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ORIGINAL: Evaluation of the Causes of Acute Respiratory Failure in Pregnant Women Admitted to Shahid Sayyad Shirazi Hospital before COVID-19 Pandemic

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ABSTRACT

Introduction: Acute respiratory failure (ARF) is rare in pregnancy and occurs in less than 0.1% of pregnancies, it is one of the most common admissions of pregnant women to the intensive care unit and one of the leading causes of maternal mortality. The aim of this study was evaluation of the causes of ARF in pregnant women admitted to Shahid Sayyad Shirazi Hospital from 2014 to 2019.

Material and Methods: This was a retrospective cross-sectional descriptive-analytical in pregnant women with respiratory disorders chief complaints. All cases of pregnant women admitted (1226 cases) were reviewed. Data were analyzed using SPSS version 26.

Results: In total, 75 patients were enrolled in the study and their records were reviewed. The mean age of patients was 28.47 ± 5.06 years. Fifteen patients (25%) had ARF. The results showed that 13.3% of pregnant women with ARF needed to use mechanical ventilation (P=0.038). Also, women with history of chronic lung disease (CLD) are at higher risk for ARF (46.7% vs. 33.3%, P<0.001). Only 1.7% of mothers without symptoms of ARF were infected, but 46.7% of mothers with symptoms of ARF were infected (P<0.001).

Conclusion: The results of the study showed that infectious causes (influenza) and underlying CLD including asthma were major causes of ARF in pregnant women. Thus, more careful attention is needed to control the underlying disease, and planning for easier access to the influenza vaccine can play an effective role in reducing the incidence of pulmonary infections.

Introduction

Acute respiratory failure (ARF) is defined as the inability of the respiratory system to maintain adequate gas exchange or adequate ventilation. Although ARF is rare in pregnancy and occurs in less than 0.1% of pregnancies, it is one of the most common admissions of pregnant women to the intensive care unit and one of the leading causes of maternal mortality (1-3).

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Dyspnea in pregnancy can occur without cause or as physiological dyspnea in 75% of pregnancies. It can also be caused by pregnancy-related conditions, such as severe preeclampsia and amniotic fluid embolism, or conditions that are not directly related to pregnancy, such as pneumonia and asthma (1, 2, 4).

Physiological changes in pregnancy that occur due to hormonal effects, mechanical effects of uterine enlargement, and increased metabolic needs of the fetus, as well as certain types of pregnancy conditions and other diseases to which a pregnant woman is exposed, the risk of ARF in Increase pregnancy (2, 3).

Although pregnant women have different respiratory physiologies and different causes for ARF, the lack of large-scale randomized controlled trials has left little information available for long-term mechanical ventilation instructions during pregnancy, and oxygenation (2, 3).

Identifying the causes of hospitalization of pregnant mothers in special wards of the hospital and especially the causes leading to shortness of breath and respiratory failure can be a step to determining research priorities, targeting educational, research, and executive programs that improve the health of women in women. Reproductive ages and prevention of pregnancy complications. The aim of this study was evaluation of the causes of ARF in pregnant women.

Methods

Study Design

This was a retrospective cross-sectional descriptive-analytical in pregnant women with respiratory disorders chief complaints, conducted between February 2014 and December 2019 in Sayyad Shirazi Hospital, Gorgan, Iran. This study was conducted after approval of the Ethics Committee in Biomedical Research, Vice Chancellor for Research and Technology of Golestan University of Medical Sciences (registration code: IR.GOUMS.REC.1396.250) and considering the Helsinki Agreement.

Study protocol

All cases of pregnant women admitted from January 2014 to December 2019 (1653 cases) were reviewed. 141 cases were admitted with respiratory complaints and 66 cases were excluded from the study due to incomplete files. Finally, 75 cases were included in the study. Demographic and clinical information of patients were recorded. ARF was considered if in arterial blood gas (ABG), PaO2 was below 60%. If PaCO2 was normal or low, hypoxic respiratory failure was considered, and if PaCO2 was above 45, hypercapnic respiratory failure was considered.

Statistical analysis

The mean ± standard deviation was used to describe the quantitative data, and the frequency and percentage were used for the qualitative data. The Kolmogorov-Smirnov and Shapiro-Wilk test was used to assess the normality of the variables. The independent t-test, Wilcoxon signed ranks test, Mann-Whitney Test, chi-square test, and fisher's exact test were used. A P-value of less than 0.05 was considered statistically significant. Data were analyzed using SPSS version 26 software.

Results

In total, 75 patients were enrolled in the study and their records were reviewed (***Figure 1***). The mean age of patients was 28.47±5.06 years and the gestational age mean was 20.67±9.07 weeks. Fifteen patients (25%) had ARF.

Comparing different variables between the two groups of pregnant women with and without ARF, no difference was observed in terms of age (P=0.71). Patients with and without ARF had 66.7% and 58.3% normal vaginal delivery (NVD), respectively, no difference was observed between the two groups (P=0.39). The results showed that 38.3% of patients had no symptoms of ARF in 20 to 30 weeks of pregnancy and 40% of patients with ARF in 20 to 30 weeks of pregnancy. But no significant difference was

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observed between the two groups in terms of gestational age (P=0.66). The results also showed that only three patients had history of cardiovascular disease (CVD), all of whom were patients without symptoms of ARF. Regarding preeclampsia, this complication was observed in only one patient. The results showed that 13.3% of pregnant women with ARF needed to use mechanical ventilation (P=0.038). Also, women with history of chronic lung disease (CLD) are at higher risk for respiratory failure (46.7% vs. 33.3%, P<0.001). In terms of infection, the findings showed that only 1.7% of mothers without symptoms of ARF were infected, but 46.7% of mothers with symptoms of ARF were infected. In other words, a significant relationship was observed between these two variables (P<0.001) (***Table 1***).

Also, Information of hospitalized patients (15 cases) with ARF is shown in ***Table 2***.

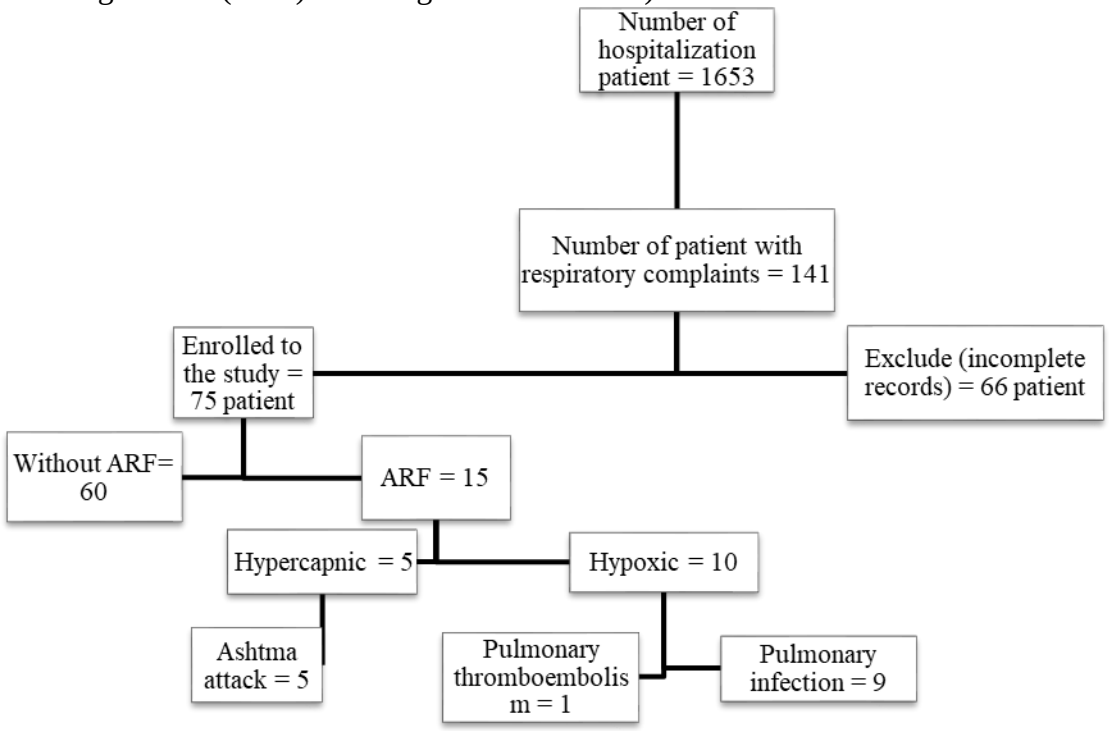

Figure 1. Study diagram

Table 1. Demographic and clinical characteristics of patients in two groups with and without respiratory failure

Variables		ARF N (%)		P-value*
		Yes	No	
Age (years)	≤25	5 (33.3)	14 (23.3)	0.71
	26 - 30	5 (33.3)	25 (41.7)	
	31≤	5 (33.3)	21 (35)	
Gestational age (week)	≤10	1 (6.7)	8 (13.3)	0.66
	11-20	4 26.7)	23 (38.3)	
	21-30	6 (40)	16 (26.7)	
	31≤	4 (26.7)	13 (21.7)	
History of CLD		7 (46.7)	2 (33.3)	<0.001
History of CVD		1 (6.67)	3 (4)	0.51
Type of delivery	NVD	10 (66.7)	35 (58.3)	0.39
	CS	5 (33.3)	25 (41.7)	
Preeclampsia		0	1 (1.7)	0.8
Mechanical ventilation		2 (13.3)	0	0.038
Pulmonary infection		7 (46.7)	1 (1.7)	<0.001

CLD: Chronic lung disease; CVD: Cardiovascular disease; NVD: Normal vaginal delivery; CS: Cesarean section
*Chi-square test

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Table 2. Demographic and clinical characteristics of patients in two groups with and without respiratory failure

Age (year)	GA (week)	Type of Delivery	Underlying diseases		Mechanical ventilation	Pulmonary infection	ABG results	Diagnosis
			CLD	CVD				
19	32	NVD	-	-	-	+	Hypoxic	Pneumonia
23	25	NVD	-	-	-	-	Hypoxic	Pulmonary thromboembolism
34	32	NVD	Asthma	+	-	-	Hypercapnic	Asthma attack
30	22	NVD	Asthma	-	-	-	Hypercapnic	Asthma attack
34	25	CS	Asthma	-	-	-	Hypercapnic	Asthma attack
30	18	CS	Asthma	-	-	+	Hypoxic	Pneumonia
27	32	CS	-	-	-	+	Hypoxic	Pneumonia
28	6	NVD	-	-	-	+	Hypoxic	Influenza
27	29	CS	-	-	+	+	Hypoxic	Influenza
18	32	NVD	-	-	-	+	Hypoxic	Pneumonia
21	24	NVD	Asthma	-	-	+	Hypoxic	Pneumonia
32	23	NVD	-	-	-	+	Hypoxic	Pneumonia
38	39	CS	Asthma	-	+	-	Hypercapnic	Asthma attack
22	11	NVD	-	-	-	+	Hypoxic	Influenza
31	19	NVD	Asthma	-	-	-	Hypercapnic	Asthma attack

GA: Gestational age; CLD: Chronic lung disease; CVD: Cardiovascular disease; NVD: Normal vaginal delivery; CS: Cesarean section; ABG: Arterial blood gas

Discussion

Identifying the causes of hospitalization of pregnant mothers, including the causes associated with respiratory problems can be an effective step in research and treatment planning that can reduce mortality and morbidity. Therefore, this study was performed in the field of causes of respiratory failure to identify the underlying factors related to it in the study population.

According to the results of this study, most patients who did not have symptoms of ARF in the age range of 24 to 30 years (41.7%) and patients with ARF equally in the age groups less than 25, 26 to 30 and above 30 years were located. Muthu et al. Showed that pregnant women with ARF were in the range of 22 to 29 years (5).

The results showed that there was no significant difference between the two groups of women with and without symptoms of ARF in terms of gestational age and most patients had ARF in 20 to 30 weeks of pregnancy. Rush et al reported 42% of pregnant women with ARF were between 20 and 32 weeks of gestation, and 50% of those observed were over 34 weeks of gestational age (6).

The results showed that 2.7% of pregnant women in this study required the use of mechanical ventilation. In a study, it was found that out of 5,400,314 pregnant patients, 2,808 pregnant patients with ARDS were mechanically ventilated, which shows the difference in the condition of patients in these two studies (6). However, this study showed that the need for mechanical ventilation was significantly higher in women with ARF. In a similar study, it was found that the need for mechanical ventilation is still a medical necessity in pregnant patients with ARF (6-8). Women with CLD are also at higher risk for ARF. The results of another study showed that CLD caused 0.4% of ARF (6). The results of the Bandi et al. study were also in line with these results (9).

Regarding infection, the results showed that women with respiratory failure are at higher risk for infection. The Rush et al. study confirmed our result and showed that infections such as influenza or postpartum infection are associated with ARF (6). Also, Catanzarite et al. showed that infection was one of the causes of ARF and out of 28 cases

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examined, 12 had infection (10). Another study found that the most common causes of ARF syndrome in pregnancy were infection, preeclampsia or eclampsia, bleeding, thrombotic thrombocytopenic purpura, and smoking (11).

The results showed that 66.7% of women with ARF had NVD and 33.3% had CS. Rush et al. has shown that 14.7% of women with ARF have had NVD and 41.4% have had CS (6), which is completely contrary to the results of the present study. The reason for this may be mentioned in the legal differences between the two studies.

Regarding preeclampsia, this complication was observed in only one patient and no significant relationship was found between preeclampsia and ARF. Another study found that 22.1% of pregnant women with symptoms of ARF had eclampsia (6). Catanzarite et al. mentioned the need for preeclampsia as another cause of ARF (10). Another study reported that one of the most important causes of ARF in pregnancy was preeclampsia or eclampsia (11).

The results also showed that only 5% of the total sample had CVD, all 5 of which were patients without symptoms of ARF. In other words, no significant relationship was observed between the previous disease and ARF in pregnant mothers. Another study found that physical examination of patients typically showed tachypnea and tachycardia without any clinical evidence of heart failure (9).A study by Yazdi et al. (2013) found that administration of selenium nanoparticles for 30 days in mice exposed to x-rays with bone marrow suppression reduced the number of lymphocytes and neutrophils (69). Selenium nanoparticles prevent the differentiation of monocytes into macrophages and also prevent the migration of neutrophils and the adhesion of lymphocytes to endothelial cells by reducing the expression of L-selectin. It is stated that the antioxidant potential of selenium nanoparticles is due to the direct reduction of the level of different oxidant species and also the increase of GPX level (70, 71). These nanoparticles exert their antioxidant effect by purifying H2O2 and phospholipid and lipid hyperoxides and converting them to alcohol and water

Conclusion

The results of the study showed that infectious causes (influenza) and underlying CLD including asthma were major causes of respiratory failure in pregnant women. Thus, more careful attention is needed to control the underlying disease, and planning for easier access to the influenza vaccine can play an effective role in reducing the incidence of pulmonary infections.

Ethical standards statement

All the investigation procedures used in the current study were reviewed and approved by the Research Ethics Committee of the Golestan University of Medical Sciences (code: IR.GOUMS.REC.1396.250).

Conflicts of interest

The authors declare no conflict of interest.

Authors' contributions

All authors have participated in the design, implementation, and writing of all sections of the present study.

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