester were prescribed single dose of albendazole for deworming. The practice followed in this hospital is to administer single dose of 400 mg albendazole to all anaemic women after first trimester. The patients who did not receive albendazole during study period might have received it earlier or later, data of which was not available.

The pharmacotherapy of hypertensive disorders in the present study was largely in accordance with standard guidelines, majority of the patients 68.8% (86/125) were managed with monotherapy but 26.4%(33/125) required combination therapy **(Table 4).** Similar treatment practices has been reported in previous studies.[20]

The good thing in the present study was that none of the contraindicated antihypertensive drugs like atenolol, angiotensin converting enzyme inhibitors (ACEI), angiotensin receptor blockers and diuretics was prescribed to a single patient. This is in contrast to earlier studies which report use of heterogeneous antihypertensive medications including angiotensin converting enzyme inhibitors (ACEIs), diuretics and beta blockers.[21] In the present study 9.6%(12/125) patients with severe hypertension received single dose of sublingual nifedipine which is against the recommendations for rational use of antihypertensive drugs. Rapid acting nifedipine is not recommended for treating hypertension or hypertensive emergencies especially in pregnancy because it has been associated with fatal and nonfatal untoward cardiovascular events such as hypotension, without any apparent reduction in uteroplacental blood flow.[22] Similar use of rapid acting sublingual nifedipine has been reported by Kumar *et al* in 70% of study population. [23] Though the frequency of use of sublingual nifedipine in our study is less compared to study by Kumar *et al*, it points towards need for appropriate interventions to improve prescribing practices.

Magnesium sulfate was used in 25.6%(32/125) patients who had severe pre eclampsia or eclampsia with a loading dose of 4 gram (20% solution) intravenously over 3-5 minutes followed by 10 gram (50% solution) deep intramuscularly (5 gm in each buttock) then maintenance dose of 5 gm (50% solution) 6 hourly in alternate buttock which is in accordance to ACOG (American College Of Obstetricians and Gynecologists) and NICE(National Institute for Health and Clinical Excellence) recommendations. [22, 24]

Careful management of pregnant women with epilepsy who are being treated with antiepileptic drugs (AED) is important as seizure frequency can change during pregnancy and both seizure activity and AED treatment might have consequences for the developing fetus including increased rates of still birth, teratogenesis and cognitive delay.[25] The American Academy of Neurology guidelines for pregnancy with epilepsy recommend use of single antiepileptic drug and avoidance of valproate as far as possible, as multiple drugs increase the risk of birth defects and valproate is associated with substantial risk of birth defects.[26] In the present study, combination therapy was used in three out of nine patients and in all three cases one of the drugs in combination was valproate **(Table 5)**. Such type likelihood of teratogenesis, but it is also important to remember that use of combination therapy and drugs like valproate may be essential to achieve complete seizure control in an individual patient. The reasons for using combination therapy containing valproate as one of the drugs in the present study are not clear and would require further studies evaluating knowledge and practices of prescribers.

The most common form of treatment besides bed rest and hydration for oligohydramnios in the present study was L-arginine (a nitric oxide donor) and essential amino acids. There is some evidence that L arginine given as sachet containing three gram of the active ingredient for periods varying between 1-4 weeks is associated with increase in amniotic fluid index by 2.03±0.39 cm in cases of oligohydramnios.[27] But L-arginine, essential amino acids or vitamin E is not a standard recommended therapy for oligohydramnios.

The most beneficial intervention for patients in true preterm labor is use of antenatal steroids (either 2 doses of betamethasone or 4 doses of dexamethasone both administered intramuscularly) as it significantly reduces the incidence and severity of neonatal respiratory distress syndrome. The incidence of intraventricular hemorrhage and necrotizing enterocolitis are also reduced by the use of antenatal steroids.[28] The use of single course of dexamethasone in almost all 37/38 (97.36%) patients of preterm labor in the present study is in accordance with ACOG guideline.[28**] (Table 7)**

The use of tocolytic drugs in preterm labor is valuable as these drugs may prolong gestation for 2-7 days which can provide time for administration of steroids and maternal transport to a facility with a neonatal intensive care unit. The use of tocolysis beyond 2 days is questionable.[28] In the present study tocolysis was used parenterally for first 2-3 days and then orally for next 4-5 days in almost all patients. Out of 38 patients of preterm labor 37 patients (97.36%) received tocolytic drugs beyond two days which is not in accordance with standard guidelines. Similarly use of antimicrobials in preterm labor in 10/38(26.31%) of women having intact membranes is also not in accordance with standard guidelines.[28]

All patients of hyperemesis gravidarum were treated with injectable ondansetron and some also received oral

doxylamine with pyridoxine, which is standard therapy for hyperemesis graviderum.[29] But the rationale for use of pantoprazole in all these patients and use of multivitamin in some is not clear.

About 29% (85/290) patients in the present study received antimicrobials. Though use of antimicrobials for treatment of infections and prophylaxis was appropriate, their use in viral fever and in preterm labor without rupture of membrane cannot be justified. Besides, prophylactic antibiotics for surgical indications were used for prolonged periods and combination of different antibiotics was used without scientific basis. These findings point to need for appropriate interventions.

Use of progesterone in early to mid pregnancy to prevent miscarriage is of doubtful efficacy [30]. A recent multicentre, double blind, placebo-controlled randomized trial involving 1568 women failed to show increased rate of live births with first trimester progesterone therapy in women with history of recurrent miscarriages.[31] In view of current evidence, use of progesterone to prevent miscarriage in patients with diverse history (cervical incompetency, per vaginal bleeding, pain in abdomen, recurrent abortions etc.) appears inappropriate.

5. Conclusion

In conclusion, anaemia even though preventable was highly prevalent disorder in hospitalized women with high risk pregnancy. Most of the drugs were used appropriately and were in accordance with standard guidelines. The important problems identified were inappropriate use of antimicrobials, prolonged tocolysis, use of progesterone for prevention of miscarriage and use of sublingual nifedipine for hypertensive disorders of pregnancy. In addition to knowledge obtained from drug utilization studies, understanding knowledge, attitude and practices of prescribers and patients can help further to plan effective interventions to improve drug use.

6. Limitation

There are several limitations to the present study. It is noteworthy that choice of drugs in Government Hospitals is generally restricted to the drugs available in the hospital. Such restrictions are somewhat relaxed for pregnant women as pregnant women are entitled to receive free treatment under Janani Shishu Suraksha Karyakarm (JSSK) run by Government of India.[32] Still, the drug utilization pattern in Government hospital which primarily caters to the needs of people from lower socioeconomic strata cannot be generalized to other health care sectors offering different levels of healthcare or catering to patients from higher socioeconomic strata. About 28% of patients with high-risk pregnancy were excluded from the present study for reasons described earlier. Still more than 70% of patients with high-risk pregnancy were included which is fair enough to give idea about drug utilization.

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