NICU pharmacist responsibilities:
Continuous quality improvement

- Documentation of medication errors
- Monthly NICU Quality Assurance Meetings
- Track trends in medication errors
- Change policies & procedures to reduce medication errors

ＮＩＣＵ担当薬剤師の職務：
継続的な業務の質の改善

- 投薬ミスの報告
- NICU業務の質を保証するための月例ミーティング
- 投薬ミス傾向の追跡
- 投薬ミスを減少させるための方法・手順の見直し

A review of the medication errors submitted to the departments of pharmacy and nursing from January through March 1987 showed a total of eight medication errors from the NICU. This rate of medication errors was higher than that of other nursing units and was determined to be unacceptable by the Risk Management Committee. Review of the literature revealed that calculation errors in pediatric patient populations are a common problem.[7,8] Folli et.al. demonstrated that instituting clinical pharmacy services reduces the incidence of medication errors in children's hospitals.[9]

Through documentation of medication errors and monthly reporting of these errors at our NICU Quality Assurance Meeting, we can track trends in errors and identify factors that increase the risk of errors. This allows us to change policies and procedures to reduce the risk of errors. One example of this happened in the first year of my practice. I discovered a tenfold error in a vancomycin dose during routine serum drug level monitoring. Although the correct dose was ordered and charted, extremely high vancomycin levels prompted me to investigate and resulted in the discovery of a decimal point error in the labeling of the vial dispensed from the pharmacy. Standardized concentrations, which were more diluted than those previously used, were established and a policy was developed for dispensing all antibiotics in unit dose syringes. This change was welcomed by the nurses and has virtually eliminated wrong dose errors.

1987年1月から3月にかけて薬剤部と看護部に提出された投薬ミスを精査したところ、NICUから8件の報告がありました。NICUでの投薬ミスの発生率は他の病棟よりも高く、リスクマネージメント委員会からも容認しがたいものとされました。文献の再検討により、小児患者における（薬用量の）計算ミスが共通の問題であることが明らかになりました[7,8]。また、Folli らは、臨床薬剤業務の開始によって子供病院での投薬ミスの発生が減少したことを報告しました[9]。

投薬ミスの報告調査や「NICU業務の質を保証するためのミーティング」でのミスの月例報告を通して、エラーの傾向を追跡し、エラーの危険性を増加させる要因を明らかにできます。これにより、業務方法や手順を見直し、エラーの危険性を減少させることが可能です。私が業務を始めた１年目にこのような事例がありました。薬物血中濃度モニタリングの際に、バンコマイシンの投与量が10倍量間違っていることに気付きました。正しい用量がオーダーされ、カルテに記載されていたにもかかわらず、極端に血中濃度が高いため即座に調査を行ったところ、薬剤部から配薬されたバイアルのラベルに小数点の記載ミスがあることが判明しました。これを受けて、今までより更に希釈して濃度の標準化を行い、全ての抗生物質を unit dose のシリンジで調製するように方法を見直しました。この変更は看護婦に喜ばれ、実際に、投与量のミスはなくなりました。

NICU pharmacist responsibilities:
Cost reduction

- Adherence to drug formulary
- Appropriate use of drugs
- Development of drug use protocols
  - New expensive drugs
- Periodic drug use review
  - Albumin, erythropoetin

ＮＩＣＵ担当薬剤師の職務：
コスト削減

- 医薬品集の厳守
- 薬剤の適正使用
- 薬物使用プロトコールの作成
  －高価な新薬
- 定期的な薬物使用状況の調査
  －アルブミン、エリスロポエチン

As I have been mentioning throughout this presentation, cost reduction is one of my job responsibilities. Steps toward the goal of cost containment focused initially on reducing waste and providing more efficient methods of drug delivery. Another way our hospital holds down drug costs is by having a strict drug formulary. For example, of the over 20 cephalosporins available, OSU only has three on the regular formulary and two others can be used on a "restricted use only" designated by our Pharmacy and Therapeutics Committee. When the physicians in my unit order a non-formulary drug, I suggest changing it to a therapeutic equivalent that is on our drug formulary. I have found compliance with this cost reduction strategy to be very good.

Another way to hold down drug costs is to develop drug use criteria especially for new expensive drugs. This helps educate physicians as to the proper use of these medications and helps avoid using them on patients that do not fit the criteria. Periodic drug use reviews document physician compliance with these protocols.

この講演を通して述べてきたように、コストを削減することは私の業務の一つです。コスト抑制の手段としてまず焦点が当てられたのは、無駄を減らし、より効果的な薬剤交付を行うことです。本院がとった薬剤費抑制のためのもう一つの手段として、厳格な医薬品集の利用があります。その一例として、セファロスポリン系抗生物質は20種類以上のものが存在しますが、OSUの通常医薬品集にはその中の3種類しかなく、薬剤部と治療委員会により「限られた場合のみの使用」が認められているものが他に2種類あるだけです。医師が医薬品集に載っていない薬品をNICUでオーダーした場合、私は医薬品集にある同等の効果を持つものに変更してもらうようにしています。このコスト削減方法の実行により良い結果が得られています。

薬剤費抑制の他の手段として、高価な新薬に対する使用基準の作成があげられます。これによって、新薬が適正に使用されるように医師を教育し、基準に適合しない患者への新薬の投与を回避できます。定期的に薬物使用状況を調査し、これらのプロトコールが遵守されているかを詳細に記録します。

Summary

- Clinical pharmacist is important part of NICU team
- Improvements in drug prescribing and administration
- Important role in teaching
- Holding down drug costs

まとめ

- 臨床薬剤師はNICUチームの一員として重要である
- 薬剤の処方と投与法の改善
- 教育における重要な役割
- 薬剤費の抑制

The results of the 1987 audit of NICU pharmacy services documented the need for creating the position of neonatal clinical pharmacist, someone who would provide services in several areas including error prevention and documentation, teaching, pharmacokinetics and nutritional support, and containment of drug costs in the NICU. Expertise in dosage forms, drug compatibility and stability and methods of drug delivery to this unique patient population were also needed. A clinical specialist in neonatal therapeutics who could interact effectively with the physicians and provide safe, rational, and cost-effective drug therapy in the NICU was desirable in this position.

I have taken on these responsibilities as well as many others in the 13 years I have been the clinical pharmacist in the NICU. I love my job because I am an integral part of the NICU team and my job is always interesting and challenging.

1987年に実施されたNICUに対する薬剤業務の監査結果には、新生児専門の臨床薬剤師のポストを創設する必要性が報告されています。NICU担当臨床薬剤師は、事故の防止・報告調査、教育、薬物動態や栄養摂取に関する支援、薬剤費抑制などの複数領域にわたる業務を行い、新生児に対する投与剤形、薬剤の適合性と安定性、調剤方法に精通していることも要求されます。従って、医師と相互に協力し、NICUにおける安全で合理的、cost-effctive な薬物療法を提供できる新生児治療の専門家がこのポストにふさわしいと思われます。

私が NICUの臨床薬剤師をしてきた13年の間、他の業務と同様にこうした業務を引き受けてきました。私はこの仕事が気に入っています。なぜなら、私はNICUチームに不可欠な一員であり、この仕事は常に私に興味を抱かせ意欲をかき立てるものだからです。

(付録 1)

Appendix 1
Dopamine NICU Monograph

Description
Inotropic, chronotropic agent.
Peripheral vasopressor.

Proposed Mechanism of Action
Stimulates dopamine1 and dopamine2 receptors directly. Stimulates endogenous release of norepinephrine from storage vesicles in presynaptic adrenergic nerve terminals.
Dopamine1 receptors : Located in renal, mesenteric, coronary, and cerebral vascular beds. Stimulation causes vascular smooth muscle relaxation, resulting in vasodilation. Increases blood flow to these areas. Results in increased GFR and increased urine output.
Dopamine2 receptors: Located in presynaptic nerve terminals in carotid body, anterior pituitary, and GI tract. Stimulation inhibits NE release in these areas, resulting in decreased hypoxic TSH release from anterior pituitary.

Indications
Shock: Cardiogenic shock from asphyxia, myocarditis, sepsis
Hypotension unresponsive to fluid expansion.
Heart failure with hypotension and decreased urine output.
Poor urine output due to prerenal causes or indomethacin therapy.
Used with Pavulon to counteract its peripheral vasodilatory effect.

Pharmacokinetics
Metabolism & Excretion: Rapidly metabolized by monamine oxidase in blood and tissues. Major metabolite is norepinephrine which is then further broken down by monamine oxidase.

Dosage and Administration
Continuous IV: a central venous line is the preferred site in adults, UVC in neonates. Second choice is a peripheral line in neonates. Do NOT administer via UAC. *Must be administered via syringe pump and microbore tubing. When physician orders 60 mg/100 mL, Pharmacy will send 30 mg/50 mL syringe.
Note: Base dose on wet weight since drug will distribute into edematous fluid, lowering intravascular concentration.

Dose (mcg/kg/min)	Response
Low 1-5	Primarily dopaminergic effects. Increased RBF, increased GFR.
Intermediate 5-10	Increased cardiac output (B1). May see increased blood pressure.
High 10-20	Combined B1 and B2 and alpha effects.Increased CO, BP, SVR.
>20	Severe vasoconstriction. Poor peripheral perfusion, hypertension, decreased RBF, and increased MvO2, increased heart rate,arrhythmias.

Side Effects/Toxicity

Tachycardia, arrhythmias
Hypertension

Excessive vasoconstriction of peripheral vessels may lead to gangrene. Blanching at IV site (try a more dilute solution).

In patients with pulmonary hypertension, dopamine can increase pulmonary vascular resistance.

Peripheral extravasation: Can lead to local ischemia, ulceration, tissue sloughing or gangrene. Treat by discontinuing dopamine infusion and leave IV line in. Infuse phentolamine (Regitine®) 1-5 mg diluted in 1-5 mL NS or use hyaluronidase (Wydase®).

Accidental overdose or bolus: Expect intense vasoconstriction, no capillary refill, decreased urine output, hypertension, risk of IVH, arrhythmias. Discontinue IV immediately.

IV Solution Compatibility
dextrose solutions, saline solutions

IV Soution Incompatibility
5% sodium bicarbonate

Terminal Site Compatibility
aminophyllline, ampicillin, calcium salts, chloramphenicol, diltiazem, dobutamine, enalaprilate, fluconazole, gentamicin, heparin in 0.9% NS, hydrocortisone, lidocaine, lipids, methylprednisolone, morphine, penicillin G, piperacillin/tazobactam, potassium chloride, rantidine, tobramycin, TPN

Terminal Site Incompatibility
acyclovir, amphotericin B, cefepime, furosemide, heparin in D5W, indomethacin, insulin, iron salts

Monitoring Parameters
Heart rate, blood pressure, MAP, TcPO2, ABG, peripheral circulation, acid-base status, urine output. Monitor IV site: blanching, cyanosis, pallor, coolness. If severe, change IV site. Try a more dilute solution of dopamine, ie. 30 mg/100 mL.

Product Availability
Dopamine (Inotropin®) 400 mg/10ml vial.
Must be diluted prior to administration.

OSU NICU Standard Preparation
Standard Dilution: Dopamine 30 mg in D5W 50 mL IV syringe
When physician orders 60 mg/100 mL, please send 30 mg/50 ml in a syringe so it can be administered via a syringe pump and microbore tubing

Pharmakon Mnemonic: DOPASYR30

For severe fluid restriction only: Dopamine 60 mg/50 mL syringe

(付録 2)

THE OHIO STATE UNIVERSITY HOSPITALS

PATIENT EDUCATION

Ferrous Sulfate

(Iron Supplement)

Dosage	
Schedule	

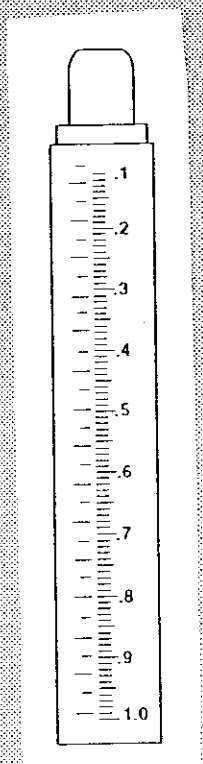
Medicine Use:

Ferrous sulfate (iron) is a mineral which is given to babies as a dietary supplement. Iron is used by the body to help produce red blood cells and help prevent anemia (low amount of red blood cells). This treatment may be necessary if the diet does not have enough iron or if your baby is anemic.

General Information:

- **Measuring The Dose:**

  You will have or can get syringes to measure the medicine. Your baby's dose is _____ mg. which equals _____ ml. To measure the dose, draw the plunger of the syringe down to the mark on this picture.



(over)

- The medicine may be mixed with a small amount of formula and fed through a nipple. It can also be given directly from the syringe into your baby's mouth.

- Take the plunger out of the syringe and wash it in warm water and allow it to dry. Throw the syringe away when you can no longer read the numbers.

Side Effects:

- Stools often become black when iron is given. This is caused by unabsorbed iron and is harmless.

- Some babies develop one or more of the following symptoms while getting this medicine.

  - Constipation
  - Red streaks in the stool
  - Dark urine

Call your pediatrician if any of these above symptoms do not go away or if you have any questions.

☹ It is very important to keep this medicine out of the reach of children. Accidental overdose is very serious. Contact the Poison Center at 1-800-682-7625 or your doctor immediately if this should occur. Symptoms of overdose include:

- Diarrhea (may have blood in it)
- Nausea and vomiting
- Sharp stomach pain

Development of a Clinical Pharmacy Practice in the Neonatal Intensive Care Unit
Debra K. Gardner, Pharm.D.

References

1. Gardner DK, Siegel J, Pathak DS. Adaptive approaches to the implementation of new clinical services: A case study of neonatal ICU pharmacy services. Topics in Hospital Pharmacy Management. 1990;9:58-72.

2. Bryant BG. Clinical pharmacist: Emerging member of the NICU team. Neonatal Network. 1985;June:40-44.

3. Zenk KE. The pharmacist: A member of the neonatal interdisciplinary team. Journal of the California Perinatal Association. 1983;1:54-59.

4. Roberts RJ. Intravenous administration of medications in pediatric patients: Problems and solutions. Pediatric Clinics of North America. 1981;28:23-34.

5. Nahata MC. Influence of infusion methods on therapeutic drug monitoring in pediatric patients. Drug Intelligence and Clinical Pharmacy. 1986;20:367-369.

6. Hartwig SC and Gardner DK. Use of standardized total parenteral nutrient solutions for premature infants. Am J Hosp Pharm. 1989;46:993-995.

7. Perlstein PH, et.al. Errors in drug computation during newborn intensive care. American Journal of Diseases of Childhood. 1979;133:376-378.

8. Koren F, Barzilay Z, Greenwald M. Tenfold errors in administration of drug doses: A neglected iatrogenic disease in pediatrics. Pediatrics. 1986;77:848-849.

9. Folli HL, et.al. Medication error prevention by clinical pharmacists in two children's hospitals. Pediatrics. 1987;79:718-722.

＜講演２＞

“Pharmacist-Initiated Hyperemesis Gravidarum Protocol”

「薬剤師による妊娠悪阻の治療計画」

Pharmacist-Initiated Hyperemesis Gravidarum Protocol

Debra K. Gardner, Pharm.D.

薬剤師による妊娠悪阻の治療計画

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In this presentation, I will begin by discussing hyperemesis gravidarum (HEG), its incidence, pathophysiology, and common treatments, including those that work and those that do not work. Then I will discuss how I became involved in the treatment of these women and I will present a small study comparing my treatment protocol with the treatments the obstetricians were providing before my involvement.

Hyperemesis gravidarum (HEG) is defined as intractable vomiting in pregnancy that causes dehydration, electrolyte disturbances, nutritional deficiencies, and weight loss

このプレゼンテーションで、私は妊娠悪阻（にんしんおそ）について、その発生率、病態生理、そして一般的な治療法をそれが有効かそうでないかも含めて話す事から始めたいと思います。その次に、どうして私がそのような女性の治療に加わるようになったのか、そして私の治療計画と私が加わる以前に産科医が行っていた治療との比較をした研究について述べたいと思います。

妊娠悪阻とは脱水、電解質異常、栄養不足、そして妊娠中の体重減少を起こす、処置の難しい嘔吐であると定義されます。

History of Hyperemesis Gravidarum (HEG)

- Documented on papyrus since 2000 BC
- Soranus Gynecology 2 A.D.
- Termination 1st reported for HEG: 1813
- HEG considered an indication for abortion starting in 1852
- Charlotte Bronte died of HEG in 1855
- 14% rate of therapeutic abortion: 1930's

妊娠悪阻(HEG)の歴史

- 紀元前2000年よりパピルスに記述
- Soranus婦人科学　西暦２年
- 妊娠悪阻に関する最初のレポートの完成：1813年
- 1852年から妊娠悪阻は流産のの徴候の指標と考えられるようになる
- 1855年、Charlotte Bronteが妊娠悪阻で死亡
- 14%が治療的流産：1930年代

Nausea and vomiting have been associated with early pregnancy since the beginning of time. Nausea and vomiting in pregnancy was documented in a physician's papyrus dated 2000 B.C. and was written about in Soranus' Gynaecology, a medical text from the second century A.D.[1]

Before intravenous fluid therapy was possible, hyperemesis was a major cause of maternal mortality. In fact, therapeutic abortion was introduced in 1813 as a treatment of hyperemesis gravidarum.[1] Charlotte Bronte, the famous 19th century author of Jane Eyre died of hyperemesis in 1855 in her fourth month of pregnancy.[2]

悪心と嘔吐は有史以来、早期妊娠と関係付けられてきました。妊娠中の悪心・嘔吐は紀元前2000年の内科医のパピルスに記述があり、また、西暦２年の医学書、Soranus婦人科学にも記載されています[1]。

静脈栄養輸液療法が可能となる以前は、悪阻は母親の死亡の主要な原因でした。事実、妊娠悪阻の治療として1813年に治療的流産が紹介されています[1]。19世紀、Jane Eyreの著者、Charlotte Bronteは1855年妊娠４ヶ月目で悪阻により死亡しています[2]。

Hyperemesis Gravidarum
Incidence

- Nausea & vomiting occur in 56% of all pregnancies
- HEG: Clinically significant in 0.3-1%
- More common in urban areas
- Rare in native Americans, Eskimos, Asians

妊娠悪阻
発生率

・悪心・嘔吐は総ての妊婦の56％に起きる
・妊娠悪阻：0.3-1%で臨床的に有意である
・都市部ではより一般的
・アメリカ原住民、エスキモー、アジア人では稀

Vomiting has been reported to occur in 56% of pregnant women.[2] Hyperemesis gravidarum, defined as intractable vomiting in pregnancy that causes dehydration, electrolyte disturbances, nutritional deficiencies, and weight loss, however, occurs with an incidence of 3.5 per 1000 deliveries.[1,3,4] It is more common in urban areas than in rural populations and it is rare in native American, Eskimo, African, and Asian societies.[1]

嘔吐は妊娠中の女性の56％に起きると報告されています[2]。妊娠悪阻は脱水、電解質異常、栄養不足、そして体重減少を起こす、妊娠中の処置の困難な嘔吐であると定義されます。妊娠悪阻は、1000人に3.5人の割合で発生します[1,3,5]。都市部では郊外よりも多く発症し、また、アメリカ原住民、エスキモー、アフリカ人、アジア人では稀です。

Factors associated with HEG

- Primigravida
- Women < 20 years old
- Nonsmokers
- Weight > 170 pounds
- Multiple gestation
- Intolerance to oral contraceptives

妊娠悪阻に関連する要因

- 初めての妊娠
- 年齢が20歳未満の女性
- 非喫煙者
- 体重が170ポンド（77キログラム）以上
- 多胎妊娠
- 経口避妊薬への不寛容

In affected populations, it is more common in women who weigh greater than 170 pounds, nonsmokers, twin pregnancies, trophoblastic disease, and in women younger than 20 years.[1] Hyperemesis is most common in first pregnancies and tends to recur in subsequent pregnancies. Epidemiologic studies indicate that women with nausea and vomiting in pregnancy have a statistically significant decreased risk of miscarriage in the first 20 weeks.[2]

影響を受けやすいポピュレーションとしては体重が170ポンド（77 kg）より重い、タバコを吸わない、双子の妊娠、絨毛上皮性の病気、20歳未満の女性、が挙げられます[1]。

嘔吐は初めての妊娠に最も多く見られ、次の妊娠でも再発する傾向があります。疫学的調査は、妊娠時に嘔気・嘔吐を催す女性は統計上、最初の20週のうちの流産の危険性が減少することを指摘しています[2]。

Etiology of HEG
Disease of theories

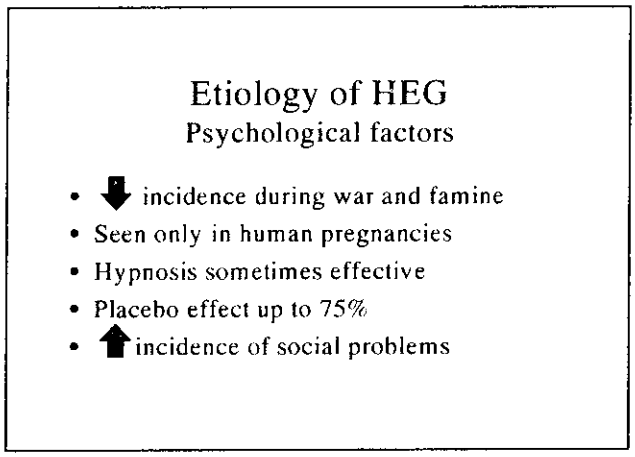
- Nutritional deficiencies
  - pyridoxine
  - magnesium
  - zinc
- Autonomic nervous system dysfunction

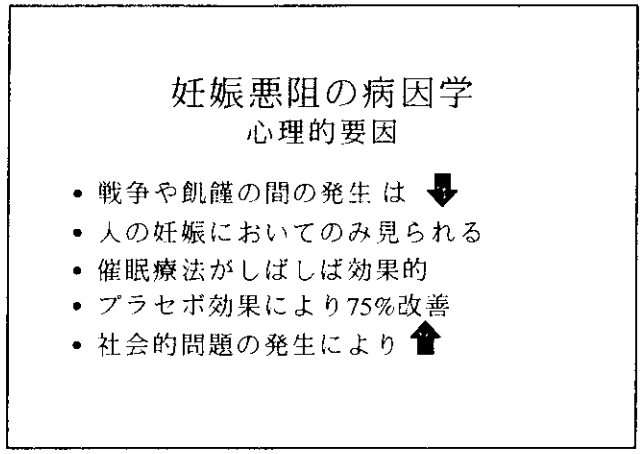
妊娠悪阻の病因学
「多くの理論がある病気」

- 栄養不足
  - ピリドキシン
  - マグネシウム
  - 亜鉛
- 自律神経失調

Although the exact cause of hyperemesis gravidarum is unknown, there are many theories as to its etiology. HEG has been described as the "disease of theories" and it is probably multifactorial in origin. Pathophysiologic theories include endocrine, psychologic, autonomic nervous system dysfunction, gastric dysrhythmia, and nutritional deficiencies.[2] Nutritional deficiencies that have been implicated include pyridoxine (vitamin B6), magnesium, and zinc. However, controlled studies have failed to show a difference in the levels of these nutrients in women with hyperemesis.[2]

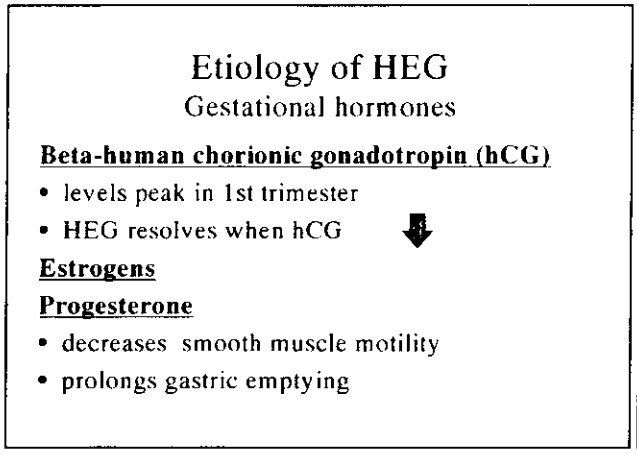
妊娠悪阻の正確な理由は分かっていませんが、その原因として多くの理論が存在します。妊娠悪阻は"多くの理論がある病気"として記述されてきており、起源においてはおそらく多要因的です。病態生理学的な理論としては、内分泌系、心理的、自律神経失調、胃の不整律動、栄養失調を含んでいます[2]。栄養素の不足は、ピリドキシン（ビタミンB_6)、マグネシウム、亜鉛が関係しているとされてきました。しかしながら、実験において、嘔吐に悩む女性に対して、これら栄養素の量の違いは示されていません[2]。

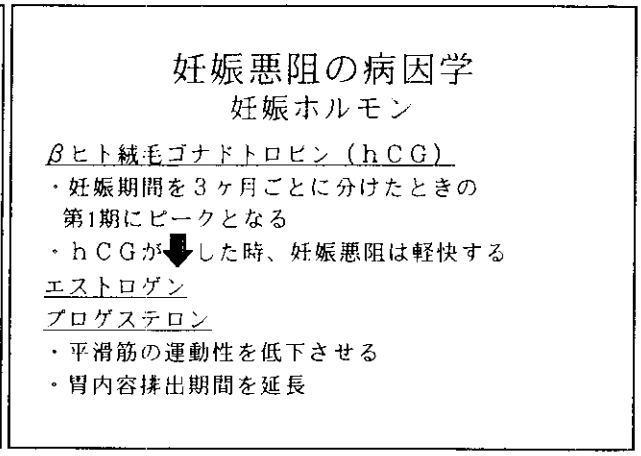




Throughout history psychogenic reasons have been thought to contribute to the pathogenesis of HEG. Hyperemesis was thought to represent a somatic expression of psychological conflict or psychiatric illness exacerbated by pregnancy.[1] There are many studies that support this theory including the fact that up to 70% of hyperemetic women respond to some degree to placebo.[1] HEG also only occurs in human pregnancies, is sometimes treatable by hypnosis, and the incidence of the disorder decreases in wartime and in times of famine.[1] Contrary to this belief, many studies have found no difference in the incidence of psychological disorders in women with and without HEG.

心理的要因が妊娠悪阻の発生に寄与すると長年考えられてきました。悪阻は妊娠によっておこされた精神的衝突または心理的病気のあらわれだと考えられてきたのです[1]。この理論をサポートする研究は多く、プラセボ効果によって悪阻の70%が改善したという報告もあります[1]。妊娠悪阻はヒトの妊娠においてのみ起こり、しばしば催眠療法によって治療可能です。また、戦争時や飢饉時の無秩序状態の発生によって減少します[1]。この様に信じられているにも関わらず、一方で、多くの研究により妊娠悪阻であろうとなかろうと心理的障害の頻度には違いはないということが示されています。





Gestational hormones have long been thought to contribute to hyperemesis. Some researchers have found serum human chorionic gonadatropin (hCG) levels to be higher in hyperemetic women than in normal pregnant controls.[1] High levels of estrogen may play a role since women that suffer nausea and vomiting while taking oral contraceptives are more likely to have hyperemesis when pregnant. Progesterone may contribute since it prolongs gastric emptying time and decreases smooth muscle motility. However, no difference in estrogen or progesterone levels have been found in women with HEG.

妊娠ホルモンは長い間、悪阻に関係すると考えられてきました。ある研究者は、血清中のヒト絨毛ゴナドトロピンのレベルは、通常の妊娠の場合においてよりも、悪阻のある妊婦におけるほうが高いということを発見しました[1]。経口避妊薬を服用している間、悪心・嘔吐する女性は妊娠時に悪阻になりやすいので、高い濃度のエストロゲンは何らかの役割を果たしているのかもしれません。プロゲステロンは、平滑筋の運動性を減少させ、胃内容排出時間を延長させるので関係があるかもしれません。しかしながら、妊娠悪阻の女性においてエストロゲンとプロゲステロンの濃度に違いはみられておりません。

Etiology of HEG

Gastric dysrhythmia/dysmotility

- Dysfunctional gastric pacesetter
- Retrograde gastric contractions
- Tachygastria or bradygastria
- Relaxation of lower esophageal sphincter causing reflux
- Decreased gastric emptying
- Gastric motility adapts by 2nd trimester

妊娠悪阻の病因学

胃の律動異常・異常運動

- 胃のペースメーカーの不調
- 胃の収縮の逆行
- タキガストリア（胃運動の亢進）とブラディガストリア（胃運動の低下）
- 逆流を引き起こす下部食道の括約筋の収縮
- 胃内容排出期間の短縮
- 胃の運動は妊娠第2期までにはもとに戻る

A recent theory of the pathogenesis of HEG sites a dysfunctional gastric pacesetter as the core of the problem. [5-7] This is characterized by reversed gastroduodenal peristaltic waves resulting in regurgitation of duodenal contents into the stomach and nausea and vomiting. The retrograde gastric contractions result in reflux of gastric contents into the esophagus even in the absence of food. This is more pronounced during the liquid phase than the solid phase of gastric emptying. This is thought to be due to maladaption of the GI tract to gestational hormones and because adaptation occurs by the end of the first trimester, gastric motility resumes and hyperemesis ceases.

妊娠悪阻の病因学の最新理論は、問題の中心として胃のペースメーカーの不調を挙げています[5-7]。これは、胃・十二指腸の蠕動の逆行によって特徴づけられ、結果として、胃への十二指腸の内容物の逆流と悪心・嘔吐を起こす。胃の収縮の逆行は、食べ物がないときでさえ、食道への胃の内容物の逆流を起こします。このことは、胃内容が固体のときよりも液体のときのほうがより明らかです。このことは、妊娠ホルモンに対する胃腸の順応不順のためであり、妊娠の第1期の終わりまでに順応が起こるので、（第2期には）胃の運動性は回復し、悪阻は消失すると考えられています。

Hyperemesis Gravidarum Clinical Features

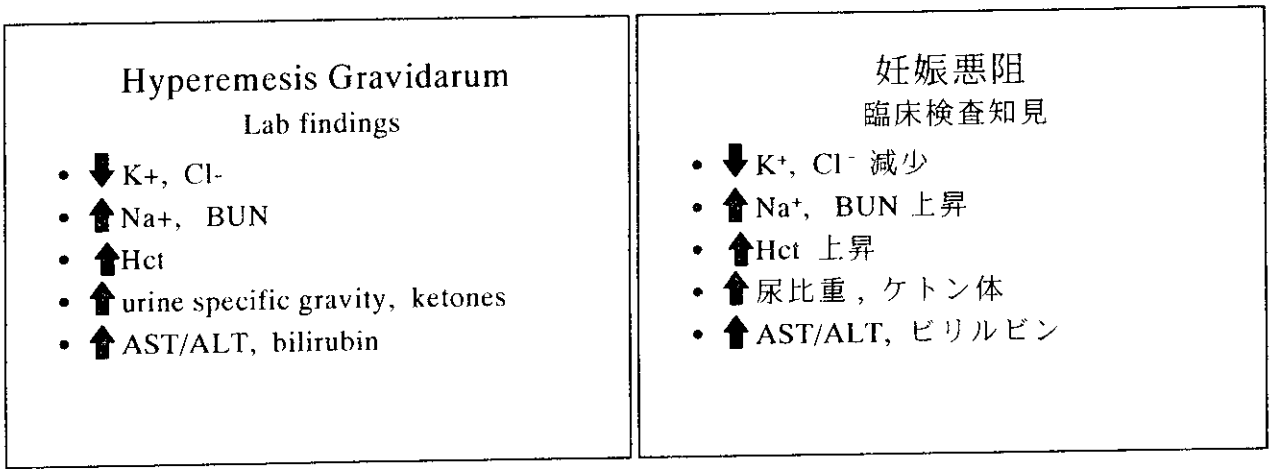
- Onset 4-6 weeks, resolution 20 weeks
- Presents with intractable vomiting, dehydration, electrolyte imbalance, ketosis
- Weight loss > 5% body weight
- Ptyalism (excessive salivation)

妊娠悪阻
臨床上の特徴

- ４－６週間でおこり２０週間で消失
- 手におえない吐き気、脱水、電解質のアンバランス、ケトーシスの存在
- ５％以上の体重の減少
- 流えん症（過度な唾液分泌）

Hyperemesis gravidarum begins between the fourth and sixth week of pregnancy, often before the woman realizes she is pregnant. Symptoms usually improve by the 15th to 20th week of pregnancy, although some continue to have frequent relapses throughout pregnancy. Most affected women have numerous episodes of vomiting throughout the day without symptom-free periods. This leads to weight loss, dehydration, electrolyte disturbances, ketosis, and acetonuria requiring hospitalization. These women present to their physicians with weight loss of five to twenty pounds, however, since many are overweight to begin with, they may not appear malnourished on visual inspection. Ptyalism, or excessive salivation, often accompanies HEG and some require an emesis basin to expectorate into.

悪阻は妊娠の４週目と６週目の間、しばしば妊娠だと気づく前に起こります。症状はたいてい妊娠の１５週から２０週までに改善しますが、妊娠中に頻繁に再発を続ける人もいます。たいていの女性は、症状のない期間はなく、一日中何度も吐き気を催します。このことは、体重減少、脱水、電解質のアンバランス、ケトーシスやアセトン尿を引き起し、入院が必要となります。これらの女性は５－２０ポンドの体重減少とともに来院されます。しかし、たいていは、体重は再増加しはじめており、見た目には栄養不良には見えません。流えん症あるいは過度の唾液分泌はしばしば妊娠悪阻と同時に起こり，吐き出すためのタライが必要な方もいます。



Laboratory findings at the time of presentation include increased ketones and increased urine specific gravity associated with an increased blood urea nitrogen. There is often an increased hematocrit indicating a contracted blood volume. Electrolyte derangements include decreased potassium, chloride, and magnesium levels. In some patients an increase in liver function tests, such as aspartate aminotransferase, alanine aminotransferase, or bilirubin occurs.[2]

今回の講演時点での臨床検査に対する知見は、血中尿素窒素（BUN）増加を伴うケトン体と尿比重の増加です。血液容積の減少を意味するヘマトクリット値の上昇がしばしば見られます。電解質挙動ではK，Cl，Mg値が低下を示しています。また何人かの患者では肝機能検査において、血清トランスアミナーゼのAST、ALTやビリルビンの増加が起こっています。

Hyperemesis Gravidarum
Differential diagnosis

- Gastroenteritis
- Peptic ulcer disease
- Severe esophageal reflux
- Gastroparesis
- Gall bladder disease
- Pancreatitis
- Hepatitis

妊娠悪阻
除外診断

- 胃腸炎
- 胃潰瘍
- 重篤な食道反射
- 胃不全麻痺　（胃アトニー）
- 胆嚢疾患
- 膵炎
- 肝炎

Other causes of nausea and vomiting unrelated to pregnancy, such as gastroenteritis must be ruled out before the diagnosis of hyperemesis can be made. Conditions such as diabetic gastroparesis, peptic ulcer disease, gall bladder disease, hepatitis, renal dysfunction, hypercalcemia, and hyperparathyroidism can all be associated with nausea and vomiting.

妊娠とは関係のない、胃腸炎などからくる吐き気や嘔吐は、悪阻の診断がなされる以前に除外しなければなりません。糖尿病、胃不全麻痺、胃潰瘍、胆嚢疾患、肝炎、腎機能障害、高カルシウム血症、副甲状腺機能亢進症などは全て吐き気や嘔吐症状を起こし得る疾患です。