



Comments on "Neonatal infratentorial subdural hematoma contributing to obstructive hydrocephalus in the setting of therapeutic cooling: A case report"

Ioannis Siasios, Aggeliki Fotiadou, Yulia Rud

Specialty type: Neurosciences

Provenance and peer review:

Invited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): A

Grade B (Very good): 0

Grade C (Good): 0

Grade D (Fair): 0

Grade E (Poor): 0

P-Reviewer: Wang Y, China; Yao W, China

Received: February 5, 2022

Peer-review started: February 5, 2022

First decision: April 8, 2022

Revised: April 17, 2022

Accepted: May 28, 2022

Article in press: May 28, 2022

Published online: June 28, 2022



Ioannis Siasios, Neurosurgery Department, Papageorgiou Hospital, Thessaloniki 56403, Greece

Aggeliki Fotiadou, Department of Neurology, General University Hospital of Alexandroupolis, Alexandroupoli 68100, Greece

Yulia Rud, Department of Anesthesiology, European Interbalkan Medical Center, Thessaloniki 57001, Greece

Corresponding author: Ioannis Siasios, MD, MSc, Neurosurgeon, Research Scientist, Department of Neurosurgery, Papageorgiou Hospital, Ring road of Thessaloniki, N. Efkarpi, Thessaloniki 56403, Greece. siasiosj@yahoo.gr

Abstract

Although therapeutic hypothermia (TH) contributes significantly in the treatment of hypoxic ischemic encephalopathy (HIE), it could result in devastating complications such as intracranial hemorrhages. Laboratory examinations for possible coagulation disorders and early brain imaging can detect all these cases that are amenable to aggravation of HIE after the initiation of TH.

Key Words: Therapeutic hypothermia; Hypoxic ischemic encephalopathy; Hemostatic disorders; Intracranial hemorrhage; Magnetic resonance imaging

©The Author(s) 2022. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: It has not been yet elucidated if the initiation of therapeutic hypothermia (TH) contributes significantly to better outcomes in cases with already confirmed intracranial hemorrhage and hemostatic disorders. In such cases a close follow up with brain magnetic resonance imaging before and after the initiation of TH and repeated laboratory and clinical examinations may promptly identify neonates requiring emergent neurosurgical intervention.

Citation: Siasios I, Fotiadou A, Rud Y. Comments on "Neonatal infratentorial subdural hematoma contributing to obstructive hydrocephalus in the setting of therapeutic cooling: A case report". *World J Radiol* 2022; 14(6): 177-179

URL: <https://www.wjgnet.com/1949-8470/full/v14/i6/177.htm>

DOI: <https://dx.doi.org/10.4329/wjr.v14.i6.177>

TO THE EDITOR

Hypoxic ischemic encephalopathy (HIE) is thought to be a significant cause of morbidity and mortality at term and pre-term infants[1,2]. As stated in the literature, HIE is an evolving pathological process which within hours after its initiation promotes neuronal cell death through several biochemical events due to primary and secondary neuronal cell's energy crisis such as hypoperfusion, extracellular concentration of amino-acids, nitric oxide and free radicals and finally membrane depolarization[3]. Based on newborn's neurological status expressed by Sarnat scale, HIE is divided to mild, moderate and severe [4]. Diagnosis and follow up is based on patient's neurological status, laboratory monitoring as well as brain imaging studies such as cranial ultrasound and magnetic resonance imaging (MRI) of the head which is the gold standard imaging modality for intracranial lesions[5].

Therapeutic hypothermia (TH) is considered the first line treatment of HIE[6]. Several studies in the past revealed that TH can reduce neonatal mortality up to 20% in developed countries[7]. TH is widely used during the last decade for moderate to severe cases of HIE and it can be induced either as whole-body cooling or selective head cooling with a great variation in treatment protocols[8,9]. According to a published case series, hypothermia is limited to 33-34 degrees of Celsius for around 72 h under close medical surveillance and is slowly reinstated at normal body temperatures by patient rewarming with an increase rate of 0.5 Celsius degree per hour[3,5]. TH is applied only 6 h after birth in newborns with low Apgar score and a gestational age above 36 wk with evidence of moderate to severe HIE[5]. The literature describes several side effects of TH with an incidence around 20% of treated cases such as skin burns, electrolyte disturbances, low blood pressure, thrombocytopenia, prolonged prothrombin time (PT), and activated thromboplastin time[3].

We have read with great interest the case reported by Rousslang *et al*[10]. The authors eloquently highlighted the potential association between TH and increased risk of intracranial hemorrhage in neonates with HIE. They described the case of a term neonate that after an emergent C-section delivery required intubation due to cardiopulmonary instability[10]. According to the authors, the neonate fulfilled the criteria for TH which was applied from the day one. It is very interesting that the patient had from his first day of life pathological values of several parameters of coagulation mechanism such prolonged international normalized ration (INR), time of thromboplastin, activated partial thromboplastin time and low number of platelets. Authors tried to restore these pathological findings of coagulation parameters during the next four days. This is a gray zone in the literature regarding contraindications for TH. The question that has to be answered is whether a neonate with pathological laboratory findings of his coagulation mechanism is eligible for TH initiation without prior restoration of these abnormal values. We have to recognize that the time frame for such decisions is short in order to prevent a possible permanent neurological damage. It is strongly supported by the literature that TH can induce abnormalities of coagulation mechanism and indirectly favor occurrence of intracranial hemorrhages similar to the one that Rousslang *et al*[10] describe in their case report[3,11]. Obviously, this effect can be reinforced in patients with already pathological ratings of coagulation parameters.

In addition, the first screening of the neonate with head ultrasound revealed a left grade I germinal matrix hemorrhage. Although the patient already had a small intracranial hemorrhage authors applied TH. It is well known that around 38% of cases treated with TH can have an intracranial hemorrhage [12]. This is a finding that could be studied more thoroughly with an MRI scan before the application of TH as the MRI is more sensitive for the detection of any other hemorrhagic lesion, rendering it a potential first reference screening study for the neonate. Additionally, a brain MRI could be more valuable in assessing the severity of HIE and thus is a prognostic tool of great significance[12-14]. The coexistence of HIE and intracranial hemorrhages is another gray zone that requires more extensive investigation regarding the final outcome for the neonates receiving TH[13,14]. The current published case series refers to MRI scans performed usually several hours after the initiation of TH. Another issue that should be clarified in the future is whether any type of intracranial hemorrhage constitutes a contraindication for the initiation of any TH protocol.

Finally, it is well presented by the authors that any type of imaging screening combined with laboratory and clinical follow up of the neonates during TH can successfully detect any emergent intracranial hemorrhage. In these cases, prompt neurosurgical consultation can remarkably affect neurological outcome and prognosis for the neonates[15].

FOOTNOTES

Author contributions: Siasios I and Fotiadou A, Rud Y designed research; Siasios I, Fotiadou A, Rud Y performed research; Siasios I, Fotiadou A and Rud Y analyzed data; Siasios I and Fotiadou A wrote the letter; and Siasios I, Fotiadou A and Rud Y revised the letter.

Conflict-of-interest statement: All the authors declare that they have no conflict of interest.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: Greece

ORCID number: Ioannis Siasios 0000-0001-7945-9604; Aggeliki Fotiadou 0000-0002-8614-2688; Yulia Rud 0000-0002-6063-4043.

S-Editor: Liu JH

L-Editor: A

P-Editor: Liu JH

REFERENCES

- Vannucci RC. Hypoxic-ischemic encephalopathy. *Am J Perinatol* 2000; **17**: 113-120 [PMID: 11012134 DOI: 10.1055/s-2000-9293]
- Lee AC, Kozuki N, Blencowe H, Vos T, Bahalim A, Darmstadt GL, Niermeyer S, Ellis M, Robertson NJ, Cousens S, Lawn JE. Intrapartum-related neonatal encephalopathy incidence and impairment at regional and global levels for 2010 with trends from 1990. *Pediatr Res* 2013; **74** Suppl 1: 50-72 [PMID: 24366463 DOI: 10.1038/pr.2013.206]
- Datta V. Therapeutic Hypothermia for Birth Asphyxia in Neonates. *Indian J Pediatr* 2017; **84**: 219-226 [PMID: 27966094 DOI: 10.1007/s12098-016-2266-0]
- Sarnat HB, Sarnat MS. Neonatal encephalopathy following fetal distress. A clinical and electroencephalographic study. *Arch Neurol* 1976; **33**: 696-705 [PMID: 987769 DOI: 10.1001/archneur.1976.00500100030012]
- Chiang MC, Jong YJ, Lin CH. Therapeutic hypothermia for neonates with hypoxic ischemic encephalopathy. *Pediatr Neonatol* 2017; **58**: 475-483 [PMID: 28416250 DOI: 10.1016/j.pedneo.2016.11.001]
- Wassink G, Davidson JO, Dhillon SK, Zhou K, Bennet L, Thoresen M, Gunn AJ. Therapeutic Hypothermia in Neonatal Hypoxic-Ischemic Encephalopathy. *Curr Neurol Neurosci Rep* 2019; **19**: 2 [PMID: 30637551 DOI: 10.1007/s11910-019-0916-0]
- Edwards AD, Brocklehurst P, Gunn AJ, Halliday H, Juszczak E, Levene M, Strohm B, Thoresen M, Whitelaw A, Azzopardi D. Neurological outcomes at 18 mo of age after moderate hypothermia for perinatal hypoxic ischaemic encephalopathy: synthesis and meta-analysis of trial data. *BMJ* 2010; **340**: c363 [PMID: 20144981 DOI: 10.1136/bmj.c363]
- Giannakis S, Ruhfus M, Rüdiger M, Sabir H; German Neonatal Hypothermia Network. Hospital survey showed wide variations in therapeutic hypothermia for neonates in Germany. *Acta Paediatr* 2020; **109**: 200-201 [PMID: 31432551 DOI: 10.1111/apa.14979]
- Gunn AJ, Laptook AR, Robertson NJ, Barks JD, Thoresen M, Wassink G, Bennet L. Therapeutic hypothermia translates from ancient history in to practice. *Pediatr Res* 2017; **81**: 202-209 [PMID: 27673420 DOI: 10.1038/pr.2016.198]
- Rousslang LK, Rooks EA, Meldrum JT, Hooten KG, Wood JR. Neonatal infratentorial subdural hematoma contributing to obstructive hydrocephalus in the setting of therapeutic cooling: A case report. *World J Radiol* 2021; **13**: 307-313 [PMID: 34630916 DOI: 10.4329/wjr.v13.i9.307]
- Rao R, Trivedi S, Vesoulis Z, Liao SM, Smyser CD, Mathur AM. Safety and Short-Term Outcomes of Therapeutic Hypothermia in Preterm Neonates 34-35 Weeks Gestational Age with Hypoxic-Ischemic Encephalopathy. *J Pediatr* 2017; **183**: 37-42 [PMID: 27979578 DOI: 10.1016/j.jpeds.2016.11.019]
- Walas W, Wilińska M, Bekiesińska-Figatowska M, Halaba Z, Śmigiel R. Methods for assessing the severity of perinatal asphyxia and early prognostic tools in neonates with hypoxic-ischemic encephalopathy treated with therapeutic hypothermia. *Adv Clin Exp Med* 2020; **29**: 1011-1016 [PMID: 32820870 DOI: 10.17219/acem/124437]
- Lakatos A, Kolossváry M, Szabó M, Jermendy Á, Barta H, Gyebnár G, Rudas G, Kozák LR. Neurodevelopmental effect of intracranial hemorrhage observed in hypoxic ischemic brain injury in hypothermia-treated asphyxiated neonates - an MRI study. *BMC Pediatr* 2019; **19**: 430 [PMID: 31718607 DOI: 10.1186/s12887-019-1777-z]
- Weeke LC, Groenendaal F, Mudigonda K, Blennow M, Lequin MH, Meiners LC, van Haastert IC, Benders MJ, Hallberg B, de Vries LS. A Novel Magnetic Resonance Imaging Score Predicts Neurodevelopmental Outcome After Perinatal Asphyxia and Therapeutic Hypothermia. *J Pediatr* 2018; **192**: 33-40.e2 [PMID: 29246356 DOI: 10.1016/j.jpeds.2017.09.043]
- van Steenis A, Fumagalli M, Kruit MC, Peeters-Scholte CMPCD, de Vries LS, Steggerda SJ. Cranial Ultrasound Is an Important Tool in the Recognition of Life-Threatening Infratentorial Hemorrhage in Newborns. *Neuropediatrics* 2021; **52**: 170-178 [PMID: 33316833 DOI: 10.1055/s-0040-1716899]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

