



Case Report

Early initiation of slow continuous ultrafiltration (SCUF) in a case of pregnancy induced hypertension (PIH) with acute decompensated heart failure (ADHF) refractory to standard medical therapy: A case report

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ARTICLE INFO

Article history:

Received 17-05-2022

Accepted 23-05-2022

Available online 13-08-2022

Keywords:

PIH

SCUF

HELMET BiPAP

Critical care ultrasound

ABSTRACT

Acute pulmonary edema may occur in approximately 3% of women with pre-eclampsia, with 70% of cases occurring after birth. Acute decompensated heart failure (ADHF) patients with refractory edema unresponsive to diuretic therapy may be considered for ultrafiltration. Judicious use of BiPAP with helmet as interface coupled with meticulous hemodynamic monitoring may be a key to successful outcome.

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1. Introduction

ADHF is one of the major causes of peri-partum morbidity and mortality. Immediate management of pulmonary edema in pregnancy includes oxygenation, ventilation and hemodynamic management with diuretics and inodilators. Patients with refractory edema unresponsive to diuretic therapy may be considered for ultrafiltration. The early application of SCUF as a novel therapy in post-partum ADHF is feasible option. It is generally well tolerated and resulted in adequate fluid removal and clinical improvement. We are reporting one such case successfully treated in our ICU.

2. Case Report

A 25 yr/F full term, second gravida, reported to emergency with labor pain. She complained of mild respiratory distress, severe headache and blurred vision.

She was admitted with working diagnosis of PIH with heart failure. Obstetric team started initial treatment with intravenous Inj. Furosemide, Inj. Labetalol, and Inj. Magnesium sulphate. Labor was induced and patient was put on non-steroidal anti-inflammatory drugs (NSAIDs) and intravenous (IV) fluids following delivery. Respiratory distress gradually increased and oxygen saturation (SpO₂) decreased. Urine output was 400 ml over 12 hours despite intensive diuretic therapy. Patient was shifted to ICU with SpO₂ - 86% while receiving 6 L/min of oxygen via Hudson mask, blood pressure (BP) 110/88 mmHg and respiratory rate (RR) 32/min.

In ICU, arterial blood gas analysis (ABG) revealed metabolic acidosis with severe hypoxemia (Pao₂/Fio₂ 98).

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Chest radiography showed bilateral fluffy opacities while lung ultrasonography (LUS) revealed numerous B lines indicating acute pulmonary edema.

2D Echocardiography showed a left ventricular ejection fraction (LVEF) 35-40% with estimated stroke volume (SV) 40 ml.

Confirmed diagnosis of PIH with ADHF and pulmonary edema was made. Conventional therapy with inodilators and diuretics failed to improve the patient condition. There was also noncompliance of BiPAP with face mask. In view of refractory edema, deteriorating SpO₂ and ABG parameters, continuous renal replacement therapy (CRRT) was initiated with the following settings: Mode – SCUF, blood flow rate (QB) 140ml/h, Net fluid removal 400 ml/h for 24 h and periodic saline flush. BiPAP with Helmet as interface, PEEP of 10 cmH₂O, pressure support of 15 cmH₂O, inflated cushion with 120 cmH₂O and a low resistance circuit of length 65 cm with a rise time of 1 millisecon was started. EF improved to 60%. SpO₂ was maintained at 99% with BNP decreasing to 300 ng/dl and then to 100 ng/ml. Dobutamine was tapered and stopped. The patient became hemodynamically stable, ABG parameters improved, hypoxemia reverted. The patient was weaned off BiPAP in the following 2 days and shifted to ward.

3. Discussion

The scottish confidential audit of severe maternal morbidity reported acute pulmonary edema as the fourth most common form of maternal morbidity.¹ Incidence of acute pulmonary edema in pregnancy vary from as low as 0.08% to as high as 0.5%. It may occur in up to approximately 3% of women with pre-eclampsia with 70% of cases occurring after birth. In the current case the patient developed pulmonary edema after delivery.¹ LUS is a simple and effective tool in diagnosing pulmonary oedema at bedside. B lines in lung ultrasound as evidenced by vertical lines till the end of field are due to fluid in interlobular septa. B lines at 7mm shows interstitial edema in inter lobular space and at 3mm indicate alveolar edema. This characteristic was used for early identification of pulmonary edema in our case.² The surviving sepsis campaign 2016 has suggested the use of dynamic parameters like stroke volume variation (SVV) to monitor fluid responsiveness,³ which was successfully utilized in this case. In CHF, measurement of BNP is useful as strong independent predictor of all relevant clinical outcomes across the whole spectrum of disease severity. It can facilitate diagnosis and guide HF therapy.⁴ The serial measurement of BNP helped in monitoring the clinical course of the patient.

Helmet (STARMED) is a novel interface better comfort, reducing the local side effects and increase the success rates during continuous positive airway pressure (CPAP) and non-invasive ventilation (NIV). Optimum effectiveness can be achieved with a PEEP of 10 cmH₂O, with an

inflated cushion of the Helmet with 120-150 cmH₂O and a low resistance circuit (22mm ID, 65 cm length, Resistance- 1.6 cmH₂O at 1 l/s) and a fast rise time. This significantly increases the pressurization and depressurization rates of the helmet and decreases the inspiratory delay, unassisted efforts and auto-triggering.⁵ When compared with facemask, helmet has been found to significantly decrease the intubation rates, 90 day mortality and increase in ventilator free days in patients with acute respiratory distress syndrome (ARDS). The higher PEEP tolerated by helmet might be the reason for its success in this subgroup of patients.⁶

Intravenous furosemide (bolus 20-40mg over 2 min) is used to promote venodilation and diuresis. Even with repeated doses of 40-60 mg (after approximately 30min) if there is an inadequate diuretic response (maximum dose 120mg/h), it is considered as diuretic resistance.⁷ In decompensated HF, ultrafiltration safely produces greater weight and fluid loss than intravenous diuretics and is an effective alternative therapy.⁸ UF for CHF is usually reserved for patients with renal failure or those unresponsive to pharmacological management. In RAPID-CHF trial, fluid removal and weight loss after 24 h was significantly higher in the UF group as compared to usual care groups.⁹

2016 ESC guidelines for diagnosis and management of patient in acute heart failure placed SCUF in Class IIb Level B recommendation for treatment of any patient with cardiac failure.¹⁰ Advantage of SCUF over diuretics are more rapid removal of fluid excess (upto 400ml/h), better improvement in symptoms, higher clearance of sodium load, isotonic fluid removal, decreased risk of electrolyte abnormalities (i.e. hypokalemia). In this case, SCUF was initiated after 3 hours of diuretics as the same did not improve the condition.

4. Conclusion

Precise hemodynamic monitoring coupled with uninterrupted NIV with helmet as interface and removal of fluid via SCUF as a novel therapy in a diuretic resistant patient was the key to a successful outcome and a life saver.

5. Source of Funding

None.

6. Conflict of Interest

The authors declare no conflict of interest.

References

1. Dennis AT, Solnordal CB. Acute pulmonary edema in pregnant women. *Anaesthesia*. 2012;67(6):646–59.
2. Zhou S, Zha Y, Wang C, Wu J, Liu W, Liu B. The clinical value of bedside lung ultrasound in the diagnosis of chronic obstructive pulmonary disease and cardiac pulmonary edema. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue*. 2014;26(8):558–62.

3. Rhodes A, Laura EE, Waleed A, Mitchell L, Massimo A, Ricard F, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. *Crit Care Med.* 2017;45(3):486–552.
4. Palazzuoli A, Gallotta M, Quatrini I, Nuti R. Natriuretic peptides (BNP and NT-proBNP): measurement and relevance in heart failure. *Vasc Health Risk Manag.* 2010;6:411–8.
5. Mojoli F, Iotti GA, Currò I, Pozzi M, Via G, Venti A, et al. An optimized set-up for helmet noninvasive ventilation improves pressure support delivery and patient-ventilator interaction. *Intensive Care Med.* 2013;39(1):38–44.
6. Patel BK, Wolfe KS, Pohlman AS, Hall JB, Kress JP. Effect of Noninvasive Ventilation Delivered by Helmet vs Face Mask on the Rate of Endotracheal Intubation in Patients With Acute Respiratory Distress Syndrome: A Randomized Clinical Trial. *JAMA.* 2016;315(22):2435–41.
7. Nieminen MS, Böhm M, Cowie MR, Drexler H, Filippatos GS, Jondeau G, et al. Executive summary of the guidelines on the diagnosis and treatment of acute heart failure: the Task Force on Acute Heart Failure of the European Society of Cardiology. *Eur Heart J.* 2005;26(4):384–416.
8. Costanzo MR. Ultrafiltration Versus Intravenous Diuretics for Patients Hospitalized for Acute Decompensated Heart Failure. *J Am Coll Cardiol.* 2007;49(6):675–83.
9. Bart BA, Boyle A, Bank AJ, Anand I, Olivari MT, Kraemer M, et al. Ultrafiltration versus usual care for hospitalized patients with heart failure: the Relief for Acutely Fluid-Overloaded Patients With Decompensated Congestive Heart Failure (RAPID-CHF) trial. *J Am Coll Cardiol.* 2005;46(11):2043–6.
10. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JGF, Coats AJS, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J.* 2016;37(27):2129–2200.

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Cite this article: Chatterjee R, Gupta L, Lopa AJ, Kulsrestha V, Gaur M. Early initiation of slow continuous ultrafiltration (SCUF) in a case of pregnancy induced hypertension (PIH) with acute decompensated heart failure (ADHF) refractory to standard medical therapy: A case report. *Indian J Clin Anaesth* 2022;9(3):402-404.