J Nur Today

REVIEW ARTICLE

www.jolnt.com

e-ISSN 2456-1630

Neonatal Pharmacology

Mahalakshmi*

*Associate Professor, Nootan College of Nursing, Visnagar, Gujarat, India

Greentree Group

Received: 29.03.2017

Edited : 04.05.2017

Accepted: 06.05.2017

Published: 15.05.2017

ABSTRACT

The neonates are significantly different physiologically from other populations and this physiology affect the way that the neonate responds to medication therapy. Specific knowledge related to neonatal pharmacology can facilitate safe drug administration in the neonatal population.

KEYWORDS

Pharmacology, Neonates

INTRODUCTION

- Primary moral, legal and ethical duties for patient care places primary responsibility for providing safe drug administration on nursing. The nurse administering the medication to the neonates is in the ideal position to evaluate issues related to medication administration, make observation and take action in the area where it counts most – the bedside.

Principles

1) Specific knowledge related to neonatal pharmacology can facilitate safe drug administration in the neonatal population.

2) The neonates are significantly different physiologically from other populations and this physiology affect the way that the neonate responds to medication therapy.

3) Medication responds influenced by Age & size, Development, concomitant administration of other medications, organ functions.

- Pharmacokinetics:

Pharmacokinetics is the arithmetic description of the movement of a substance through the various body compartments.

- Pharmacodynamics: is the study of how chemicals produce their pharmacologic effects on living tissue when medication is administered.

Medication Administration at NICU

1) Parental Administration: Intravenous drug therapy is usually recommended.

2) Intramuscular Administration

3) Enteral Administration: is an integral part of long term management for many premature infants.

4) Loading doses: Medications gradually accumulate in the body over time. When there is an immediate need to achieve a desired therapeutic concentration to elicit an effect and accumulation of drug is expected, a loading dose of medication may be necessary.

5) Continuous Infusion Dosing: It is used to calculate infusion doses to reach specific concentrations of free drug in the circulation.

6) Diagnosis:

Effective treatment requires an accurate diagnosis and accurate assessment of the symptoms to be relieved.

7) Drug Selection: Effective treatment requires selection of the appropriate drug for the diagnosis. An accurate diagnosis is critical to drug selection, since the drug should be selected according to the specific physiologic variable that is guided by the sensitivities of microbes.

8) Drug Binding: The goal of drug therapy is to produce an effective concentration of free or unbound drug at a specific site to achieve the Therapeutic effect.

Many drugs both acidic and basic are bound to various serum and tissue proteins. Albumin binds primarily to acidic drugs, whereas basic drugs is active and available to interact with tissue receptors and produce therapeutic effect as well as to be metabolized and excreted.

Unique physiology in Neonate:

- the neonatal period is a time of incredible physiology change leading to unpredictable responses to doses of drugs deemed safe and efficacious in adults.
- Rapid developmental changes in neonatal organs systems influence pharmacologic safety and efficacy due to changes in the way drugs are absorbed, distributed, metabolized and eliminated.
- Differences in neonatal physiology can also affect pharmacodynamics,resulting in differences in the expected potency, efficacy or toxicity of drugs.
- METABOLISM:

The process of biotransformation occurs mainly in the liver. Although the liver is the major organ responsible, other organs are quiet active for newborns (kidneys, intestine, adrenal and skin).

➢ Maternal medications during pregnancy must also be considered. There is evidence that prenatal exposure to drugs that have capacity to induce liver enzymes may affect neonatal metabolism.

DRUG ABSORPTION

- Drug absorption in neonates is largely affected by the maturation process of organ systems. Characteristics of the neonatal gastrointestinal tract that affect absorption of orally administered drugs include increased gastric pH ,decreased intestinal motility ,delayed intestinal emptying time, and a reduction in bile acid synthesis.
- Characteristics of neonatal skin that lead to increased absorbtion of drugs administered transdermally include a thinner stratum corneum,increased skin

perfusion secondary to immature vasomotor control,increased water content,and higher body surface area to weight ratio.

- Intramuscular absorption affect in neonates include decreased muscle mass,reduced over all muscular perfusion,and decreased contractility.
- Intramuscular drug absorption in neonataes can vary depending on the physiochemical properties of the drug,such as pH.molecular weight.solubility,ester salt formulationor dissolution rates
- No absorption time is required for intravenous or intra – arterial administration. Other route of administration requires absorption of the medication from the site of administration for the drug to be recovered from the blood stream.

DRUG DISTRIBUTION

- Compared with children and adults, neonates have higher volumes of extracellular fluid and total body water, lower proportion of adipose tissue and decreased muscle mass. Premature neonates have lower fat and higher water than term neonates.
- The presence of a patent ductus arteriosus, renal injury or use of extracorporeal membrane oxygenation can result in increased volumes of distributed leading to lower peak serum drug concentration.
- Neonates have a decreased drug protein binding affinity relative to children and adults. Only unbound drug travels across membrane, exerts biological effect and is eliminated from body.
- Distribution is the rapid transfer of drug from a site with a high concentration to tissues with low concentrations until equilibrium is established Immunity, organ function alter distribution.

EXCRETION

- Renal clearance of drugs increase with increasing gestational age,postnatal age,and body weight. Mechanisms of renal excretion affected by these factors are glomerular filtration, active tubular secretion and tubular reabsorption.
- Active tubular secretion and tubular reabsorption are also immature at birth and are approximately 20 -30% of adults values. Maturation of active tubular reabsorbing continues slowly into adolescence, with the steepest rise occurring between 1 and 3 years of age.elinimination by these processes is dependent on renal blood flow, which increase over time with GFR.reduced protein binding in neonates will increase the clearance of drugs by these renal

processes due to higher concentrations of unbound drug available.

- Excretion begins with administration of the drug and ends when the drug is completely eliminated from the body. Glomerular filtration rate is lower in infants than adults and significantly lower in premature infants.

SPECIFIC DRUG CATEGORIES IN NICU

- Antimicrobial agents: inhibit the growth and kill microorganisms.
- Diuretics: are commonly used in both acute and long term neonates care to encourage the removal of excessive extracellular fluid.
- Central Nervous System (CNS drugs)

There are three types of CNS drugs

1. Analgesic drugs: - provide diminished sensation of pain and help to promote a diminished response to painful events.
2. Anesthetic drugs: - remove pain sensation through peripheral nerve block.
3. Sedative / hypnotic drug: - provide mood alteration.

- Cardiovascular Agents:

CV agents are a broad group of drugs that affect the regulations, inhibition or stimulation of the CV system.

They have increased utilization in acute and long term care of neonates.

- Inotropic agent:- improve cardiac output
- Antihypertensive agents: - are used to normalize blood pressure.
- Vasodilators: - used to actually diminish blood pressure.
- Anti arrhythmias: are used in the treatment of cardiac arrhythmias.

REFERENCES

1. Avanel S, Bomkratz A, Dassieu G, et al. The incidence of prescription without marketing product license in a neonatal intensive care unit. Arch Pediatric. 2000;7(2):143–147.

2. Conroy S, Choonara I, Impicciatore P, et al. Survey of unlicensed and off label drug use in paediatric wards in European countries. European Network for drug Investigation in Children. BMJ. 2000;320(7227):79–823.

3. Van den Anker J. Managing drug safely. Semin Fetal Neonatal Med. 2005;10(1):73–81.

4. Rakhmanina NY, van den Anker JN. Pharmacological research in pediatrics: from neonates to adolescents. Adv Drug Deliv Rev. 2006;58(1):4–14.

5. Blumer JL, Reed MD. Principle of neonatal pharmacology. In: Yaffe SJ, Aranda JV, editors. Neonatal and Pediatric Pharmacology. 3rd ed. Philadelphia: WB Saunders & Co; 2005. pp. 146–158.

6. Wadsworth SJ, Suh B. In vitro displacement of bilirubin by antibiotics and 2-hydroxybenzoylglycine in newborns. Antimicrob Agents Chemother. 1988;32(10):1571–1575]

7. Pollard AJ, Rylance G. Inappropriate prescribing of promethazine in infants. Arch Dis Child. 1994;70(4):357