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### Pregnancy of unknown location in a cohort of patients treated with methotrexate

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## Abstract

**Introduction:** To determine the prevalence of pregnancy of unknown location (PUL) in patients treated with Methotrexate (MTX) for nonsurgical diagnosis of ectopic pregnancy (EP). To determine the  $\beta$ -HCG treatment outcomes.

**Methods:** Retrospective cohort study of patients who received MTX for treatment of EP over a 10-year period in an urban-based healthcare system. Wilcoxon test was used for statistical analysis.

**Results:** A total of 150 pregnancies were identified as treated with MTX over a 10-year period. Pregnancies were classified based on reviews of ultrasound as pregnancy of unknown location (PUL), ectopic pregnancy (EP), or Intrauterine pregnancy (IUP). 47 were classified as PUL, 101 EP, 2 IUP. Approximately 1/3 of patients treated with MTX were PULs. The average baseline  $\beta$ -HCG was 2960<sub>MIU/ML</sub> and the average  $\beta$ -HCG at treatment was 4188<sub>MIU/ML</sub> for the entire cohort. Resolution of  $\beta$ -HCG levels with one dose of MTX differed between pregnancy types with PULs prescribed MTX at a lower  $\beta$ -HCG level on day of treatment (56% vs 27% at  $\beta$ -HCG of less than 1000<sub>MIU/ML</sub>) compared to EP. Additionally, 61% of the entire cohort were treated with 2 data points or less. 38% of PUL were treated with 1 to 2  $\beta$ -HCG values and 82% PUL were treated at  $\beta$ -HCG <2000<sub>MIU/ML</sub>. Of the two IUPs,  $\beta$ -HCG level at treatment was 6267<sub>MIU/ML</sub> and 13353<sub>MIU/ML</sub>.

**Conclusion:** There may be an underappreciated risk of inadvertent administration of Methotrexate to patients with early IUP. A minimum of three  $\beta$ -HCG assays over seven days in the diagnostic algorithm for EP would decrease treatment of PUL.

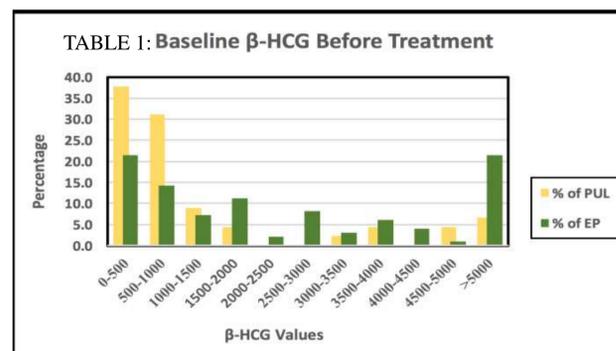
## Introduction

- The incidence of ectopic pregnancy is approximately 20 per 1000 pregnancies.
- Between 1980-2007, 876 deaths were attributed to ectopic pregnancy in the United States alone.
- Methotrexate has been used to treat small un-ruptured ectopic pregnancies since the 1980's.
- The one-dose protocol by Stovall and colleagues in 1991 relies on a non-surgical diagnosis of ectopic pregnancy utilizing serial serum assays of beta human chorionic gonadotropin ( $\beta$ -hCG) combined with high resolution transvaginal ultrasound.
- The "non- surgical " diagnostic protocol must perform at a very high rate of accuracy in order to avoid either unnecessary patient exposure of a non-ectopic failed pregnancy or inadvertent exposure of an ongoing viable intra-uterine pregnancy (IUP) with embryopathy and legal implications.

## Background

- In spite of the seriousness of inadvertent teratogenic effects to IUP treatment, literature on methotrexate treatments focus on success rates, and there is no literature that assesses the incidence of such events.
- To date no research has been performed to analyze how often methotrexate is used in the setting of PUL. PUL is defined as pregnancies wherein  $\beta$ -hCG levels continue to rise abnormally with ambiguous ultrasound findings.
- The purpose of this study is to characterize BHCG levels and ultrasound findings present at the time of methotrexate administration in patients with diagnosed with an ectopic pregnancy and produce recommendations for modifying current clinical guidelines to minimize the risk of unnecessary or inadvertent methotrexate exposure to pregnancies labeled as PUL that are subsequently identified as IUP.

## Results



HBCG Level (mIU/mL)	BASELINE			
	# of PUL	% of PUL	# of EP	% of EP
0-500	17	37.8	21	21.4
500-1000	14	31.1	14	14.3
1000-1500	4	8.9	7	7.1
1500-2000	2	4.4	11	11.2
2000-2500	0	0.0	2	2.0
2500-3000	0	0.0	8	8.2
3000-3500	1	2.2	3	3.1
3500-4000	2	4.4	6	6.1
4000-4500	0	0.0	4	4.1
4500-5000	2	4.4	1	1.0
>5000	3	6.7	21	21.4

TABLE 2: Baseline  $\beta$ -hCG levels and pregnancy location

HBCG Level (mIU/mL)	MTX Treatment			
	# of PUL	% of PUL	# of EP	% of EP
0-500	13	28.9	14	13.3
500-1000	13	28.9	15	14.3
1000-1500	5	11.1	6	5.7
1500-2000	0	0.0	3	2.9
2000-2500	3	6.7	10	9.5
2500-3000	1	2.2	6	5.7
3000-3500	1	2.2	5	4.8
3500-4000	1	2.2	4	3.8
4000-4500	0	0.0	4	3.8
4500-5000	3	6.7	4	3.8
>5000	5	11.1	34	32.4

TABLE 3:  $\beta$ -hCG levels and pregnancy location at time of methotrexate treatment

	PUL Not Resolved		
	n	Mean	SD
MTX Dose	3	98.7	9.3
Baseline BHCG	3	335	321
Treatment BHCG	3	1095	1046
Days between Baseline and Rx	3	8.3	4.5
# of BHCG	3	3	1.73

TABLE 4: Comparison  $\beta$ -hCG levels in unresolved pregnancy of unknown location

	PUL Resolved		
	n	Mean	SD
MTX Dose	23	93.3	16.6
Baseline BHCG	23	625	82.2
Treatment BHCG	23	893	963
Days between Baseline and Rx	23	7.3	7.8
# of BHCG	23	3.52	2.23

TABLE 5: Comparison  $\beta$ -hCG levels in resolved pregnancy of unknown location

## Methods

**Project design:** Retrospective chart review

**Location:** A single community based healthcare institution, Henry Ford Health System

**Inclusion criteria:** All patients who were diagnosed with ectopic pregnancies and treated with methotrexate from 01/01/2007 - 12/31/2017.

**Exclusion criteria:** Patients who had an ectopic pregnancy and not treated with methotrexate or those who underwent initial conservative or surgical management.

**Duration:** 10 years, from 01/01/2007 - 12/31/2017.

**Statistical Analysis:** Wilcoxon test. All Wilcoxon test used the Fligner-Policello Test for unequal variables

## Results

- A total of 150 pregnancies were identified as treated with MTX over a 10-year period.
- Pregnancies were classified based on reviews of ultrasound as: 1) pregnancy of unknown location (PUL) N=47, 2) ectopic pregnancy (EP) N=101 or 3) Intrauterine pregnancy (IUP) N=2
- Approximately 1/3 of all patients treated with MTX were PULs
- Average baseline B-HCG was 2960 MIU/ML for the entire cohort
- Average b-HCG at treatment was 4188 MIU/ML for the entire cohort.
- 61% of the entire cohort were treated with 2 data points or less
- PULs were prescribed MTX at a lower b-HCG level on treatment day
- Resolution occurred more often (56% vs 27% ) at b-HCG of less than <1000 MIU/ML for PUL compared to EP
- 38% of PUL were treated with 1-2 b-HCG values.
- 82% PUL were treated at b-HCG <2000 MIU/ML.
- Of the two identified IUPs, b-HCG level at treatment was 6267 MIU/ML and 13353 MIU/ML.

## CONCLUSION

- One-third of the patients treated with Methotrexate for EP were classified as PUL and two IUPs were treated with Methotrexate.
- There is an underappreciated risk of inadvertent administration of Methotrexate to patients with early IUP.
- A minimum of three  $\beta$ -HCG assays in the diagnostic algorithm for EP would decrease treatment of PUL

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