COLLEGE OF MEDICINE, DEPARTMENT OF BIOMEDICAL INFORMATICS

Systematic approach to evaluate clinical trials in pregnancy serious disease

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INTRODUCTION

- Facilitating inclusion of pregnant women in clinical research could help answer important questions about the effects of medication use during pregnancy.
- Understanding the ways in which pregnancy alters pharmacokinetics and drug effects is crucial for optimizing maternal and fetal health outcomes.

AIM

- Objective: Gather existing information on the drug from medical literature, including clinical trials, observational studies, and case reports specifically focusing on use in pregnancy.
- Sources: Use databases like clinical trials(https://clinicaltrials.gov/), PubMed, Embase, and Cochrane Library to find relevant studies and reviews for drug treatment and associated targets.
- Searching pregnancy related disease and associated treatments, we will focus on the following conditions (15 diseases) : (1) Pre-eclampsia/eclampsia (PE/E), (2) Hyperemesis Gravidarum, (3) Gestational Diabetes, (4) Intrahepatic Cholestasis of Pregnancy (ICP), (5) Placenta Previa , (6) Anemia,(7) Preterm Labor/Birth (PTL/PTB), (8) Fetal Growth Restriction (FGR), (9) Obstetric Cholestasis, (10) Maternal Vascular Malperfusion (MVM), (11) Preterm Premature Rupture of Membranes (PPROM), (12) Post-partum hemorrhage (PPH), (13) intrauterine growth restriction (IUGR), and (14) fetal distress (15) gestational hypertension.

DATA COLLECTION

Searching and collecting treatment drug options and their targets during pregnancy

- **Clinical Trials and Drug Databases Search:** Conducted searches on ClinicalTrials.gov (https://clinicaltrials.gov/)using drug names as keywords for 15 pregnancy-related diseases. Extracted drug indications and targets from DrugBank (https://go.drugbank.com/)using Natural Language Program (NLP).
- **Python and Web Scraping**: Utilized Python scripts for web scraping and automated data retrieval from ClinicalTrials.gov and DrugBank.
- **Systematic Data Organization:** Structured the collected data into a comprehensive pregnancy disease-drug-target database, organizing by disease, drug, and target.
- **CSV File Structure:** Compiled the data into a CSV file, detailing drug names, associated diseases, clinical trial records, and drug targets for easy access and analysis. (Table 1)

Table 1: Example dataset

DATA ANALYSIS

Statistical Analysis

- **Data Analysis Tools:** The collected data was analyzed using the SPSS statistical software (version SPSS 20.0). This involved using various statistical methods to interpret the data accurately.
- **Statistical Methods:** Count data were expressed as percentages (%), while measurement data were presented as mean ± standard deviation (S.D.). Comparisons between groups were performed using independent samples t-test or Mann–Whitney U-test, with a significance level set at $\alpha = 0.05$ ($p \leq 0.05$).

DRUG Mechanism of Action Enrichment to 15 Diseases

- Each disease associated drugs and their targets are used pathway enrichment analysis by DAVID Functional Annotation Bioinformatics Microarray Analysis Tool (http://david.ncifcrf.gov)
- DAVID Functional Annotation Bioinformatics Microarray Analysis (Fig. 3) visualizes the enriched pathways for drug targets in the 15 diseases, clearly demonstrating the impact of the drugs on specific biological pathways and aiding in understanding their mechanisms of action.

RESULTS

Result 1: Data distribution of drug-disease from Clinical Trials associated with Pregnancy

Figure 1. Disease Distribution to Clinical Trails

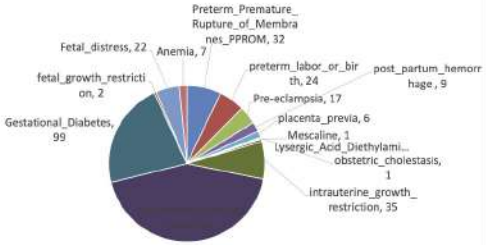
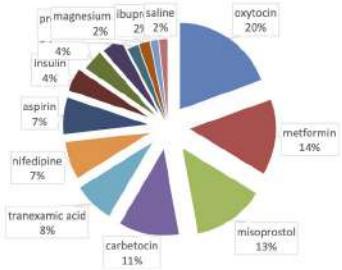


Figure 2. Drug distribution to Clinical Trails in disease during pregnancy



Result 2: Targets of drugs enrichment in KEGG pathways in Hyperemesis Gravidarum

- KEGG Pathway Analysis: The targets of drugs used in the treatment of Hyperemesis Gravidarum were analyzed for enrichment in KEGG pathways using the DAVID Functional Annotation Tool. This analysis identifies significant biological pathways impacted by these drugs.

Figure 3 visualizes the enriched pathways for drug targets in the diseases Hyperemesis Gravidarum from KEGG pathways.

Figure 3: Pathway Enrichment Analysis of Drug Targets in Hyperemesis Gravidarum

CONCLUSIONS

Significance of Data Extraction and Analysis: Using web scraping and NLP tools, we addressed gaps in drug information for pregnant women, improving understanding for better-targeted therapies and clinical guidelines.
Study Findings: We created a comprehensive database of pregnancy-related disease-drug-target information and identified key pathways through pathway enrichment analysis.
Implications and Future Directions: The insights aim to optimize drug therapies, enhance maternal and fetal health outcomes, and support safer clinical practices, with ongoing research to refine the database.

REFERENCE

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