# **Dexmedetomidine and Hypernatremia**

Case Report

www.pjkd.com.pk

# Dexmedetomidine Related Polyuria and Hypernatremia: A Case Report

Mubashar Dilawar, Omer Sabir, Muhammad Mohsin Riaz, Bilal Basit

Department of Medicine, Division of Nephrology, Fatima Memorial Hospital College of Medicine and Dentistry University of Health Sciences, Lahore, Pakistan.

## **Abstract:**

Dexmedetomidine is commonly used sedative nowadays. It is being used as an anesthetic for surgical procedures and frequently being used in ICU Settings for sedation, and analgesia. Dexmedetomidine is a highly selective, alpha-2 agonist that also blocks arginine-vasopressin release. Dexmedetomidine is suspected to cause diabetes insipidus leading to polyuria and hypernatremia. We report a case of Diabetes Insipidus associated with use of dexmedetomidine.

**Key Words:** sedation, sedative, dexmedetomidine, diabetes insipidus, hypernatremia.

# **Corresponding Author:**

Dr Mubashar Dilawar.

Department of Medicine, Division of Nephrology,

Fatima Memorial Hospital College of Medicine and Dentistry

Email: mubashirdilawar@hotmail.com

Received: March 8,2020. Accepted April 12, 2021. PJKD 2021;5(2):

Received: March 8,2021. Accepted April 12, 2021.

PJKD 2021;5(2):60-62

#### Introduction:

Fluid status monitoring and repeated evaluation of output and intake is a routine for any intensive care unit (ICU). Polyuria observed in patients in the post-operative period may be due to increase solute or nitrogen load. Polyuria can also be observed as a sequalae of acute tubular necrosis or post obstructive diuresis.

We present here a case of polyuria due to most likely dexmedetomidine use as a sedative in this patient. We discuss the possible cause and presentation with literature review.

### Case Presentation.

A 17-year-old boy noticed gradually increasing swelling on the lateral side of neck for the last one month. There was no history of fever, cough or weight loss. Examination only revealed lymphadenopathy. USG neck confirmed the presence of enlarged lymph nodes. Excisional lymph node biopsy was planned under general anesthesia. During the procedure patient suddenly collapsed and had CPR and was placed on mechanical ventilation. The patient-maintained vitals and oxygen saturation on minimal FIO<sub>2</sub>. However, after 48 hours he had fever and hypotension. Norepinephrine was given to maintain adequate perfusion pressures. Ketamine was used for sedation initially which was then changed to dexmedetomidine for sedation and analgesia.

Maintenance intravenous fluids Dextrose Saline alternating with Dextrose Half Saline were adjusted according to repeated hydration status evaluation and central venous pressures (CVP) measurement.

# **Dexmedetomidine and Hypernatremia**

Urine output was adequate for first 48 hours however, on the third day he was noticed to have polyuria (urine output 500-600ml/hour). Due to polyuria nephrology consult was taken. Clinically, patient seemed to be dehydrated. CVP was 7 mm of Hg. Intravenous fluids as dextrose saline was increased to maintain blood pressures and CVP. Considering the differential of diabetes insipidus and cerebral salt wasting syndrome labs were requested (Table 1). Hypernatremia with coexisting low urinary specific gravity and osmolality suggested the diagnosis of Diabetes Insipidus. Low urinary sodium excluded the diagnosis of Cerebral Salt wasting syndrome.

Table 1: Daily urine output and electrolyte changes in a patient with Dexmedetomidine induced polyuria.

Post- Op Days	<b>1</b> st	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>				5 <sup>th</sup>	7 <sup>th</sup>
Time	6 AM	6 AM	12 PM	2 AM	8 AM	2 PM	8 PM	6 AM	6AM
Urine Output	50 ml/hour	75-100 ml/hr	600 ml/hr	350 ml/hr	200 ml/hr	150 ml/hr	75-100 ml/hr	50 ml/hr	30-50 ml/hr
Serum sodium (mmol/L)	145		161	161	159	155	151	148	141
Urine Sodium (mmol/L)			20.9						
Serum Osmolality (mOsm/L)			350		364				
Urine Osmolality (mOsm/L)			155.2		384				
Serum Potassium (mmol/L)					3.7			4.2	3.9
Serum Creatinine (mg/dl)			0.70		0.74				
Serum Albumin (g/dl)			2.94						
Serum Calcium (mg/dl)			8.75						_
Urine Specific Gravity			1.005						

Dexmedetomidine was suspected to be the cause of polyuria and hypernatremia. Dexmedetomidine was held immediately, and Intranasal Desmopressin was also given. Intravenous fluids were changed to Dextrose water. Slowly the urine volume and serum sodium levels started to improve within 24 hours, and normalization of serum sodium levels, as seen in Table 1.

#### Discussion:

Polyuria, high plasma osmolality, high serum sodium levels and low urine specific gravity present in this case are seen in diabetes insipidus. Polyuria is a term used for urine output more than 3L/day, which is mainly due to defect in the Antidiuretic hormone (ADH) production or its response on the kidneys. Urine osmolality can differentiate between causes of polyuria. (diabetes insipidus, diabetes mellitus, cerebral salt wasting) urine osmolality in lower side can point towards diabetes insipidus which can be nephrogenic or central.<sup>1-3</sup>

All possible causes of polyuria were explored including hyperglycemia, possible medications or previous history of polyuria and dexmedetomidine was the only cause found to be associated with polyuria as reported previously. <sup>3,4</sup> Dexmedetomidine is a selective alpha<sub>2</sub> adrenoceptor agonist with anesthetic and sedative properties which are thought due to activation of G-proteins by alpha<sub>2a</sub>-adrenoceptors in the brainstem inhibiting the norepinephrine release. Peripheral alpha<sub>2b</sub>-adrenoceptors

# **Dexmedetomidine and Hypernatremia**

are activated at high doses or with rapid intravenous administration resulting in vasoconstriction.<sup>1</sup> Dexmedetomidine has a diuretic like action resulting in polyuria, low urine osmolality, high serum osmolality and decreased urine specific gravity as observed in our patient.<sup>1,7-9</sup> It is however still not clear that polyuria is either due to low ADH levels or decreased renal responsiveness to ADH.

In our patient, the temporal relation of infusion of dexmedetomidine continued for 2 days at 1 mcg/kg/hour and then development of polyuria and high serum sodium levels. After discontinuation of the dexmedetomidine urine output and serum sodium levels started improving within 6-8 hours.

Dexmedetomidine is being used in ICU settings in critically ill patients as a sedative and analgesic. It is also being used during different surgeries such as carotid endarterectomy and stenting, cardiopulmonary bypass, spine, head and neck surgery, as an anesthetic; and occasionally in patients for alcohol withdrawal.<sup>10-12</sup>

We did not find any publication from Pakistan to the best of our knowledge either suggesting infrequent use of dexmedetomidine or unawareness of its side effects. Our case report therefore underlines the importance of revisiting an important medication used in anesthesia and intensive care units.

#### Conclusion:

Dexmedetomidine may cause polyuria and hypernatremia in critically ill patients and treating physicians should be aware of this potentially dangerous adverse effect.

Conflict of Interest: None Declared

#### References:

- 1. Dexmedetomidine: an updated review. Gerlach AT, Dasta JF. Ann Pharmacother. 2007;41:245-52
- 2. Panzer O, Moitra V, Sladen RN. Pharmacology of sedative analgesic agents: dexmedetomidine, remifentanil, ketamine, volatile anesthetics, and the role of peripheral mu antagonists. Crit Care Clin. 2009;25(3):451-69.
- 3. Ji, F., Liu, H. Intraoperative hypernatremia and polyuric syndrome induced by dexmedetomidine. J Anesth. 2013;(4):599-603.
- 4. Shannon Granger and David Ninan, Intraoperative Dexmedetomidine-Induced Polyuric Syndrome, Cureus. 2017; 9(5):e1218
- 5. Pratt A, Aboudara m, Lung L. Polyuria related to dexmedetomidine. Anesth Analg. 2013;117(1):150-152.
- 6. Fuhai Ji, Hong Liu, Intraoperative hypernatremia and polyuric syndrome induced by dexmedetomidine. J Anesth. 2013; 27(8):599-603.
- 7. Adams PS, Cassara A. Dexmedetomidine-related polyuria in a pediatric patient. J Anesth. 2016;30:352-55
- 8. Greening A, Matthews L, Blair J. Apparent dexmedetomidine-induced polyuric syndrome in an achondroplastic patient undergoing spinal fusion. Anesth Analg. 2011;113:1381-83.
- 9. Villela NR, do Nascimento Júnior P, de Carvalho LR, Tiexeria A. Effects of dexmedetomidine on renal system and on vasopressin plasma levels. Experimental study in dogs. Rev Bras Anesth. 2005;55:429-440.
- 10. Sugawaraa A, Hanadab S, Hayashia K, Kurosawaa A, Sunoc M, Kunisawa T.Anesthetic management using effect-site target-controlled infusion of dexmedetomidine. J Clin Anesth. 2019;55(8):42.
- 11. Biccard BM, Goga S, de Beurs J. Dexmedetomidine and cardiac protection for non-cardiac surgery: a meta-analysis of randomized controlled trials. Anaesthesia. 2008;63:4-14.
- 12. Argoff C. Mechanisms of pain transmission and pharmacologic management. Curr Med Res Opin 2011;27:2019-31.