早產兒的呼吸器使用軌跡與神經發展之關連性

Invasive mechanical ventilation

Nasal non-invasive positive ventilation

Nasal cannula

報告者: 成大醫院小兒神經科
余文豪
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國立成功大學醫學院
College of Medicine, National Cheng Kung University
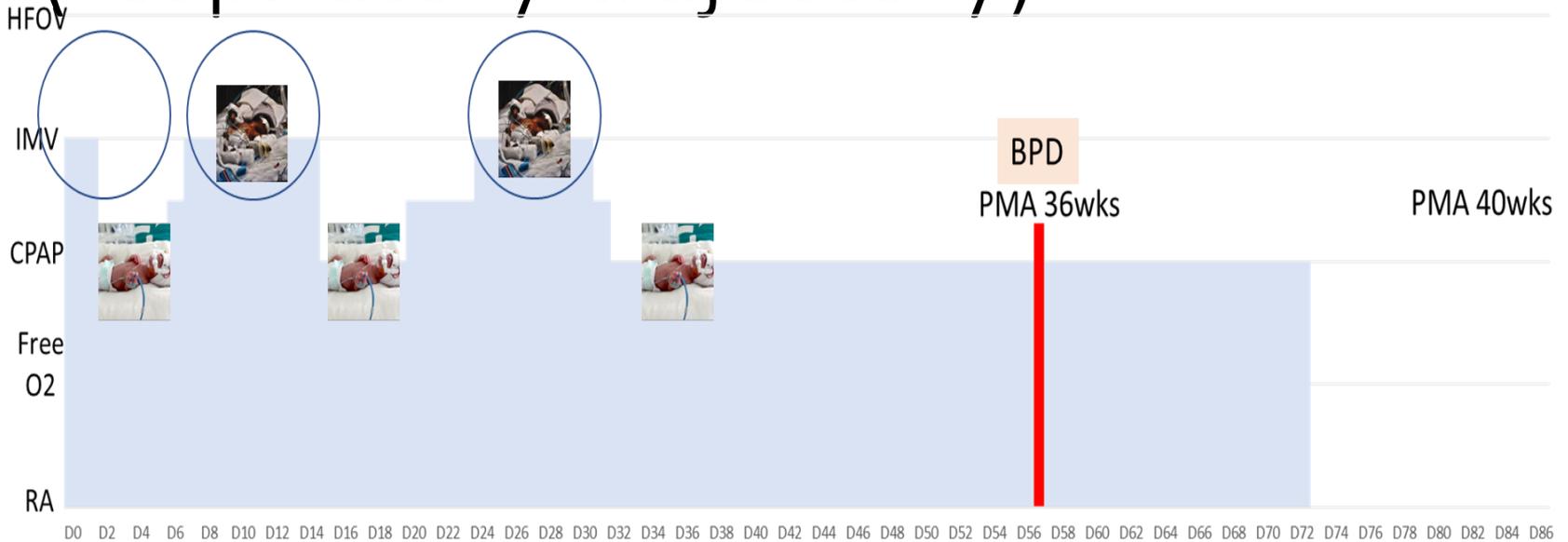
研究起源

-早期早產兒有神經發展障礙(neurodevelopmental impairment)的比率居高不下。

-對於引起神經發展障礙症的早期不良暴露，應該用不同的觀點去作探討。

為何選擇呼吸器使用軌跡 (respiratory trajectory)

研究目標

-檢視早期呼吸器使用軌跡與早產兒矯齡24個月時神經發展障礙的關聯性。

研究假設

-早期不良的呼吸器使用軌跡與早產兒神經發展障礙有所相關，且此關聯性在出生週數不到28周的極早產兒(extremely preterm infant)更為明顯。

研究方法

-回朔性世代研究 (retrospective cohort study)
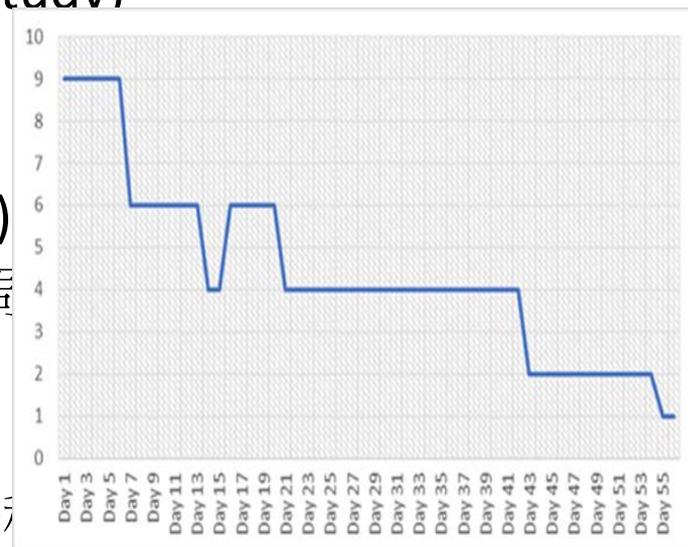
-依據出生週數不同分為:
　(1) 早期早產兒(very preterm, 28–30周)
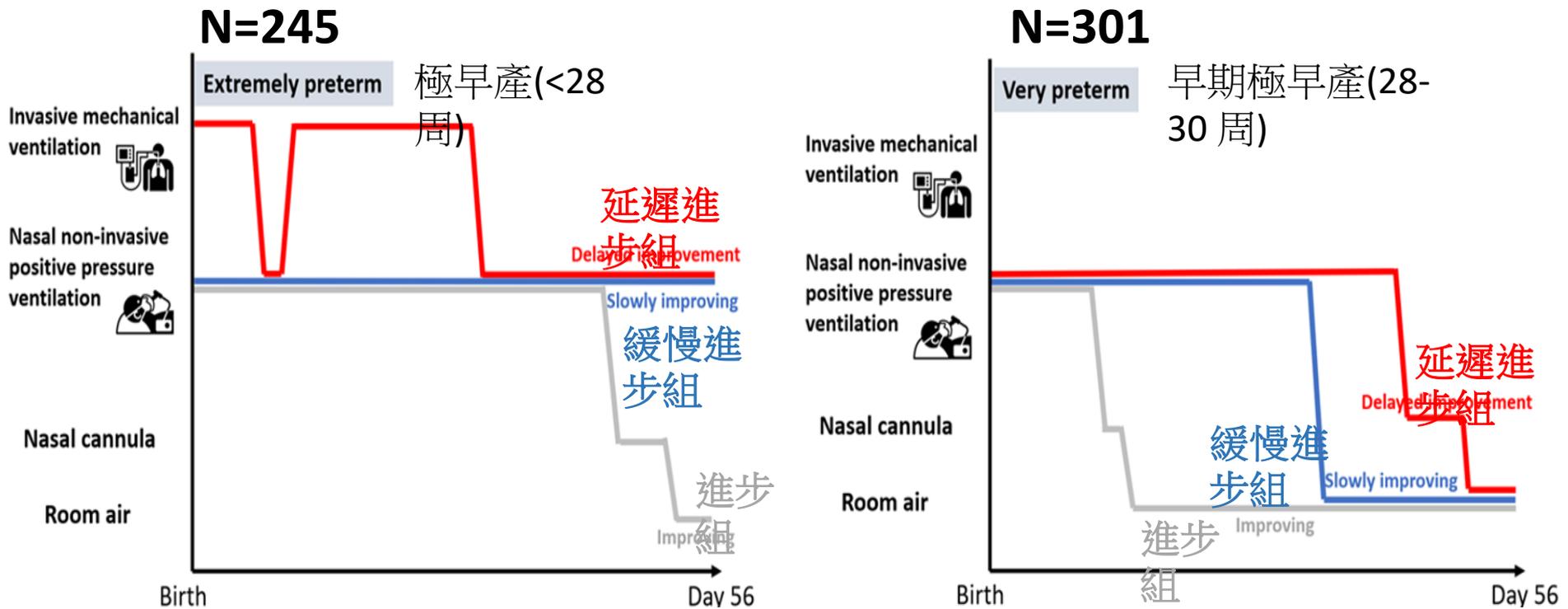　(2) 極早產兒(extremely preterm, <28 周)

-呼吸器使用軌跡分析:
　(1) 出生後前八周，每天使用的呼吸器
　(2) kmlShape 聚類分析 (kmlShape clustering analysis)

-在矯齡24個月時評估神經發展

兩組早產兒，依據嚴重程度的不同，個別都可分出三條獨特的呼吸器使用軌跡

N=245

極早產(<28 周)

延遲進步組

緩慢進步組

進步組

N=301

早期極早產(28-30 周)

延遲進步組

緩慢進步組

進步組

Outcome	Early-life respiratory trajectories			
	Improving 進步組	Slowly improving 緩慢進步組	Delayed improvement 延遲進步組	p
Infants born extremely preterm 極早產 (<28 周)	$n = 84$	$n = 70$	$n = 91$	
Neurodevelopmental outcomes				
Neurodevelopmental impairment, n (%) 神經發展障礙	14 (16.7)	28 (40.0)[a]	45 (49.5)[a]	<0.001
Moderate-to-severe cerebral palsy, n (%) 腦性麻痺	3 (3.6)	3 (4.3)	14 (15.4)	0.006
Cognitive impairment, n (%) 認知遲緩	8 (9.5)	16 (22.9)	32 (35.2)[a]	<0.001
Profound hearing or vision impairment, n (%)	0 (0)	1 (1.4)	6 (6.6)	0.099[a]
Growth outcomes				
Body weight (kg), mean (SD)	11.6 (1.6)	11.4 (1.7)	10.7 (1.3)[a]	<0.001
Head circumference (cm), mean (SD)	47.3 (1.7)	47.1 (1.8)	46.1 (1.8)[a]	<0.001
Infants born very preterm 早期早產(28-30 周)	$n = 97$	$n = 97$	$n = 107$	
Neurodevelopmental outcomes				
Neurodevelopmental impairment, n (%) 神經發展障礙	11 (11.3)	22 (22.7)	26 (24.3)	0.043
Moderate-to-severe cerebral palsy, n (%) 障礙	3 (3.1)	2 (2.1)	2 (1.9)	0.685[a]
Cognitive impairment, n (%)	7 (7.2)	15 (15.5)	19 (17.8)	0.074
Profound hearing or visual impairment, n (%)	0 (0)	0 (0)	2 (1.9)	1.000[b]
Growth outcomes				
Body weight (kg), mean (SD)	11.5 (1.7)	11.8 (1.6)	11.5 (1.6)	0.954
Head circumference (cm), mean (SD)	47.6 (1.9)	48.0 (1.7)	47.6 (1.9)	0.935

不良的呼吸器使用軌跡與神經發展障礙相關

Risk factor	Without respiratory trajectory patterns 不含呼吸器軌跡			With respiratory trajectory patterns 包含呼吸器軌跡		
	Adjusted OR	95% CI	p	Adjusted OR	95% CI	p
Infants born very preterm 早期早產(28-30周)						
Assisted reproductive technology for pregnancy	0.40	0.15–1.04	0.059	0.36	0.13–0.96	0.041
Lower maternal education 較低的母親教育程度	2.18	1.19–4.05	0.014	2.50	1.32–7.46	0.005
Hypotension requiring vasopressors	NA	NA	0.492	NA	NA	0.381
Haemodynamically significant PDA requiring intervention	1.74	0.88–3.42	0.111	NA	NA	0.208
RDS requiring surfactant therapy	1.83	0.85–3.94	0.123	2.25	0.99–5.15	0.054
Severe IVH[a]	NA	NA	0.364	NA	NA	0.289
NEC 壞死性腸炎	4.37	1.01–18.87	0.048	6.43	1.37–30.24	0.019
Cystic PVL 白質軟化症	8.37	2.89–24.22	<0.001	10.20	3.39–30.68	<0.001
Respiratory trajectory patterns						
Slowly improving[b] 緩慢進步	NA	NA	NA	3.74	1.53–9.15	0.004
Delayed improvement[b]	NA	NA	NA	2.21	0.88–5.55	0.091
Akaike information criterion[c] (AIC)	NA	NA	272.89	NA	NA	268.11
Log likelihood ratio test	NA	NA	NA	NA	NA	0.009

呼吸器使用軌跡與早期早產兒神經發展障礙有顯著相關

開放性動脈導管PDA:patent ductus arteriosus
壞死性腸炎NEC:necrotizing enterocolitis
白質軟化PVL:periventricular

Risk factor	Without respiratory trajectory patterns 不含呼吸器軌跡			With respiratory trajectory patterns 包含呼吸器軌跡		
	Adjusted OR	95% CI	p	Adjusted OR	95% CI	p
Infants born extremely preterm (<28 周) 極早產						
Gestational age, weeks	NA	NA	0.230	NA	NA	0.535
Assisted reproductive technology for pregnancy	NA	NA	0.519	NA	NA	0.523
Male sex 男性	2.18	1.18–4.06	0.013	2.21	1.18–4.15	0.014
Multiple gestation	1.69	0.85–3.37	0.138	1.66	0.83–3.35	0.155
5-minute Apgar score <7	NA	NA	0.213	NA	NA	0.261
Hypotension requiring vasopressors	NA	NA	0.317	NA	NA	0.399
Haemodynamically significant PDA requiring intervention 開放性動脈導管需要接受治療	3.19	1.53–6.66	0.002	2.46	1.12–5.40	0.024
Severe IVH[a]	NA	NA	0.751	NA	NA	0.908
NEC 壞死性腸炎	3.65	1.28–10.40	0.015	3.75	1.29–10.92	0.015
Cystic PVL 白質軟化症	24.94	5.32–116.99	<0.001	28.68	5.83–141.15	<0.001
BPD (moderate or severe)	2.15	1.10–4.21	0.026	NA	NA	0.176
Respiratory trajectory patterns						
Slowly improving[a] 緩慢進步	NA	NA	NA	3.82	1.61–9.05	0.002
Delayed improvement[a] 延遲進步	NA	NA	NA	3.14	1.33–7.38	0.009
Akaike information criterion[b] (AIC)	NA	NA	261.62	NA	NA	257.39
Log likelihood ratio test	NA	NA	NA	NA	NA	0.012

呼吸器使用軌跡與神經發展障礙有顯著相關，特別是在極早產兒 (extremely preterm)

開放性動脈導管PDA:patent ductus arteriosus
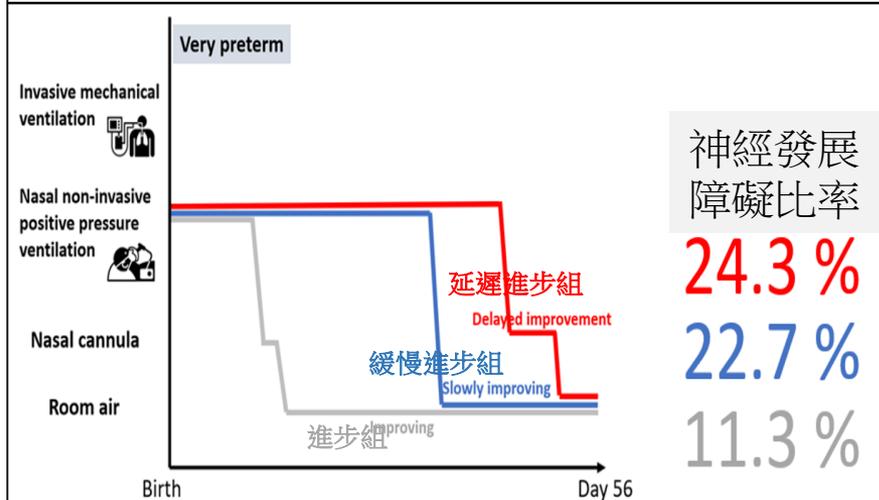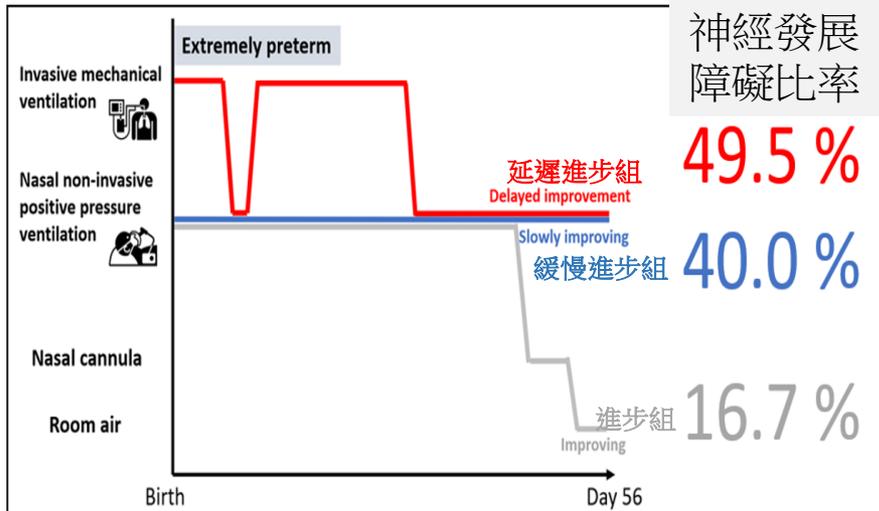壞死性腸炎NEC:necrotizing enterocolitis
白質軟化PVL:periventricular

感謝聆
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