doi: 10.13241/j.cnki.pmb.2019.13.039

早期与晚期应用肺表面活性物质联合经鼻持续气道正压通气治疗新生儿呼吸窘迫综合征的比较研究*

邢芳华[1] 林 毅[1] 胡 夏[1] 邢存乔[2] 符小妹[3]

（1 海南省三亚市人民医院儿科 海南 三亚 572000；
2 海南省三亚市妇幼保健院儿童保健科 海南 三亚 572000；3 海南省人民医院儿科 海南 海口 570000）

摘要 目的：比较早期与晚期应用肺表面活性物质（Ps）联合经鼻持续气道正压通气（NCPAP）治疗新生儿呼吸窘迫综合征（NRDS）的临床疗效。**方法：**选取海南省三亚市人民医院于2014年1月~2018年7月期间收治的NRDS患儿100例，根据随机数字表法将患儿分为对照组（n=50）和研究组（n=50），对照组给予NCPAP治疗，研究组在对照组基础上联合Ps治疗，并根据Ps注入时间的不同将研究组患儿分为早期组（出生6h内注入，n=25）和晚期组（出生6~12h注入，n=25）。观察并比较对照组、早期组、晚期组患儿的临床疗效，并比较三组患儿治疗前、治疗1d后动脉血酸碱度（pH）、动脉二氧化碳分压（PCO_2）、动脉血氧分压（PO_2）、呼气末正压通气（PEEP）、吸入氧浓度（FiO_2）以及并发症发生情况。**结果：**早期组患儿临床总有效率高于对照组、晚期组（*P<0.05*）；而对照组、晚期组患儿临床总有效率比较差异无统计学意义（*P>0.05*）。治疗1d后，三组患儿PCO_2较治疗前降低，PO_2较治疗前升高，且早期组PCO_2低于对照组、晚期组，PO_2高于对照组、晚期组（*P<0.05*）；但对照组、晚期组PCO_2、PO_2比较差异无统计学意义（*P>0.05*）。治疗1d后，三组患儿PEEP、FiO_2较治疗前降低，且早期组低于对照组、晚期组（*P<0.05*）；但对照组、晚期组PEEP、FiO_2比较差异无统计学意义（*P>0.05*）。三组患儿并发症总发生率比较差异无统计学意义（*P>0.05*）。**结论：**与晚期相比，早期应用Ps联合NCPAP治疗NRDS疗效确切，其改善患儿血气指标及NCPAP参数的效果更佳，同时不会增加不良反应。

关键词：早期；晚期；肺表面活性物质；经鼻持续气道正压通气；新生儿呼吸窘迫综合征；疗效；比较

中图分类号：R722 **文献标识码：**A **文章编号：**1673-6273(2019)13-2571-05

A Comparative Study of Early and Late Application of Pulmonary Surfactant Combined with Nasal Continuous Positive Airway Pressure in the Treatment of Neonatal Respiratory Distress Syndrome*

XING Fang-hua[1], LIN Yi[1], HU Xia[1], XING Cun-qiao[2], FU Xiao-mei[3]

(1 Department of Pediatrics, Sanya People's Hospital, Sanya, Hainan, 572000, China;
2 Department of Child Health, Sanya Maternal and Child Health Care Hospital, Sanya, Hainan, 572000, China;
3 Department of Pediatrics, Hainan Provincial People's Hospital, Haikou, Hainan, 570000, China)

ABSTRACT Objective: To compare the clinical efficacy of early and late application of pulmonary surfactant (Ps) combined with nasal continuous positive airway pressure (NCPAP) in the treatment of neonatal respiratory distress syndrome (NRDS). **Methods:** 100 children with NRDS who were admitted to Sanya People's Hospital from January 2014 to July 2018 were selected, they were divided into control group (n=50) and study group (n=50) according to the random number table method. The control group was treated with NCPAP, and the study group was treated with Ps on the basis of the control group. The children in study group were divided into early group (injected within 6 hours of birth, n=25) and late group (injected within 6 to 12 hours of birth, n=25) according to the injection time of Ps. The clinical effects of control group, early group and late group were observed and compared. The arterial pH (pH), partial arterial carbon dioxide (PCO_2), arterial oxygen partial pressure(PO_2), end-expiratory positive pressure ventilation (PEEP), oxygen concentration (FiO_2) and complications were compared in three groups before and 1d after treatment. **Results:** The total effective rate of early group was higher than that of control group and late group (*P<0.05*), but there was no significant difference between control group and late group (*P>0.05*). 1d after treatment, PCO_2 in three groups were lower than that before treatment, PO_2 was higher than that before treatment, and PCO_2 in early group was lower than that in control group and late group, PO_2 was higher than that in control group and late group (*P<0.05*). However, there was no significant difference in PCO_2 and PO_2 between control group and late group (*P>0.05*). 1day after treatment, PEEP and FiO_2 in three groups were lower than those before treatment, and those in the early group were lower than those in control group and late group (*P<0.05*), but there was no significant difference in PEEP and FiO_2 between control group and late group (*P>0.05*). There were no significant differences in the incidence of complications in three groups (*P>0.05*). **Conclusion:** Compared with advanced

* 基金项目：海南省医药卫生科研项目（1302000230A2210）
作者简介：邢芳华（1982-），女，本科，主治医师，从事儿科及新生儿科方面的研究，E-mail: zaagoe@163.com
（收稿日期：2018-11-30 接受日期：2018-12-26）

stage, early application of Ps combined with NCPAP in the treatment of NRDS is effective. It can improve the blood gas and NCPAP parameters of children, and it will not increase adverse reactions.

Key words: Early; Late; Pulmonary surfactant; Nasal continuous positive airway pressure; Neonatal respiratory distress syndrome; Curative effect; Comparison

Chinese Library Classification(CLC): R722 Document code: A

Article ID: 1673-6273(2019)13-2571-05

前言

新生儿呼吸窘迫综合征（Neonatal respiratory distress syndrome，NRDS）是指新生儿出生后 4～12h 内即出现呼吸困难以及呼吸衰竭等症状的一类临床综合征，其主要是由于患儿缺乏肺泡表面活性物质（Pulmonary surfactant，Ps），从而致使肺泡萎陷以及肺顺应性降低[1-3]。该病多发于早产儿，且其发病与患儿胎龄及体重有关，胎龄越小，其发病率越高，体重越轻，病死率越高，NRDS 现已成为早产儿死亡的主要原因之一[4,5]。目前临床对该病的治疗原则主要是保证患儿换气功能正常。经鼻持续气道正压通气（Nasal continuous positive airway pressure，NCPAP）是临床常用的无创呼吸模式，在 NRDS 治疗中，其常与 Ps 替代治疗联合使用[6-8]。既往研究表明[9]，应用 Ps 联合 NCPAP 治疗可显著改善患儿临床症状，但对于在何种时间点应用 Ps 联合 NCPAP 治疗的观点尚存争议。因此，本研究通过比较分析早期与晚期应用 Ps 联合 NCPAP 治疗 NRDS 的临床疗效，以期为 NRDS 的临床治疗提供参考，报道如下。

1 资料与方法

1.1 临床资料

选取海南省三亚市人民医院于 2014 年 1 月 ~2018 年 7 月期间收治的 NRDS 患儿 100 例，纳入标准：（1）所有患儿均符合《实用新生儿学》[10]中有关 NRDS 的相关诊断标准；（2）产前未接受过糖皮质激素治疗；（3）出生后 12h 内转入重症监护室；（4）患儿家属知情，签署同意书。排除标准：（1）疑似肺发育不良的早产儿；（2）存在先天性代谢疾病、染色体异常、先天性心肺畸形、严重贫血患儿；（3）产前超声检查显示血管内溶血严重的患儿；（4）出生时已经出现严重呼吸困难症状的患儿。根据随机数字表法将患儿分为对照组（n=50）和研究组（n=50），并根据 Ps 注入时间的不同将研究组患儿分为早期组（出生 6h 内注入，n=25）和晚期组（出生 6~12h 注入，n=25）。其中对照组男 26 例，女 24 例，胎龄 29~36 周，平均（34.78± 0.65）周；出生时体质量为 1630~2210g，平均（1941.72± 43.46）g。早期组男 14 例，女 11 例，胎龄 28~35 周，平均（31.83± 0.59）周；出生时体质量为 1590~2250g，平均（1947.53± 60.82）g。晚期组男 13 例，女 12 例，胎龄 29~34 周，平均（32.19± 0.82）周；出生时体质量为 1640~2240g，平均（1960.23± 58.63）g。三组患儿基础资料比较无差异（*P>0.05*）。本研究已获我院伦理学委员会批准。

1.2 治疗方法

患儿入重症监护室后给予常规处理，包括正常供暖、维生素 K 预防出血、纠正酸中毒、改善循环、抗感染以及营养支持等。在此基础上，对照组患儿给予 NCPAP 治疗，具体如下：患儿取仰卧位，采用德国 Drager Babylog 8000 CPAP 仪进行通气，流量控制在 4~10 L/min，正气通气压力为 4.5~8 cm H_2O，吸入氧浓度为 40%。研究组患儿则在对照组的基础上应用气管插管复苏囊注入 Ps（固尔苏：意大利凯西制药有限公司，生产批号：H20140849），其中早期组在出生 6h 内进行注入，晚期组则在出生 6~12h 进行注入，具体操作如下：将患儿羊水、分泌物吸尽，给予常规气管插管，插管成功后一次给予固尔苏 100~200 mg/kg，并采用辅助气囊人工加压通气 1~2 min，使固尔苏在肺内可均匀散开。随后通过鼻塞连接 CPAP 仪，给予持续气道正压通气。固尔苏使用方法：储藏于 2~8℃冰箱，开瓶即用，使用前药瓶需升温至 37℃，上下轻转，摇匀药液，无菌注射器抽取药液待用。

1.3 观察指标

（1）于治疗 1d 后评价三组患儿临床疗效。根据《实用新生儿学》[10]中制定的疗效评价标准，分为无效、有效以及显效。具体如下：治疗 1d 后，患儿临床症状显著改善，血气分析结果显示正常，NCPAP 参数下调，准备撤机记为显效；治疗 1d 后，患儿临床症状有所改善，血气分析结果部分正常，但需继续观察，暂不予以撤机记为有效；治疗 1d 后，患儿临床症状未见改善或加重记为无效。临床总有效率 = 显效率 + 有效率。（2）于治疗前、治疗 1d 后分别采集三组患儿桡动脉血 2 mL，以 3000 r/min 的速率离心 8 min，离心半径为 6 cm，取上清液，置于 -20℃冰箱中待测。采用丹麦雷度米特 ABL 血气分析仪检测三组患儿动脉血酸碱度（pH value，pH）、动脉血氧分压（Blood oxygen partial pressure，PO_2）、动脉二氧化碳分压（Arterial partial pressure of carbon dioxide，PCO_2）情况。（3）记录三组患儿 NCPAP 参数：包括呼气末正压通气（Positive end expiratory pressure ventilation，PEEP）、吸入氧浓度（fraction of inspired oxygen，FiO_2）。（4）记录三组患儿治疗期间并发症发生情况，包括肺气漏、肺出血、呼吸机相关性肺炎、颅内出血、败血症等。

1.4 统计学方法

采用 SPSS25.0 软件进行数据分析，计数资料以[n(%)]表示，行 χ^2 检验。计量资料以（$\bar{x}\pm s$）表示，多组间比较行 F 检验，两组间比较行 t 检验，检验水准α=0.05。

2 结果

2.1 三组患儿临床疗效比较

三组患儿临床总有效率整体比较有统计学差异（*P<0.05*）；早期组患儿临床总有效率高于对照组、晚期组（*P<0.05*）；而对照组、晚期组患儿临床总有效率比较差异无统计学意义（*P>0.05*）。见表 1。

2.2 三组患儿血气分析指标比较

三组患儿治疗前 pH、PCO_2、PO_2 整体比较差异无统计学意义（*P>0.05*）；治疗 1d 后，三组患儿 pH 整体比较差异无统计学

表 1 三组患儿临床疗效比较 [例(%)]

Table 1 Comparison of clinical efficacy in three groups of children [n(%)]

Groups	Effect	Good	Invalid	Total effective rate
Control group(n=50)	9(18.00)	24(48.00)	17(34.00)	33(66.00)*
Early group(n=25)	17(68.00)	7(28.00)	1(4.00)	24(96.00)
Late group(n=25)	12(48.00)	7(28.00)	6(24.00)	19(76.00)*
x^2				8.822
P				0.016

Note:compared with the early group, *$P<0.05$.

意义($P>0.05$),而三组患儿 PCO_2、PO_2 整体比较差异有统计学意义($P<0.05$);治疗 1d 后,三组患儿 PCO_2 较治疗前降低,PO_2 较治疗前升高,且早期组 PCO_2 低于对照组、晚期组,PO_2 高于对照组、晚期组($P<0.05$),但对照组、晚期组 PCO_2、PO_2 比较差异无统计学意义($P>0.05$)。见表 2。

表 2 三组患儿治疗前后血气分析指标比较($\bar{x}\pm s$)

Table 2 Comparison of blood gas analysis values in three groups before treatment and after treatment($\bar{x}\pm s$)

Groups	pH		PCO_2(mmHg)		PO_2(mmHg)	
	Before treatment	1d after treatment	Before treatment	1d after treatment	Before treatment	1d after treatment
Control group (n=50)	7.26± 0.19	7.33± 0.24	49.21± 8.41	41.39± 8.38*#	48.73± 9.34	61.62± 7.31*#
Early group(n=25)	7.23± 0.14	7.35± 0.27	49.52± 9.28	33.63± 7.15#	48.65± 8.53	70.37± 8.94#
Late group(n=25)	7.25± 0.12	7.31± 0.22	49.93± 10.39	38.27± 7.96*#	48.39± 10.48	63.65± 6.17*#
F	0.281	0.169	0.052	7.907	0.011	11.486
P	0.756	0.845	0.949	0.001	0.989	0.000

Note: compared with before treatment, #$P<0.05$; compared with the early group,*$P<0.05$.

2.3 三组患儿 NCPAP 参数比较

三组患儿治疗前 PEEP、FiO_2 整体比较差异无统计学意义($P>0.05$);治疗 1d 后,三组患儿 PEEP、FiO_2 整体比较差异有统计学意义($P<0.05$);治疗 1d 后,三组患儿 PEEP、FiO_2 较治疗前降低,且早期组低于对照组、晚期组($P<0.05$),但对照组、晚期组 PEEP、FiO_2 比较差异无统计学意义($P>0.05$)。见表 3。

表 3 三组患儿 NCPAP 参数比较($\bar{x}\pm s$)

Table 3 Comparison of NCPAP parameters in three groups of children($\bar{x}\pm s$)

Groups	PEEP(cmH_2O)		FiO_2(%)	
	Before treatment	1d after treatment	Before treatment	1d after treatment
Control group(n=50)	5.15± 1.35	4.23± 1.03#*	52.34± 8.13	45.93± 7.88#*
Early group(n=25)	5.13± 1.47	3.09± 1.17#	51.85± 7.27	36.64± 7.21#
Late group(n=25)	5.14± 1.42	4.19± 1.02#*	51.90± 9.57	44.76± 6.82#*
F	0.002	10.524	0.039	13.528
P	0.998	0.000	0.962	0.000

Note: compared with before treatment, #$P<0.05$; compared with the early group,*$P<0.05$.

2.4 三组患儿治疗后并发症发生情况比较

三组患儿并发症总发生率比较无差异($P>0.05$)。见表 4。

3 讨论

NRDS 主要发生于早产儿,一般为出生后早期发病,病情 2d 内加重,若不立即治疗,可因进行性的低氧血症或者呼吸衰竭而最终导致患儿死亡[11-13]。目前临床治疗 NRDS 的主要目标为保证患儿存活,同时减少并发症的发生。NCPAP 是一种无创的呼吸模式,在辅助 NRDS 患儿呼吸中较为常用,为患儿呼吸过程提供正压支持,保持肺扩张,减少 Ps 消耗[14,15]。众所周知,NRDS 的发生是由于患儿缺乏 Ps 所致[16,17],李百玲等人[18]动物实验证明,Ps 可降低肺泡表面张力,复张已萎缩的肺泡等,故采用外源性 Ps 替代治疗是针对 NRDS 治疗的特效疗法[7]。一般认为影响 Ps 疗效的主要因素为给药时间, 不同的给药时间其疗效不尽相同,且临床对于 NRDS 患儿何时使用 Ps 始终无定论,因此,本研究设置对照试验,并就此展开探讨。

表 4 三组患儿治疗后并发症发生情况 [例(%)]

Table 4 Complications in three groups of children after treatment [n(%)]

Groups	Pulmonary air leaks	Pulmonary hemorrhage	Ventilator-associated pneumonia	Septicemia	Intracranial hemorrhage	Total incidence
Control group (n=50)	5(10.00)	1(2.00)	2(4.00)	3(6.00)	1(2.00)	12(24.00)
Early group(n=25)	3(6.00)	0(0.00)	0(0.00)	1(2.00)	1(2.00)	5(10.00)
Late group(n=25)	2(4.00)	1(2.00)	1(2.00)	1(2.00)	1(2.00)	6(12.00)
x^2						2.289
P						0.320

研究显示，治疗后早期组患儿临床总有效率高于对照组、晚期组，而晚期组、对照组比较无差异，提示相对于未使用或者晚期使用 Ps 的患儿，早期使用 Ps 可进一步提高治疗效果，这与蹇琼等人[19]研究结果基本一致。分析其原因为 NCPAP 通过维持肺泡扩张，可以减少肺内分流以及肺间质水肿，从而缩短吸氧时间，进而在一定程度上缓解了患儿吸氧情况[20-21]。同时联合使用外源性 Ps 治疗可增加肺泡表面积，促进内源性 Ps 的合成及其分泌，并促进肺上皮细胞再生，帮助患儿各脏器功能恢复。另外，早期给予 Ps 可有效减少肺泡塌陷、再复张而引发的肺损伤，进而减轻或阻止 NRDS 的发病，提高治疗效果[22,23]。本研究结果显示，治疗 1d 后三组患儿血气分析指标、NCPAP 参数均较治疗前好转，且早期组好转情况较对照组、晚期组优，提示早期给予 Ps 联合 NCPAP 治疗 NRDS 可有效改善患儿血气分析指标以及 NCPAP 参数。血气分析可反映机体的呼吸功能以及代谢功能，是诊断呼吸衰竭以及酸碱平衡常用的指标及依据，而 NCPAP 参数亦可反映患儿呼吸情况，为患儿准备撤机提供参考依据。分析三组患儿上述指标改善原因为 NCPAP 可在整个呼吸周期使气道维持一定的扩张状态，增加跨肺压力，抑制肺泡萎缩，改善肺顺应性；而 Ps 的主要成分为磷脂以及特异性蛋白质，其主要分布于肺泡表面，可降低肺表面张力，以保持功能残气量、稳定肺泡内压，维持整个呼吸周期气体循环。而早期组改善效果更佳原因在于早期使用 Ps 可最大程度的发挥 Ps 的作用，可快速充分、均匀的分布于肺泡内，有效改善患儿氧合、换气功能，并有效防治肺泡 - 毛细血管被破坏，避免肺泡内液体渗出，减少肺损伤[24-26]。由于气管插管、气管内滴注 Ps 属于侵入性操作，加之患儿长时间处于机械通气状态，因此并发症的产生不可避免[27-29]。本研究中三组患儿并发症总发生率比较差异无统计学意义，提示早期应用 Ps 联合 NCPAP 治疗 NRDS 不会增加患儿不良反应，具有一定的安全性。McPherson C 等人[30]研究报道，患儿出生后应尽早给予 Ps，可有效减少肺损伤，降低并发症发生率，与本研究结果存在一定差异。这可能是由于本次研究样本量偏小，导致结果存在一定的偏倚，后续报道将扩大样本量，以期提供更为可靠的数据。

综上所述，与晚期相比，早期应用 Ps 联合 NCPAP 治疗 NRDS 疗效显著，在改善患儿血气分析及 NCPAP 参数方面，其作用更为显著，且安全性较好，值得临床推广。

参 考 文 献(References)

[1] Al-Sheibani SM, Sawardekar KP, Habib SJ, et al. Nasopharyngeal Salivary Gland Anlage Tumour: A rare cause of neonatal respiratory distress[J]. Sultan Qaboos Univ Med J, 2018, 18(2): e211-e214

[2] 程光清,付扬喜,张森山,等.经鼻间歇正压通气与经鼻持续正压通气治疗新生儿呼吸窘迫综合征的临床疗效比较[J].现代生物医学进展, 2016, 16(34): 6738-6741, 6621

[3] De Luca D, Harrison DA, Peters MJ. 'Lumping or splitting' in paediatric acute respiratory distress syndrome?(PARDS)[J]. Intensive Care Med, 2018, 44(9): 1548-1550

[4] Wu YQ, Ding YJ. Overexpressed microRNA-615-3p promotes progression of neonatal acute respiratory distresssyndrome by inhibiting differentiation of mesenchymal stem cells to alveolar type II epithelial cells [J]. Eur Rev Med Pharmacol Sci, 2018, 22 (14): 4625-4633

[5] Spillane NT, Zamudio S, Alvarez-Perez J, et al. Increased incidence of respiratory distress syndrome in neonates of mothers with abnormally invasive placentation[J]. PLoS One, 2018, 13(7): e0201266

[6] Zhang C, Zhu X. Clinical effects of pulmonary surfactant in combination with nasal continuous positive airway pressure therapy on neonatal respiratory distress syndrome[J]. Pak J Med Sci, 2017, 33 (3): 621-625

[7] Jensen CF, Sellmer A, Ebbesen F, et al. Sudden vs Pressure Wean From Nasal Continuous Positive Airway Pressure in Infants Born Before 32 Weeks o f Gestation: A Randomized Clinical Trial [J]. JAMA Pediatr, 2018, 172(9): 824-831

[8] Zhu XW, Shi Y, Shi LP, et al. Non-invasive high-frequency oscillatory ventilation versus nasal continuous positive airway pressure in preterm infants with respiratory distress syndrome: Study protocol for a multi-center prospective randomized controlled trial [J]. Trials, 2018, 19(1): 319

[9] Chen C, Tian T, Liu L, et al. Gender-related efficacy of pulmonary surfactant in infants with respiratory distress syndrome: A STROBE compliant study[J]. Medicine (Baltimore), 2018, 97(17): e0425

[10] 邵肖梅,叶鸿瑁,丘小汕.实用新生儿学[M].北京:人民卫生出版社, 2011, 328

[11] Kherkheulidze M, Chkhaidze I, Kavlashvili N, et al. EVALUATION OF DEVELOPMENTAL OUTCOMES WITH BAYLEY III TEST IN PRETERM INFANTS WITH RESPIRATORY DISTRESS SYNDROME[J]. Georgian Med News, 2018, (279): 67-73

[12] Rijal P, Shrestha M. Scenario of Neonatal Respiratory Distress in Tertiary Hospital[J]. J Nepal Health Res Counc, 2018, 16(2): 131-135

[13] Seeni I, Ha S, Nobles C, et al. Air pollution exposure during

pregnancy: maternal asthma and neonatal respiratory outcomes [J]. Ann Epidemiol, 2018, 28(9): 612-618.e4

[14] Perri A, Riccardi R, Iannotta R, et al. Lung ultrasonography score versus chest X-ray score to predict surfactant administration in newborns with respiratory distress syndrome [J]. Pediatr Pulmonol, 2018, 53(9): 1231-1236

[15] Gitaka J, Natecho A, Mwambeo HM, et al. Evaluating quality neonatal care, call Centre service, tele-health and community engagement in reducing newborn morbidity and mortality in Bungoma county, Kenya[J]. BMC Health Serv Res, 2018, 18(1): 493

[16] Chavez TA, Lakshmanan A, Figueroa L, et al. Resource utilization patterns using non-invasive ventilation in neonates with respiratory distresssyndrome[J]. J Perinatol, 2018, 38(7): 850-856

[17] Gronbach J, Ehrhardt H, Zimmer KP, et al. Early Pulmonary Interstitial Emphysema in Preterm Neonates-Respiratory Management and Case Report in Nonventilated Very Low Birth Weight Twins[J]. AJP Rep, 2018, 8(2): e99-e105

[18] 李百玲,柴家科,胡泉,等.外源性肺泡表面活性物质对重度烧冲复合伤大鼠急性肺损伤的治疗作用 [J]. 中华医学杂志, 2015, 95(2): 133-137

[19] 寒琼. 早期应用持续气道正压通气治疗新生儿呼吸窘迫综合征的效果观察[J].中国急救医学, 2016, 36(z1): 221

[20] Carns J, Kawaza K, Quinn MK, et al. Impact of hypothermia on implementation of CPAP for neonatal respiratory distress syndrome in a low-resource setting[J]. PLoS One, 2018, 13(3): e0194144

[21] Crehan C, Colbourn T, Heys M, et al. Evaluation of 'TRY': an algorithm for neonatal continuous positive airways pressure in low-income settings[J]. Arch Dis Child, 2018, 103(8): 732-738

[22] Guay JM, Carvi D, Raines DA, et al. Care of the Neonate on Nasal Continuous Positive Airway Pressure: A Bedside Guide [J]. Neonatal Netw, 2018, 37(1): 24-32

[23] Abd El-Fattah N, Nasef N, Al-Harrass MF, et al. Sustained lung inflation at birth for preterm infants at risk of respiratory distress syndrome: The proper pressure and duration [J]. J Neonatal Perinatal Med, 2017, 10(4): 409-417

[24] Rambaud J, Lidouren F, Sage M, et al. Hypothermic total liquid ventilation after experimental aspiration-associated acute respiratory distress syndrome[J]. Ann Intensive Care, 2018, 8(1): 57

[25] Ibrahim M, Omran A, AbdAllah NB, et al. Lung ultrasound in early diagnosis of neonatal transient tachypnea and its differentiation from other causes of neonatal respiratory distress [J]. J Neonatal Perinatal Med, 2018, 11(3): 281-287

[26] Sadeh-Vered T, Rosenberg N, Morag I, et al. A Proposed Role of Surfactant in Platelet Function and Treatment of Pulmonary Hemorrhage in Preterm and Term Infants [J]. Acta Haematol, 2018, 140(4): 215-220

[27] Ronan N, Bennett DM, Khan KA, et al. Tissue and Bronchoalveolar Lavage Biomarkers in Idiopathic Pulmonary Fibrosis Patients on Pirfenidone[J]. Lung, 2018, 196(5): 543-552

[28] Mannan MA, Hossain MA, Nasim J, et al. Immediate Outcome of Preterm Neonates with Respiratory Distress Syndrome Required Mechanical Ventilation[J]. Mymensingh Med J, 2018, 27(1): 130-135

[29] Zhang FY, Yang N, Rao YF, et al. Profiling of miRNAs in neonatal cloned bovines with collapsed lungs and respiratory distress [J]. Reprod Domest Anim, 2018, 53(2): 550-555

[30] McPherson C, Wambach JA. Prevention and Treatment of Respiratory Distress Syndrome in Preterm Neonates [J]. Neonatal Netw, 2018, 37(3): 169-177

（上接第 2558 页）

[22] Al Khalifah R, Moisan L, Bui H. The shortened combined clonidine and arginine test for growth hormone deficiency is practical and specific: a diagnostic accuracy study [J]. J Pediatr Endocrinol Metab, 2016, 29(3): 305-310

[23] Oh HS, Oh SK, Lee JS, et al. Effects of l-arginine on growth hormone and insulin-like growth factor 1[J]. Food Sci Biotechnol, 2017, 26(6): 1749-1754

[24] Liang S, Zhang D, Qi J, et al. Reduced peak stimulated growth hormone is associated with hyperuricemia in obese children and adolescents[J]. Sci Rep, 2018, 8(1): 7931

[25] Castagno M, Monzani A, Zanetta S, et al. Evaluation of growth hormone response to GHRH plus arginine test in children with idiopathic short stature:role of peak time [J]. J Endocrinol Invest, 2018, 41(8): 977-983

[26] Szczesna M, Kirsz K, Misztal T, et al. The effects of leptin on plasma concentrations of prolactin, growth hormone, and melatonin vary depending on the stage of pregnancy in sheep [J]. J Anim Sci, 2018, 96(8): 3348-3357

[27] Löhr H, Hess S, Pereira MMA, et al. Diet-Induced Growth Is Regulated via Acquired Leptin Resistance and Engages a Pomc-Somatostatin-Growth Hormone Circuit [J]. Cell Rep, 2018, 23 (6): 1728-1741

[28] Su L, Qiao Q, Li R, et al. Leptin attenuates the growth of rabbit mesenchymal stem cells via the extracellular signal-regulated kinase signaling pathway[J]. Exp Ther Med, 2018, 15(5): 4185-4190

[29] Grimberg A, DiVall SA, Polychronakos C, et al. Guidelines for Growth Hormone and Insulin-Like Growth Factor-I Treatment in Children and Adolescents: Growth Hormone Deficiency, Idiopathic Short Stature, and Primary Insulin-Like Growth Factor-I Deficiency [J]. Horm Res Paediatr, 2016, 86(6): 361-397

[30] Katsumata N. Standardization of Growth Hormone and Insulin-like Growth Factor-I Measurement [J]. Pediatr Endocrinol Rev, 2018, 16 (Suppl 1): 28-32