

## Case Report

# Management of Suboptimal Cortisol Response in patients with Structural Heart Disease-Two Case Reports

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### Abstract

Suboptimal Cortisol Response (SCR) is an inadequate cortisol response in relation to the severity of illness. Also known as critical illness induced corticosteroid insufficiency, it is frequently observed in patients with septic shock. We describe two patients presented to us with sign and symptoms of heart failure. Up titration of diuretics dose was a big challenge to us due to the concomitant severe electrolyte imbalance likely due to altered hypothalamic pituitary axis leading to relative adrenal insufficiency. Random serum cortisol level was checked which was relatively low. Cortisol was replaced which helped us in normalizing serum electrolytes by correcting the SCR. Purpose of writing these two cases is to highlight the importance of SCR in decompensated heart failure, as the early diagnosis and treatment of this condition will help physicians in the better management of patients with heart failure.

**Keywords:** Electrolyte Imbalance; Heart Failure; Suboptimal Cortisol Response (SCR); Structural Heart Disease

### Introduction

The Suboptimal Cortisol Response (SCR) is defined as an inadequate cortisol response in relation to severity of the illness. It is also known as critical - illness induced corticosteroids insufficiency. Both high and low levels of cortisol are associated with high mortality, with high level indicating severe stress while low level indicates inadequate response to stress also called suboptimal adrenal response or relative adrenal insufficiency diagnosed when random serum cortisol level is less than 10 ug/dl (<15 ug/dl in one study) in patients with stress. Functioning adrenals of the critically ill patients are already maximally stimulated in response to stress. In such patients the value of stimulated cortisol level (a random value), can diagnosed SCR [1,2].

This has been observed in critically ill patients with septic shock due to insufficient stress response of the hypothalamic-pituitary-adrenal axis [3]. However in patients with structural heart disease and decompensated heart failure this has not been reported. It might cause some therapeutic challenges in management of

patients with heart failure due to electrolyte imbalance.

We are reporting two case of decompensated heart failure with suboptimal adrenal response diagnosed by measuring their random cortisol level. They responded to diuretic therapy with optimal serum electrolytes level by adding steroids in their management and hence their heart failure could be effectively managed. These cases represent a unique and difficult situation where heart failure management could not be optimized due to SCR. To our knowledge these are first cases reports of SCR with heart failure where correcting adrenal insufficiency made heart failure management feasible.

### Case 1

A 68 years old woman presented with sign and symptoms of heart failure. She was a diagnosed case of Secundum atrial septal defect with severe pulmonary artery hypertension. Her ECG showed atrial fibrillation with ventricular rate of 130-140 beats/minutes. X-ray chest showed evidence of pulmonary edema. She was considered very high risk for ASD closure due to underlying severe pulmonary artery hypertension. She was started on diuretics. However, her serum sodium level declined and potassium went up

after starting diuretics as shown in table-1(left column).

	BEFORE STEROIDS				AFTER STEROIDS			
SERUM LEVEL	DAY 1	DAY 2	DAY 3	DAY 4	DAY 1	DAY 2	DAY 3	DAY 4
Sodium (mmol/L)	131	123	121	117	126	127	133	135
Potassium(mmol/L)	4.3	4.3	5.2	5.5	4.1	3.8	3.5	3.5

**Table 1:** Serum electrolytes values showing hyponatremia and hyperkalemia before steroids (left column) and improvement in the level after steroids (right column).

We were not able to titrate up her diuretics. Suspecting SCR, her baseline random cortisol was checked and was found to be low (07 ug/d l). She was therefore started on recommended stress dose of hydrocortisone. After adding steroids in the treatment, we were able to increase the diuretics dose with optimal electrolyte levels as shown in table -1(right column). Her symptoms remarkably improve. She was sent home in stable condition.

## Case 2

A 75 year old, thin and lean (BMI =16) old woman known to have severe aortic stenosis and severe mitral regurgitation with left ventricular systolic dysfunction (ejection fraction of 20% on visual estimation). Her effective cardiac output was significantly low but due to her co-morbid conditions risk of surgery (aortic valve replacement or Transcatheter Aortic Valve Implantation [TAVI]) out weighted the benefits and therefore she was managed conservatively. She now presented with signs and symptoms of heart failure. She was started on standard treatment of heart failure however due to severe electrolytes imbalance (hyponatremia and hyperkalemia) as shown in table-2 day, we were not able to effectively diurese her. Considering associated SCR due to her critical illness her random cortisol was checked. It was 08 ug / dl. She was therefore started on recommended stress dose of hydrocortisone. With this we could effectively manage her heart failure without worsening in electrolyte imbalance as shown in table -2 from day 3 onward. She was stabilized and sent home.

Serum level	Day 1	Day 2	Day 3	Day 4	Day 5
Sodium(mmol/L)	106	118	125	131	134
Potassium(mmol/L)	5.7	5.5	5	4.9	4.8
Mean blood pressure mmHg(in 24 hours)	90/50	90/60	101/60	110/66	110/60

**Table 2:** Showing trend of serum sodium and potassium before (day 1) and after introducing steroids (day 2 -5).

## Discussion

Synthesis and secretion of cortisol which is a major glucocorticoid hormone is stimulated by Adrenocorticotrophic

Hormone (ACTH), released by anterior pituitary. In a healthy, unstressed person, cortisol is secreted according to a diurnal pattern. The secretion is under the influence of hypothalamic corticotrophin-releasing hormone [4]. Acute stress in body results in loss of normal diurnal variation in cortisol secretion.

The reported incidence of syndrome of suboptimal adrenal response varies widely depending on the patient population studied and diagnostic criteria used and have been related to increased morbidity and mortality in several studies [5]. This syndrome is mostly reported in septic shock. Though reported in a case of cardiogenic shock however in daily practice with heart failure this has not been reported [3]. We described two challenging cases of structural heart disease with different etiologies. Effective diuresis could not be achieved due to electrolyte imbalances secondary to suboptimal adrenal response. To our knowledge these are the only case reports in literature where concept of suboptimal adrenal response is addressed as one of the contributing factor in electrolyte imbalance, because in common practice while managing patients with heart failure, diuretics are usually thought of causing such imbalances.

Purpose of reporting these cases is to highlight the importance of suspecting alteration in hypothalamic- pituitary -adrenal axis in patients with heart failure in whom optimized medical therapy is the only left option for their survival. Although literature is showing the role of steroids in patients with septic shock and is being practice as well [1,2].

## Conclusion

Critical illness its self can be the triggering factor for the development of SCR. Further research is highly recommended to validate the important of SCR in patients of SHD with heart failure requiring higher doses of diuretics. Early diagnosis and treatment of this condition can help the physicians in up titrating the heart failure therapy especially diuretics and can impact on the management of such patients.

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