Feasibility of Low-Complexity Therapeutic Hypothermia in a Resource-Limited Setting

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Abstract

Access to servo-controlled devices for therapeutic hypothermia in neonates with moderate-to-severe hypoxic-ischemic encephalopathy (HIE) is limited in low-resource settings. We evaluated a low-complexity cooling protocol using gel packs in a public hospital in Peru. Thirteen neonates (77% male; median gestational age: 38 weeks) were treated between 2018 and 2024. Cooling was initiated at a median of 103 minutes after birth; 69% reached 34 °C within 6 hours, and 31% maintained it for 72 hours. Complications occurred in 23% of cases, and mortality was 15%. Gel pack-based therapeutic hypothermia proved feasible but showed limited temperature stability, underscoring the need for structured protocols.

Introduction

Therapeutic hypothermia reduces morbidity and mortality in neonates with moderate-to-severe hypoxic-ischemic encephalopathy. In low-resource settings, access to servo-controlled devices is limited. Low-complexity methods, such as gel packs, have been proposed as alternatives, but evidence on their feasibility and safety remains limited. We describe the implementation and outcomes of a low-complexity therapeutic hypothermia protocol in a public hospital in Peru.

Methods

Retrospective case series of neonates ≥36 weeks with moderate-to-severe encephalopathy treated between 2018 and 2024. Classification was based on Sarnat or Thompson criteria. Cooling was performed with gel packs following a standardized protocol. Data on timing, target temperatures, duration, complications, and hospital course were collected and analyzed descriptively.

Results

13 neonates were included (77% male, median gestational age: 38 weeks [IQR: 37–39], median birth weight: 3565 g [IQR: 3020–3640]).

Maternal comorbidities were present in 46% of cases, including urinary tract infections, cocaine base paste use, cord prolapse, and premature rupture of membranes. All neonates required resuscitation, and 54% had an Apgar score < 5 at 5 minutes.

Results

Hospitalization lasted a median of 13 days (range: 2–60). All neonates required sedation and ventilatory support; 77% received antibiotics, 46% required inotropes, and 15% received anticonvulsants. Complications occurred in 23% of cases (pneumothorax, coagulation disorders, seizures). The mortality rate was 15.4% (n=2), with deaths occurring within the first days of hospitalization.

FIGURE. Temperature Trajectory in Neonates Receiving Therapeutic Hypothermia for Hypoxic-Ischemic Encephalopathy

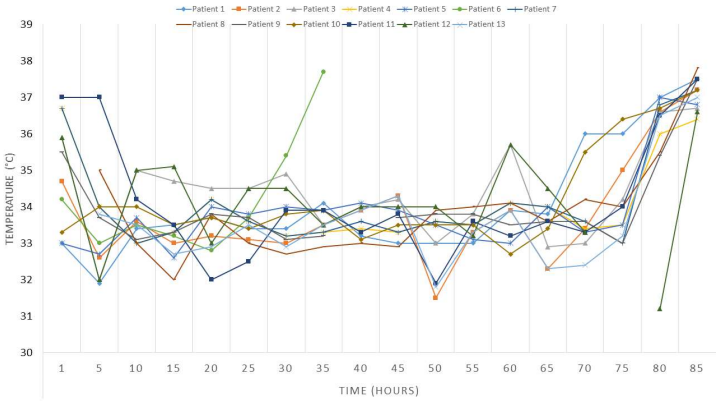

TABLE: Clinical and Therapeutic Characteristics of Neonates Undergoing Hypothermia for Hypoxic-Ischemic Encephalopathy

	Patients												
Management characteristics	1	2	3	4	5	6	7	8	9	10	11	12	13
Hypoxic-ischaemic encephalopathy classification	Moderate	Severe	Moderate	Moderate	Moderate	Severe	Moderate	Moderate	Moderate	SARNAT II	SARNAT II - III	SARNAT II	SARNAT II
Time of life at onset of hypothermia (hours)	2:22	1:30	2:29	1:43	0:56	1:54	1:05	1:07	2:13	1:13	3:15	4:00	1:03
Time in which 35°C was reached	9:27	1:36	2:37	4:08	1:00	1:56	2:15	5:37	3:13	9:43	5:17	1:15	4:03
Time in which 34°C was reached	11:27	1:38	2:40	5:53	1:02	2:00	3:15	6:02	5:13	11:43	6:45	1:15	3:33
Hypothermia was maintained at a temperature of 34°C.	No	Yes	No	No	Yes	No	No	No	No	Yes	No	No	Yes
Duration of hypothermia (hours)	Died	77:20:00	73:30:00	77:25:00	75:20:00	75:00:00	75:00:00	73:25:00	76:00:00	65:30:00	71:45:00	72:15:00	76:43:00
Rebasing time (hours)	Died	13:03	8	15	9:05	12	10	5	7	7:20	ND	8	9
Duration of hospitalization (days)	2 (died)	13	4 (died)	10	15	60	12	16	13	10	14	17	15
Use of sedation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Use of ventilatory support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Use of antibiotics	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No
Use of inotropes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	No
Use of anticonvulsant medication	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes
Complications during handling	No	No	No	No	No	No	No	Pneumothorax, meconium aspiration syndrome	Coagulation disorder due to asphyxiation	No	Tonic-clonic seizures	Erb-Duchenne palsy	No

ND: not documented

Conclusions

Low-complexity therapeutic hypothermia using gel packs showed partial effectiveness in achieving and maintaining target temperatures. Despite implementation challenges, this approach is feasible. Structured protocols and close temperature monitoring are essential to improve outcomes in resource-limited settings.

References

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