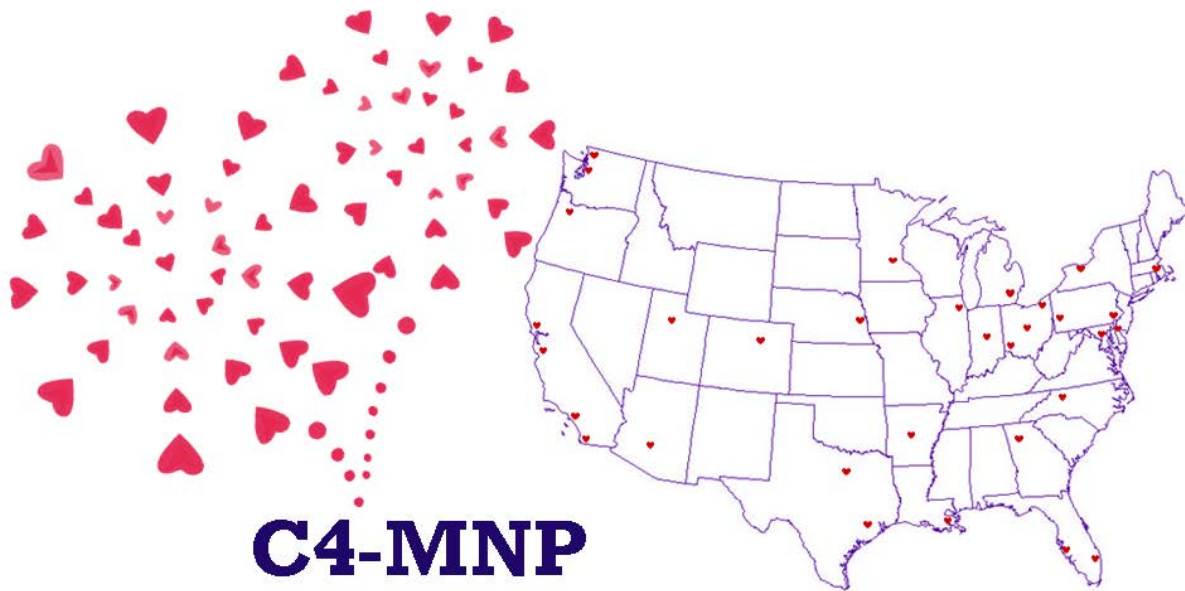


Consortium for Congenital Cardiac Care - Measurement of Nursing Practice

Hydrocortisone Use for Management of Vasoactive Resistant Shock

State of Practice Assessment Aggregate Result Report

July 10, 2017 – August 21, 2017



C4-MNP

Consortium for Congenital Cardiac Care Measurement of Nursing Practice

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Dear Colleagues,

We are pleased to inform you that we have completed the analysis of surveys for the Consortium for Congenital Cardiac Care - Measurement of Nursing Practice (C4-MNP) state of practice assessment regarding hydrocortisone use for management of vasoactive resistant shock in cardiac intensive care.

The purpose of the C4-MNP state of practice assessment regarding hydrocortisone use for management of vasoactive resistant shock in cardiac intensive care was to describe the current state of practice surrounding post-operative cardiac patients and the use of steroids.

This survey was developed by Christin Huff RN, MSN, CPNP-AC, practicing in the CICU at Cincinnati Children's Hospital Medical Center. Christin is currently a doctorate of nursing practice student at the University of Alabama and a Nursing Research Fellow at Boston Children's Hospital.

The invitation to participate was sent to 31 C4-MNP centers and 24 completed the survey for a response rate of 77 percent. Below, please find the aggregate result report.

We would like to extend our heartfelt appreciation for your continued commitment to this collaborative as we work to improve outcomes for pediatric cardiovascular patients and their families.

Sincerely,



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Executive Summary

Survey Overview

Hydrocortisone use for vasoactive resistant shock in pediatric cardiac intensive care patients is a topic with sparse literature support, and we assumed variation of practice throughout pediatric cardiac centers. In an effort to define the current state of practice, an electronic survey was developed and sent to 31 cardiac centers in free-standing children's hospitals with 24 responses resulting in a 77 percent response rate.

Key Findings

Nearly all responding centers (95%) reported using hydrocortisone for the treatment of low cardiac output syndrome refractory to fluid resuscitation and vasoactive medications. Responses confirmed that substantial variation in practice exists on a national level in regards to diagnosis, dosing, and duration of hydrocortisone.

- Among responding centers, 83% reported that there was no written clinical guideline in place for diagnosis of critical illness-related adrenal insufficiency.
- Diagnosis of vasoactive resistant shock requiring hydrocortisone included baseline cortisol levels sometimes, often, or always in 91% of responding centers.
- Other clinical factors for diagnosis included:
 - Hypotension refractory to vasoactive medications and fluid resuscitation (100% of respondents)
 - Increased inotrope requirement (96% of respondents)
 - Relative bradycardia (25% of respondents)
- Dosing of hydrocortisone was quite variable:
 - 38% of responding centers indicated that dosing varies by provider
 - 14% of responding centers selected 50 mg/m²/day
 - 29% of responding centers selected 100 mg/m²/day

Conclusion

These findings support the need for further research on optimal dosing for the use of hydrocortisone in the pediatric cardiac patient population, as well as the need for a clinical practice guideline to inform best practices and promote standardization of care. With the known risk of cumulative steroid exposure increasing the risk of infection (Mastropietro), it is important to establish optimal dosing for this population to have the maximum hemodynamic benefit with the least complications.

Next Steps

The C4-MNP state of practice assessment regarding hydrocortisone use in pediatric cardiac intensive care generated additional opportunities for advancing the science. An IRB-approved study of hydrocortisone use and outcomes is now underway at Cincinnati Children's Hospital Medical Center. Results from this state of practice survey will also inform the development of a clinical practice guideline (CPG) for hydrocortisone use. We will then evaluate the effectiveness of a CPG for hydrocortisone use at multiple C4-MNP sites.

Table of Contents

Executive Summary	2
Topic One: Diagnosis of Postop Adrenal Insufficiency	4-6
Topic Two: Intervention	7-10
Topic Three: Duration of Therapy	11
Topic Four: Clinical Decision Making	12-14
Demographics	15-16

Topic One: Diagnosis of Postop Adrenal Insufficiency

Question 1. Does diagnosis routinely include baseline cortisol levels?

Baseline Cortisone Levels	Respondents (N = 24)	
	# of Respondents	% of Respondents
Always	7	29.2%
Often	5	20.8%
Sometimes	10	41.7%
Never	2	8.3%

Question 2. Does diagnosis routinely include Adrenocorticotrophic stimulation test?

Adrenocorticotrophic Stimulation Test	Respondents (N = 24)	
	# of Respondents	% of Respondents
Always	1	4.2%
Often	2	8.3%
Sometimes	13	54.2%
Never	8	33.3%

Question 3. What type of ACTH stimulation test is conducted?

ACTH Stimulation Test in Use	Respondents (N = 16)	
	# of Respondents	% of Respondents
Rapid IV ACTH Test	16	100.0%
Prolonged ACTH Test	0	0.0%

Topic One: Diagnosis of Postop Adrenal Insufficiency (continued)

Question 4. What clinical factors are included in diagnosis? (check all that apply)

Clinical Factors Included in Diagnosis	Respondents (N = 24)	
	# of Respondents	% of Respondents
Hypotension refractory to vasoactive medication and fluid resuscitation	24	100.0%
Tachycardia	6	25.0%
Increased inotropic requirement	23	95.8%
Relative bradycardia	6	25.0%
Other	3	12.5%

Other clinical factors included in diagnosis were described as follows:

Other Clinical Factors Included in Diagnosis
Together with other sx's low C.O. state (i.e. decreased UOP)
High into pic/vasoactive support, ongoing resuscitation efforts with poor response

Question 5. Does your center have a written clinical practice guideline for diagnosis of relative adrenal insufficiency or critical illness related adrenal insufficiency in cardiac patients?

Clinical Practice Guideline	Respondents (N = 24)	
	# of Respondents Reported Yes	% of Respondents Reported Yes
	4	17%

Topic One: Diagnosis of Postop Adrenal Insufficiency (continued)

Question 6. What are some of the factors you consider before prescribing hydrocortisone?

Factors Considered Before Prescribing Hydrocortisone
Hypotension refractory to vasoactive meds, fluid resuscitation, and cortisol level
Age and type of operation
Risks associated with steroid administration
Preoperative history and steroid administration in the OR
Wound healing
Poor prognosis, poor response to increasing vasoactive/inotropic agents, sepsis, ongoing resuscitative efforts, physician preference
Ineffective escalation of vasoactive support, evidence of florid inflammatory response, and hyperglycemia

Topic Two: Intervention

Question 1. Does your center use hydrocortisone therapy as a treatment modality for low cardiac output syndrome refractory to vasoactive and fluid medications?

Hydrocortisone Therapy	Respondents (N = 22)	
	# of Respondents Reported Yes	% of Respondents Reported Yes
	21	95.5%

Question 2. Does your center have written guidelines for indications of hydrocortisone therapy?

Written Guidelines for Indications of Hydrocortisone Therapy	Respondents (N = 21)	
	# of Respondents Reported Yes	% of Respondents Reported Yes
	2	9.5%

Question 3. In your center is hydrocortisone routinely used for low cardiac output syndrome refractory to vasoactive infusions and fluid resuscitations?

Routine Use of Hydrocortisone	Respondents (N = 21)	
	# of Respondents Reported Yes	% of Respondents Reported Yes
	19	90.5%

Question 4. If no, what steroid is used?

Other Type(s) of Steroid Used
Methylprednisolone

Topic Two: Intervention (continued)

Question 5. What is the initial dose of hydrocortisone used in your center for refractory hypotension not responsive to fluid and vasoactive medications?

Initial Dose of Hydrocortisone	Respondents (N = 21)	
	# of Respondents	% of Respondents
50 mg/m2/day	3	14.3%
100 mg/m2/day	6	28.6%
Varies by provider	8	38.1%
Other	4	19.0%

Other initial dose of hydrocortisone was described as follows:

Initial Dose of Hydrocortisone
1 mg/kg/dose/q 6hrs
1-2 mg/kg/dose
2 mg/kg/dose/q 6hrs

Question 6. How is hydrocortisone administered?

Hydrocortisone Administration Route	Respondents (N = 21)	
	# of Respondents	% of Respondents
IV Continuous Infusion	2	9.5%
IV Intermittent Bolus Dosing	19	90.5%
Other	0	0.0%

Topic Two: Intervention (continued)

Question 7. Is there variation in practice within your institution regarding hydrocortisone use (initiation, dosing, duration, etc)?

Variation in Practice Re: Hydrocortisone Use	Respondents (N = 21)	
	# of Respondents	% of Respondents
Always	1	4.8%
Often	7	33.3%
Sometimes	10	47.6%
Never	3	14.3%

Reasons for Variations
Different doses (intermittent vs. continuous)
Individualizing hydrocortisone use and utilizing more selectively
Previously - quick initiation of hydrocortisone therapy with any sign of low C.O. state, without relationship to cortisol level. Over the years, individualizing therapy and more judicious use of steroids with cortisol level always drawn beforehand.
Different thresholds for institution, use of stim testing, different duration of use, and different doses.
Some providers start with an initial 2mg/kg dose followed by 1mg/kg q6h. Other providers use BSA for dosing. Some providers start with 1mg/kg q6h. Once the patient has stabilized some patients will wean hydrocortisone off, others will wean to physiologic dosing if the patient remains in the ICU.
The initial dose usually is 2 mg/kg, and then 1 mg/kg q6 hours. The weaning sometimes depends on the attending preference. Some attendings calculate dose mg per meter square. Some attendings won't treat elevated cortisol levels.
Variation among providers regarding dose and timing.
Physician preference.
Variation includes getting an endocrine consult or not.
Some start for low baseline OR low stir while others require both to be low. Some prefer 50mg/m2 vs. 100.
Provider dependent. If no improvement after a dose, some of us do not continue its use. Some of us also use the 50mg/m2/day dose vs. the mg/kg dosing but they are mostly equivalent.
We have started patients at 50mg/m2 dosing without the initial stress dose in instances where the patient is responding to interventions, but only occasionally. Or if the patient is back from the OR and just received a large dose of steroids on pump.
There is no set cut off regarding what vasoactives and which dosing to start the medicine, although as a general standard the intensivists all strongly consider its use when escalating vasoactive support.

Topic Two: Intervention (continued)

Question 8. In your best estimation, how many patients per year are started on steroids for hypotension that is refractory to high dose vasoactive medications and fluid resuscitation?

Estimated Number of Patients on Steroids for Hypotension	Respondents (N = 11)	
	# of Respondents	% of Respondents
0-20	4	36.4%
21-40	1	9.1%
41-60	3	27.3%
61-80	1	9.1%
81-100	2	18.2%
>100	0	0.0%

Topic Three: Duration of Therapy

Question 1. In general, when do you as a provider begin to wean hydrocortisone?

Time to Wean Hydrocortisone	Respondents (N = 21)	
	# of Respondents	% of Respondents
24 – 48 Hours	6	28.6%
3 – 5 Days	6	28.6%
7-10 Days	1	4.8%
When patient tolerates wean of inotropes	5	23.8%
Other	3	14.3%

Other time to wean hydrocortisone was described as follows:

Other Time to Wean Hydrocortisone
Within 7 days after pt begins tolerating wean of inotropes
Stress dosing only lasts 3-5 days, then stops. If the patients deteriorates quickly then it is restarted for a longer time and a wean is ordered once ionotropes can be weaned

Question 2. Is weaning of hydrocortisone driven by a written clinical guideline?

Clinical Guideline on Hydrocortisone Weaning	Respondents (N = 21)	
	# of Respondents Reported Yes	% of Respondents Reported Yes
	1	4.8%

Question 3. In your center, what is the average duration of hydrocortisone therapy (in days)?

Average Duration of Hydrocortisone Therapy	Respondents (N = 13)	
	# of Respondents	% of Respondents
0 – 2 days	2	15.4%
3 – 4 days	2	15.4%
5 – 7 days	9	69.2%

Topic Four: Clinical Decision Making

Question 1. If drawn, do cortisol levels drive decision making related to dosing or duration of therapy of steroid?

Cortisone Level: Tool for dosing or duration of steroid therapy	Respondents (N = 20)	
	# of Respondents	% of Respondents
Always	3	15.0%
Often	7	35.0%
Sometimes	7	35.0%
Never	3	15.0%

Unique Description of Dosing and Duration by Cortisol Levels by Respondents
Cortisol level decides whether to initiate therapy. Dosing is always the same.
Dependent on if they are low or normal, this would make a difference in length of therapy etc.
Cortisol levels drive the decision to initiate therapy, not the dosing and not necessarily the duration of therapy.
Some people use 9 as a cutoff from a stim test to determine whether or not to treat, some don't test, some test and treat regardless.
Cortisol level <20 on patient of any age almost always gets started on stress dose hydrocortisone (dose varies by provider). Cortisol level 20-25 may still be started on stress dose hydrocortisone based off of clinical exam, vitals and continued liability in blood pressure. Typically cortisol >25 hydrocortisone is not started.
Yes, if it is critical illness related corticoids insufficiency we will start hydrocortisone, and come off when patient stable. If it is adrenal insufficiency with a level less than 10 and a response less than 9, we will keep them on physiologic dose until endocrine evaluate them. The dose of hydrocortisone will be the same.
Practitioner dependent.
If level low, the treatment tends to be longer than others.
If less than 18, dose is given. If the level is high, it is repeated in 12 hours, and with its decline to < 18, it is then administered.
If drawn cortisol is normal we discontinue.
Low levels indicate a possible underlying problem, and trigger an Endocrine consult. However, it can be misleading if the patient just underwent surgery.

Topic Four: Clinical Decision Making (continued)

Question 2. Does your ICU consult Endocrine for patients receiving hydrocortisone therapy during their ICU stay?

Endocrine Consult	Respondents (N = 20)	
	# of Respondents	% of Respondents
Always	0	0.0%
Often	0	0.0%
Sometimes	13	65.0%
Never	7	35.0%

Question 3. Is there any long term follow up/testing for adrenal insufficiency in patients who received stress steroids?

Long Term Follow Up for Adrenal Insufficiency	Respondents (N = 20)	
	# of Respondents Reported Yes	% of Respondents Reported Yes
	2	10.0%

Unique Description of Long-Term Follow-Up for Adrenal Insufficiency
If they have been on stress steroids for a long time. They sometimes get a stim test once the course is completed.
If patients prove to have insufficiency, then follow up is done after discharge. Usually about 2-4 weeks depending on severity.

Question 4: As the provider managing care of patients who have previously required stress-dose steroids, when do you initiate steroid?

Steroid Initiation by Provider	Respondents (N = 20)	
	# of Respondents	% of Respondents
Upon return from OR	0	0.0%
At time patient appears clinically symptomatic/labile	7	35.0%
Variable depending on procedure/pt characteristics	8	40.0%
Other	5	25.0%

Topic Four: Clinical Decision Making (continued)

Other time of steroid initiation was described as follows:

Other Time of Steroid Initiation
If utilized for relative adrenal insufficiency after Norwood, do not automatically initiate steroids post Glenn
Intraoperative
Not done
Prior to operation

Question 5. Is there a specific population of patients that you would hesitate to prescribe steroid?

Specific Population of Patients that Providers are Hesitant to Prescribe Steroid
Anyone at increased risk of infection.
Actively infected, having a go bleed.
Hem/Onc
No, although some of our attendings are concerned about neurologic damage while on steroids.
Those with severe infections and decreased ability to heal wounds.
Patients who have NEC or gut issues or patients with significant wound healing issues are discussed more thoroughly.

Additional Information Provided by Respondents
Some patients that had CIRCI will be started on stress dose of steroids prior to going to the OR, and wean them off shortly after surgery, especially if they are still in house.
Cannot answer the question of number of patients who receive steroids per year, as you would need to know the denominator to make this meaningful. I would say however, that approximately 80% of patients who undergo the Norwood procedure receive hydrocortisone. I think it is also important to know if patients receive pre and intra-operative methylprednisolone.

Demographics

Question 1. What is your clinical role?

Clinical Role	Respondents (N = 21)	
	# of Respondents	% of Respondents
Advanced Practice Provider - PA	1	4.8%
Advanced Practice Provider – NP	10	47.6%
Physician	8	38.1%
Other	2	9.5%

'Other' Clinical Role
CNS
RN

Question 2. What is your area of practice?

Area of Practice	Respondents (N = 21)	
	# of Respondents	% of Respondents
Inpatient cardiac floor or step down	0	0.0%
Cardiac or pediatric intensive care unit	19	90.5%
Outpatient care area	0	0.0%
Other	2	9.5%

'Other' Area of Practice
CT surg service line (pre/postop clinics, CTICU, CV Acute ward)

Demographics (continued)

Question 3. Please indicate your overall years of clinical experience.

Years of Clinical Experience	Respondents (N = 21)	
	# of Respondents	% of Respondents
0-2 Years	1	4.8%
3-5 Years	4	19.1%
5-10 Years	4	19.1%
>10 Years	12	57.0%

Question 4. Approximately how many cardiopulmonary bypass cases are completed per year at your center?

Cardiopulmonary Bypass Cases per Year	Respondents (N = 21)	
	# of Respondents	% of Respondents
0 – 50	0	0.0%
51 – 100	1	4.8%
101 – 200	0	0.0%
201 – 400	13	61.9%
401 – 600	4	19.1%
>600	3	14.2%