·LECTURE·

Surfactant Replacement Therapy

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Indications for Surfactant Treatments

Surfactant is standard of care for preterm infants with RDS[1]. Multiple multicenter trials have demonstrated that surfactant decreases the severity of RDS and decreases death. BPD has not been consistently decreased, probably because the very immature infants that would have died without surfactant are the infants at highest risk of developing BPD[2]. Many preterm infants born at < 30 weeks gestation have been exposed to chronic, subclinical chorioamnionitis[3]. There is no contraindication to surfactant use for infants that may have surfactant deficiency and infection. Infants with Group B Strep seem to respond favorably to surfactant treatments[4]. Surfactant treatments may also help term infants with severe respiratory failure resulting from pneumonia and meconium aspiration[5,6]. The reason for efficacy in these situations is thought to result from the additional surfactant overcoming inactivation from proteinaceous pulmonary edema and meconium[7].

Why Surfactant Treatments Work

Surfactant effects can best be understood from how surfactant changes the relationship between airway pressure and lung gas volumes as measured by pressure-volume curves[1] (Fig. 1). Surfactant allows the collapsed lung to open at a lower airway pressure because of the effects of surfactant to lower the surface tension on the meniscus of fluid in small airways. The lung opens to a much larger volume, permitting more of the lung parenchyma to participate in gas exchange. The lung also retains much more volume at low transpulmonary pressures on deflation which results in an increased FRC with dynamic ventilation. The major acute effect of surfactant is to improve oxygenation[8]. Other effects of surfactant are to make lung inflation much more uniform which will decrease injury by minimizing regional overinflation and collapse[9]. Surfactant also may decrease the inflammation resulting from ventilation of the preterm lung.

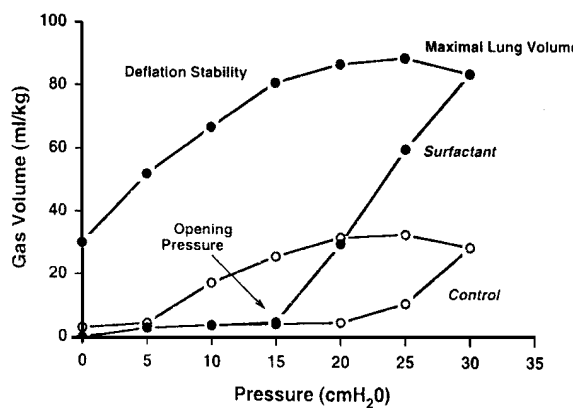

Figure 1

Which Surfactant is Best?

Two general types of surfatant are available for the treatment of RDS-surfactant that contains lipids only and surfactants recovered from animal lungs or alveolar lavages that contain varying amounts of the hydrophobic surfactant proteins SP-B and SP-C[10]. The composition of natural surfactant is given in Figure 2. The surfactants for clinical use from animals contain the lipids and SP-B and SP-C, which are the biophysically active protein components of natural

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surfactant. These surfactants are very surface active and the commercial products made by organic solvent extraction of the animal source material are equivalent in clinical use, based on available comparison trials[11]. Synthetic surfactants that contain lipids only are less effective and are now seldom used[12,13]. New surfactants that contain lipids and recombinant surfactant proteins (SP-C and/or SP-B) are being developed. A surfactant that contains lipids and recombinant SP-C is very effective in preterm animal models and is being used in clinical trials to treat ARDS[14].

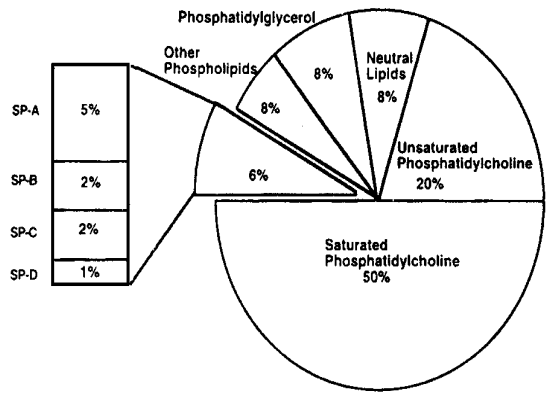

Figure 2

When to Give Surfatants

In the inital clinical trials surfactants were given either immediately after delivery of preterm infants at risk of RDS or after the disease was severe after about 6 h of age. More recent trials demonstrate that surfactant need not be given "before the first breath" at delivery but treatment early in the course of RDS is of benefit because infants will have a better clinical response and will have less lung injury before treatment[15,16]. This early but not immediate treatment is reasonable, because the surfactant treatment does not interfere with the initial stabilization of the infant and infants that do not have RDS do not need to be treated.

The timing of surfactant treatment will depend on the delivery room approach to resuscitation that is used. If the practice is to intubate most very preterm infants in the delivery room, then early treatment (before verification of ET tube position) is appropriate if the lungs are stiff and the infant needs a high amount of supplemental oxygen. However, another approach is to initiate continuous positive airway pressure (CPAP) in the delivery room and allow the infant to breathe spontaneously[17]. In a comparison of the practices at Columbia and several Boston hospitals, the use of CPAP resulted in a striking decrease in surfactant use for preterm infants [18](Fig. 3). This early use of CPAP also changes subsequent management. A third approach being evaluated is to electively intubate most small infants, treat them with surfactant and transition them to extubation and CPAP as quickly as possible. The question of when to treat depends on other care strategies, and the best approach as evaluated by outcomes has not been established. The best approach will depend in part on local conditions. If a infant is 1-3 days old and has severe RDS but has not been treated, a treatment should be given and most of these infants will have a good response.

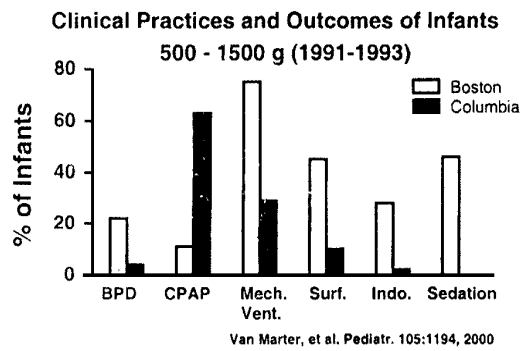

Figure 3

The timing and criteria for retreatment also remains somewhat controversial. There is some benefit to a second treatment of infants with mild residual disease, but few infants will require more than 2 doses[19]. The amount of surfactant given as treatment is a very large dose that exceeds the amount of surfactant in the adult human by about 10 fold when expressed per kg body wieght[20].

How to Give Surfactant

Surfatant will spread repidly into the alveoli and airways, but it needs to be initially distributed to the large airways as uniformly as possible[21]. When sur-

factant is given soon after delivery, it is generally given as a single bolus of 2 to 4 ml, depenting on the commercial surfatant that is used. Later treatments are given by dividing the dose into 2 or 4 aliquots and giving the surfactant with positioning of the infant to try to get the surfactant into the major airways of both lungs. The details of treatment that are recommended for each surfactant reflect how the trials for licensure were performed. The variables that are important are listed below:

* Surfactant initially will distribute based on gravity

* The larger the volume of surfactant, the better the distribution

* The more rapid the dose is given, the better the distribution

Treatment strategies are compromises to achieve a reasonable distribution without obstructing the airways with the fluid volume. I recommend giving a divided dose by giving 1/2 the dose with one lung dependent, ventilating the infant briefly, and then giving the second dose with the other lung dependent. The treatments can be given while the infant is being ventilated by passing a catheter to the tip of the endotracheal tube.

Summary

Surfatant therapy is effective but expensive. New approaches to the management of infants in the delivery room can decrease the need for surfactant.

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(本文编辑:俞燕)

·消息·

小儿脑水肿与神经系统疾病诊治进展学习班通知

(国家级医学继续教育项目　项目编号:2001 - 06 - 01 - 059)

小儿急性脑水肿、颅高压和神经系统疾病是儿科临床常见病和危重症,病因复杂,而且涉及多个学科,在临床诊治、预防和机制研究方面具有一定难度。近年来随着神经病理学、免疫学及神经遗传学、分子生物学的进步,在小儿脑水肿、颅高压和神经系统疾病的研究方面也取得了长足的进展,为了提高儿科医务人员对脑水肿及神经系统疾病的理论和临床认识,更新知识结构,经卫生部继续医学教育委员会批准,由湘雅医院儿科主办小儿脑水肿与神经系统疾病诊治进展学习班。该班由全国知名小儿脑水肿专家虞佩兰教授、杨于嘉教授,脑电图专家欧阳珊教授、癫痫专家章蓓教授、小儿精神心理疾病专家李雪荣教授等主讲,同时中国当代儿科杂志编辑部将派人参加。欢迎儿科及相关各科医务工作者报名参加,并请携带有关论文参加学术活动,中国当代儿科杂志社将择优刊登。参加学习者经考核合格可取得国家级 I类学分 18 分,作为职务续聘及职称晋升的必备条件之一。现将有关事项通知如下:

1. 学习对象:儿科及相关学科的医务人员。

2. 学习时间:2001 年 11 月 19～28 日(11 月 19 早日上午 8:00～晚上 10:00 报到)。上课地点:湘雅医院内。

3. 收费:学费及资料费 550 元整。

4. 报到及食宿地点:湖南长沙,湘雅大酒店(湘雅医院马路对面)。乘车路线:长沙火车站乘 9 路公共汽车到北站下向西步行 100 米左右,或乘 111 路公共汽车到湘雅医院站。自火车站乘的士至湘雅大酒店的费用约 12 元左右。乘飞机者由机场乘民航班车至民航售票处,再乘 111 路至湘雅医院。

5. 食宿费用:住宿费每人每天 60 元(需加收一天预订床位费),食宿费用自理,回原单位报销。

凡参加学习的同志请带一张一寸免冠照片,办理结业证用。

联系地址:湖南长沙湘雅路 141 号湘雅医院儿科李清香、邓芳明同志,邮编:410008,联系电话:0731 - 4327208 或 0731 - 4327402;传真:0731 - 4327402;E - mail:xyped@public.cs.hn.cn