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Research Article

Impact of an Intervention in the Diagnosis and Treatment of Urinary Infection in Pregnancy and its Relationship with Frequency of Premature Labor in Hidalgo, Mexico

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Abstract

Objective: To evaluate an intervention in primary care physicians to improve guideline compliance in the diagnosis and treatment of urinary infection in pregnancy (DTUI) and determine its relationship with the frequency of preterm labor (PL).

Methods: This was a community intervention trial carried out in three stages in eight primary care health centers in Hidalgo, Mexico with an Intervention Group (IG) and a Control Group (CG). The first stage was a review of clinical records (CR) to assess guideline compliance and a test to measure the level of knowledge and identify barriers to DTUI. The second stage consisted of guideline training and an opinion survey on the availability of supplies for DTUI. The third stage determined the correlation between post-training guideline compliance and the frequency of PL.

Results: Between March and November 2019, a community trial was carried out with 60 primary care physicians and a review of 270 CR. Compliance and the level of knowledge in the IG, before and after the training, was 20% and 57% ($p < 0.0056$), knowledge was 58% and 64% ($p < 0.024$), respectively. The barriers identified were a lack of training, a lack of availability of urinalysis and a lack of health education for the users. Regarding the availability of supplies, the results showed a coincidence between administrators and pharmacists with an availability of 100%, which contrasts with the opinion of the physicians who consider that the availability was 69% in the IG and 60% in the CG.

Conclusion: The intervention significantly improved compliance and knowledge and the workshops improved medical care procedures. The correlation showed an inverse relationship with the frequency of PL.

Keywords: *Prenatal Control; Pregnancy; Urinary Infection; Community Trial; Compliance*

Abbreviations

PL: Preterm or Premature Labor; UI: Urinary Infection; AB: Asymptomatic Bacteriuria; IG: Intervention Group; CG: Control Group; CR: Clinical Records

Introduction

Preterm or premature labor (PL) is an important clinical problem in general and perinatal medicine. It is defined as the interruption of pregnancy before week 37 of gestation [1]. Its frequency varies from 5 to 15% in high-income countries, while in low to medium income countries frequency can reach 40% [2,3]. It is an important determinant of perinatal morbidity and mortality [4] and it is closely linked to neonatal mortality, which has been documented in up to 70% of cases, and it also increases the cost of care. For example, in a study in the United States, the medical, educational, and loss of productivity costs associated with PL were calculated at more than 26 billion dollars [5].

One of the most frequent and preventable risk factors of PL in pregnancy is urinary infection (UI). A UI is a condition in which bacteria establish and multiply in any area of the urinary tract causing direct damage or damage secondary to the inflammatory response, and serious maternal and perinatal morbidity, such as low birth weight, premature rupture of membranes, and preterm labor [2,3].

This predisposition of the urinary tract to infection is due to an endocrine cause that is directly linked to an increase in placental hormones that decreases the ureter-pyelocalyceal tone, reducing its peristalsis and attenuating urinary flow which directly causes increased storage or ectasia of the ureters and renal pelvis [6,7]. This loss of tone of the urinary tract occurs more frequently between the sixth and eighth month of gestation [7,8].

Other predisposing factors that have been documented are anatomic susceptibility, an active sex life, incomplete bladder emptying, and an estrogen deficiency [9]. If we add these factors to the physiological changes that occur during the gestational period in which there is a temporary insufficiency of the vesicoureteral valves, the probability of suffering a UI increases [7].

Meydana., *et al*. [4] identified risk factors in pregnant women in the Women's Hospital of La Paz, Bolivia. Of the 269 clinical records reviewed, the most frequent factors found were, in order of frequency, a history of premature labor, urinary tract infection, twin pregnancy, epilepsy, placenta previa, polyhydramnios, and preeclampsia. Maldonado., *et al*. [10] reported a prevalence of asymptomatic bacteriuria (AB) of 7.9% in pregnant adolescents with individuals of greater age being those most affected.

It has been found in some studies that UI, including AB, are associated with other risk factors as reported by Quiroga., *et al*. [11] in a study carried out in 72 pregnant women in Mexico. They concluded that the predisposition to these infections is greater in primiparous women in 66.6% versus 16.2% in twin pregnancies, and 8.3% in both triplet and quadruplet pregnancies.

Most pregnant women have AB. The most frequent cause is stasis associated with the effects of progesterone compounds on ureteral and bladder smooth muscle and the compression exerted by the enlarged uterus [12]. In general, because it is asymptomatic, it is overlooked both by patients and healthcare professionals, and since it is not treated, it can cause pyelonephritis accompanied by a risk of PL, neonatal mortality, and low birth weight [13,14].

In contrast, in symptomatic UI, the predominant clinical symptom is dysuria, which is the difficult and painful discharge of urine that is also associated with other symptoms according to the site of infection [2]. The risk of suffering a symptomatic UI gradually increases during pregnancy from beginning to end. In pregnant women with no comorbidity, the risk is greater in those with greater age, a low socioeconomic level, and multiparty, among others, especially in those with a previous history of UI.

Regarding UI that manifests as acute pyelonephritis, an increased risk during pregnancy has been found with an incidence of 1 - 4%, while among non-pregnant women, low urinary tract infection (cystitis) rarely progresses to pyelonephritis. This makes urinary infection in pregnancy a problem that must be closely monitored [15,16].

A study conducted in Colombia with 1,429 pregnant women who came for prenatal care and birth showed that of the patients studied, 36.1% presented a UI; of these 45.9% were detected in the first trimester with asymptomatic bacteriuria being the most frequent in 9.1%. Associated complications were not found in 95.1% and the most frequently used laboratory test was urinalysis in 99.9%. The patients who presented a UI received antibiotic treatment with systemic penicillin in 47.7% and 75.2% did not require hospitalization [2].

Sanchez., *et al*. [17], in a study performed in 2004 in Caracas, found a higher percentage of urinary infections during pregnancy in the 20 to 25 age group (31%), in the second trimester of pregnancy (41,8%), and in multiple pregnancies (51,7%). Another study in pregnant women in the General Hospital of Tula, Hidalgo [19] found a PL frequency of 7.5%, a history of UI in a previous pregnancy of 59%, and in the current pregnancy of 64.1%, with UI being the highest risk factor associated with PL in 77.5% (OR = 3.3; 95% CI 2.06 - 5.43).

In the pregnant woman, urinalysis should be performed routinely since an important proportion of pregnant women have a risk of UI and one third of these cause AB [18,19]. Urine culture should be carried out in all pregnant women when AB is suspected, initial empirical treatment has failed, urolithiasis is present and in immunocompromised patients or those with diabetes [20].

There are guidelines for the implementation of actions to avoid PL, specifically for the detection, treatment, and monitoring of UI [12,16,21]; however, there has been a lack of guideline compliance in the medical units of the Hidalgo Health Services for the diagnosis and treatment of UI in pregnancy [22].

In this regard, a study carried out by Aguirre., *et al*. evaluated the quality of care in medical units and they concluded that in order to provide quality services, sufficient physical resources, training of human resources, and a supply of consumable materials must coexist, in addition to the expectations that the user has of the quality of care she receives [13]. Another study [23] measured the service provider's compliance to the Clinical Practice Guidelines for prenatal care; this study showed low compliance (73%). The greatest deficiencies in compliance were diagnosis (55%), patient education (60%), requesting laboratory analysis (61%), and referral to secondary care (62%).

The detection and treatment of a pregnant woman with a UI as a risk factor for PL is of great importance to reduce the frequency of PL. This improves the quality of care provided to patients who use the state health system and also contributes to the reduction of perinatal morbidity and mortality associated with PL [12,24]. Therefore, it is necessary to identify the barriers that prevent the implementation of actions to prevent PL in the Health Services of Hidalgo. Its identification could help in its modification and contribute to an important decrease in the frequency of PL with the subsequent savings in health costs.

Objective of the Study

The objective of this study was to carry out an intervention to improve guideline compliance by physicians in pregnant women with a diagnosis of UI and determine its relationship with the frequency of PL in the medical units of the Health Services of Hidalgo.

Materials and Methods

This was a three-stage experimental community intervention trial performed in eight primary care health centers (24%) of four Health Jurisdictions in Hidalgo, Mexico. An intervention group (IG four) and a control group (CG four) were randomly selected. A cross-sectional study was performed in the first stage with the aim of identifying possible barriers in the application of guidelines for the diagnosis and treatment of UI. For this, a total of 270 clinical records (CR) of pregnant women in prenatal care (PC) were reviewed recording the variables of interest in a data collection sheet. The second stage consisted of performing a community trial in the intervention group providing training workshops for medical personnel. In the first workshop, the level of guideline knowledge was evaluated, the second was designed to correct and improve the deficiencies identified in the first, and the third was used to reach a consensus on improvement agreements in the diagnosis and treatment of pregnant women with a UI, with the participation of administrators. The third stage consisted of determining a correlation between the proportion of medical personnel that improved their level of knowledge, the correct application of guideline processes, and the frequency of premature labor in the corresponding medical units.

The variables of interest analyzed were age and sex of the participating physicians, years of experience, opinion regarding the availability of laboratory studies in their health center (urinalysis and test strips) and the physician´s compliance to guidelines in the diagnosis and treatment of UI in pregnancy. In this regard, compliance was considered, in an arbitrary way, when the physician registered 85% of the measurement variables in the CR: performing a medical history, a perinatal medical history, calculation of gestational age, detection of risk factors, regular attendance of the patient to prenatal care, five or more PC visits, if the doctor reported warning signs, if he or she collected a history of UI and if he or she detected urinary symptoms, requested laboratory tests for UI, registered a diagnosis of UI, and provided measures of hygiene and diet.

The research instruments, once collected, were verified by the researchers and taken to the Research Coordination for processing in a Microsoft Windows Excel spreadsheet for analysis. The statistical analysis consisted of calculating descriptive statistics for numerical and categorical variables and a bivariate analysis of categorical variables with statistical significance, defined at 0.05.

Results and Discussion

A community trial was carried out from March to November 2019 with 60 primary care physicians of the Hidalgo Health Services who belong to 4 of the 17 Jurisdictions of the state of Hidalgo (24%). The IG consisted of physicians (32) of the Health Centers of Tula (8), Tulancingo (9), Huejutla de Reyes (8) and Ixmiquilpan (7); in the CG, physicians (28) from Tlahuelilpan (8), Coatepec (7), Atlapexco (6) and Alafajayucan (7) (Table 1).

Health Centers					
Intervention Group			Control Group		
Health Center	Number of doctors	No. of CR	Health Center	Number of doctors	No. of CR
Tulancingo	9	33	Cuautepec	7	32
Tula	8	36	Tlahuelilpan	8	29
Huejutla de Reyes	8	38	Atlapexco	6	39
Ixmiquilpan	7	27	Alfajayucan	7	36
Totales	32	134	Totales	28	136

Table 1: *Distribution of health centers according to research group.*
CR: Clinical Records.

The opinion survey of medical personnel regarding the barriers that limit or impede diagnosis and guideline treatment of UI in pregnancy, showed an important coincidence between the two groups (IG and CG). The most frequently mentioned barriers were the lack of training of doctors (30 and 60%, respectively), that urinalysis was not always available (20 and 45%), and the lack of health education for users (20 and 35%) (Table 2).

Barrier	Percentage	
	IG	CG
Drugs not always available	15	20
Lack adequate SINOS	–	10
Urinalysis not always available	20	45
Test strips not always available	10	15
Lack of standard urinalysis process	20	0
Lack of health education for users	20	35
Lack of training for health personnel	30	60

Table 2: *Barriers that limit or impede diagnosis and treatment of urinary infection in pregnancy.*
SINOS: System Informatic Record of Health Information.

According to the survey applied to administrators (8), physicians (60) and pharmacy staff (8) regarding the availability of supplies at their workplace (antibiotics, urinalysis, and urine test strips), the results showed a coincidence in the IG between administrators and pharmacists with an availability of 100%. This contrasted with the opinion of the physicians who considered that the availability was 69% in the IG and 60% in the CG (Figure 1).

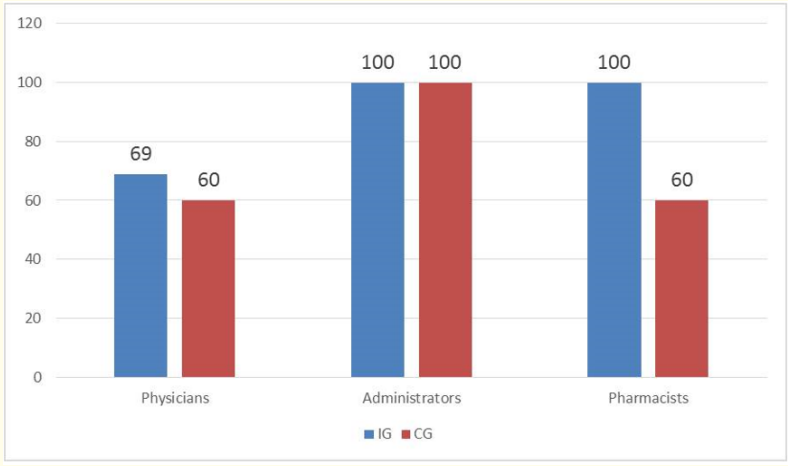

Figure 1: *Percentages of opinion regarding availability of supplies by category of doctors, administrators and pharmacists (IG: Intervention Group; CG: Control Group).*

Guideline compliance was assessed in the review of the CR; it was found that before the workshop compliance was 20% and afterward 57%, $p < 0.0056$ (Figure 2). Regarding level of knowledge, before the training workshop it was 58% (on a scale of 100) and afterward, 64%, $p < 0.024$ (Figure 3); both variables were compared with the control group.

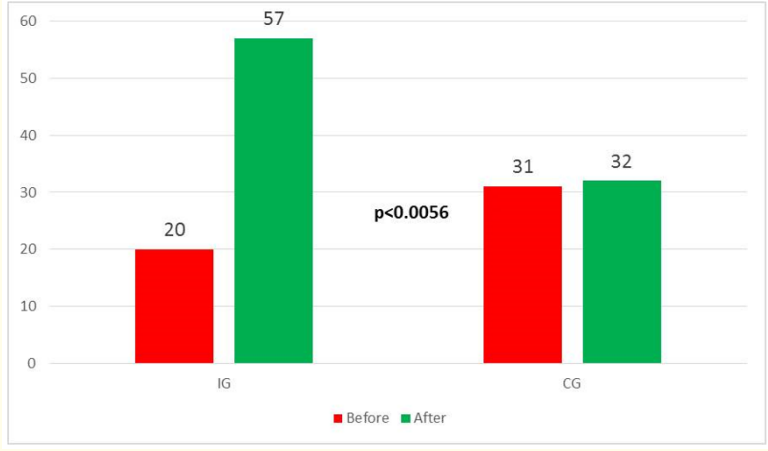

Figure 2: *Modification of guideline compliance of primary care physicians (IG: Intervention Group; CG: Control Group).*

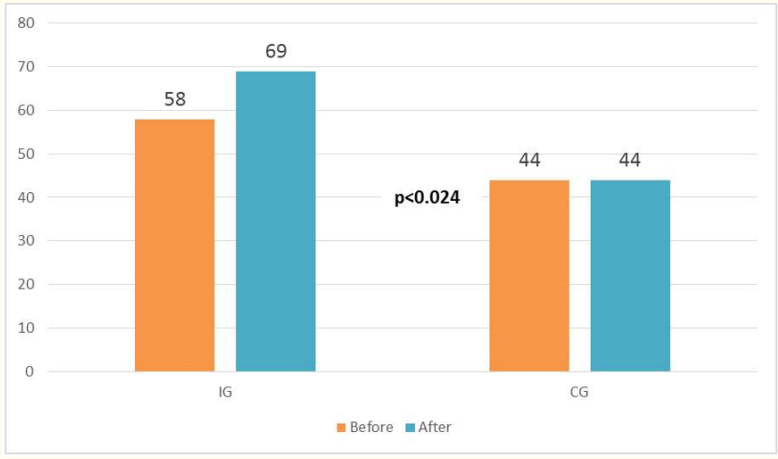

Figure 3: *Proportion of change in level of physician guideline knowledge (IG: Intervention Group; CG: Control Group).*

With the information obtained from the first two workshops, a third workshop was held in the IG health centers to correct UI in pregnancy diagnosis and treatment procedures according to the guidelines, with the presence of the administrators. In this activity, the procedure for performing urinalysis was reviewed, corrected, and standardized, a consensus on the standard procedure for starting treatment in uncomplicated UI in pregnancy with two of three urinary symptoms without the need to perform urinalysis was achieved, and an agreement was reached on providing supplies for the diagnosis and treatment of UI so that these were always available in a timely manner.

Finally, a correlation was determined between the level of knowledge and compliance with guidelines and the frequency of PL in a secondary-care hospital of the study area. The correlation analysis showed a weak relationship between improvement of knowledge level and frequency of PL ($r^2 = 0.5198$) and improvement in guideline compliance and prevalence of PL ($r^2 = 0.4346$).

UI is a frequent bacterial infection of pregnancy that can lead to multiple severe complications that can risk the viability of the mother-fetus unit; hence, the importance of its timely diagnosis and treatment, as indicated by Campusano., *et al*. and Vallejo., *et al*. in two studies in Ecuador [25,26].

UI in pregnancy is a risk factor for the development of multiple perinatal complications. Its epidemiological association with PL, premature rupture of membranes, intrauterine growth delay, low birth weight, anemia, and early neonatal disease (neonatal sepsis) has been documented [27,28].

Likewise, PL is a risk factor that significantly increases morbidity, disability, and neonatal mortality [29]. In our setting, the most frequent associated risk factor for PL is UI in pregnancy [22]. Its detection in primary care during PC is important to identify possible barriers that can limit or impede the timely diagnosis and treatment of UI in pregnancy. In this case, the main barriers reported by the physicians were a lack of training and supplies.

Regarding training, the physicians said that this action was necessary to provide adequate care during PC consultation. Our data show that adequate guideline training [30] for medical personnel resulted in a higher level of knowledge in the diagnosis and treatment of UI in pregnancy and also that guideline adherence to the standard operating procedures described in the manuals improved the institutional procedures of PC and UI.

Regarding providing supplies for the diagnosis and treatment of UI in pregnancy, although there was no coincidence of opinion between doctors and administrators, the research showed, in some cases, that in fact the supply of test strips for urinalysis was not always available in time and quantity in the pharmacy of the medical units; likewise, the antibiotics required for correct treatment were also not available in the necessary quantity.

For these reasons, the institutions that provide primary and secondary medical care must always be prepared in three aspects that contribute to improve the quality of care in the pregnant woman and her child [31,32]: Training of health personnel, primary care doctors and nurses in standard management of UI in pregnancy; provision of the necessary and essential supplies to establish a correct and timely diagnosis and treatment of women with UI in pregnancy in order to prevent possible associated complications, and that health institutions have updated manuals of good clinical practice with the aim of providing high-quality medical care to this type of patient as indicated by Viquez., *et al* [33].

Due to the high frequency of pregnancy, a fact documented by Zúñiga., *et al*. in Mexico and Fretes., *et al*. in Paraguay [27,34], it becomes essential to detect these cases in a timely manner and provide opportune medical care to avoid maternal and fetal complications.

In primary care, as in this study, the physician must intentionally look for signs and symptoms of UI during PC consultation. In our case, the frequency with which the physician intentionally sought these data was very low before training, a practice that subsequently improved significantly, with results similar to those of Zúñiga [27] and Fretes [34].

The training workshops for IG physicians with the aim of raising their level of knowledge and compliance with health care standards in primary care of pregnant women with UI during their prenatal evaluation were successful, since an inverse relationship between the level of knowledge and a decrease in the frequency of PL was seen, an inverse relationship that was also observed between compliance and the prevalence of PL in the referral hospitals, and although both correlations were not very robust (perhaps due to the amount of data), it was possible to see an inversely proportional trend.

Conclusion

The training of physicians improved their level of knowledge and their guideline compliance, and these two variables were associated with a decrease in the frequency of PL; for this reason, it is important to improve training actions for the staff and ensure an efficient and effective stock of supplies for the timely diagnosis and treatment of UI in pregnancy. The main reason is to reduce its frequency and prevent maternal and fetal complications.

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Conflict of Interest

The authors declare that they have no financial conflict of interest.

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