

Oliguria during Thoracoabdominal Aortic Aneurysm Surgery: A Case Report

Hyun-Joong Kim, Kuen-Su Lee, Byeong-Hwa Kim, Hyun-Don Jung and Yun-Hee Kim*

Department of Anesthesiology and Pain Medicine, Korea University Ansan Hospital, Ansan, South Korea

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*Corresponding author: Yun-Hee Kim, Department of Anesthesiology and Pain Medicine, Korea University Ansan Hospital 123, Jeokgeum-ro, Danwon-gu, Ansan-si, Gyeonggi-do, 15355, South Korea, Tel: +82-31-412-5316; Fax: +82-31-412-5294; E-mail: 4moon@naver.com

Abstract

The author et al., for this study has discovered obstructive oliguria and AKI due to atypical blood clots during thoracoabdominal aortic aneurysm surgery, and therefore is reporting this result. The patient is a 73-year-old male with aneurysm of ascending aorta and aortic arch, and was prepared for surgical replacement of aortic arch and ascending aorta. Start surgery, urine production was counted on the hour, and it was 40 ml and 5 ml, respectively. For 4 hours during CPB, urine production was 30 ml, 60 ml, 10 ml, and 5 ml, respectively, indicating presence of oliguria. End of surgery, the bladder distention was found but urine was not well drained. Consequently, cystostomy was done, and after 1 hour urine production was successfully counted. On the 12th POD, cystostomy catheter was removed, and the patient could do self-voiding about six times. And he was discharged on the 20th POD.

Keywords: Oliguria; Thoracoabdominal aortic aneurysm surgery; Post-renal AKI;

Introduction

Oliguria is a common complication during surgeries, and may evolve into Acute Kidney Injury (AKI) [1]. Three to five hours continuous oliguria predicts the development of kidney disease.

Incidence of AKI during thoracoabdominal aortic aneurysm surgery ranges from higher than other surgery [2]. One of the reasons why AKI commonly occurs during thoracoabdominal aortic aneurysm surgery is that hypovolemia and renal hypoperfusion may result from aortic clamping and Cardiopulmonary Bypass (CPB) pump. Currently, there are several ongoing studies of AKIs due to thoracoabdominal aortic aneurysm surgeries. These studies indicate a correlation between AKI and preoperative creatinine (Cr), operation time, CPB time, and clamping time [3,4,5]. However, there are still limited researches conducted on post-renal AKI such as foley catheter obstruction.

The author et al., for this study has discovered obstructive oliguria and AKI due to atypical blood clots during thoracoabdominal aortic aneurysm surgery, and therefore is reporting this result.

Case Report

The patient is a 73-year-old male with aneurysm of ascending aorta and aortic arch, and was prepared for surgical replacement

of aortic arch and ascending aorta (Figure 1). He has hypertension which was well controlled by aspirin, angiotensin receptor blocker, and calcium channel blocker, chronic obstructive pulmonary disease and Benign Prostatic Hyperplasia (BPH). At the time of admission, Blood Pressure (BP) was 120/70 mmHg, Heart Rate (HR) was 60 bpm, and serum hemoglobin level was 14.0 g/dL, serum blood urea nitrogen (BUN) was 16.6 mg/dL, serum Cr was 0.85 mg/dL, urine specific gravity was 1.020, urine pH level was 7.0, and the result of dipstick proteinuria was +1.

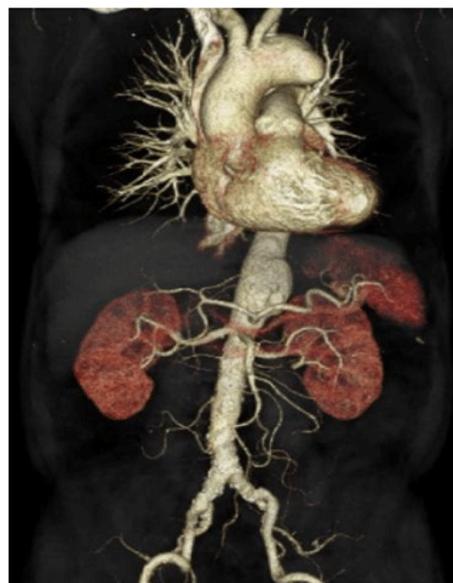


Figure 1: The patient's thoracoabdominal aortic aneurysm

At the time of entering the operation room, initial BP was 150/70 mmHg, HR was 65 bpm, and no adverse event during induction of anesthesia. During the surgery, patient's anesthesia management was under total intravenous anesthesia (2% propofol 2.5 - 3.5 ng/ml, remifentanyl 1.0 - 3.0 ng/ml), and BP was 100 - 150 / 50 - 70 mmHg; mean arterial BP was 50 - 80 mmHg during CPB. 55 minutes after induction, 14 Fr Foley catheter was inserted, and the amount of urination during the first 40 minutes resulted in 150 ml due to hematuria. After that, urine production was counted on the hour, and it was 40 ml and 5 ml, respectively.

For 4 hours during CPB, urine production was 30 ml, 60 ml, 10 ml, and 5 ml, respectively, indicating presence of oliguria. In response, we used furosemide and fluid loading was done, but oliguria did not improved. There were no signs of kinking of the Foley catheter. However end of surgery, the bladder distention was found but urine was not well drained. We were aware of the situation and immediately had a foley catheter was removed. Then we tried to insert 14 Fr and 18 Fr Foley catheter, but both failed. Consequently, cystostomy was done, and after 1 hour urine production was successfully counted.

Initial Cr level was 0.85 mg/dL, 0.87 mg/dL at 6th hour, 1.10 mg/dL at 9th hour, 1.33 mg/dL at 12th hour (immediately after the surgery), this increasing trend indicates AKI.

Patient underwent voiding cystourethrogram during the surgery, and demonstrated an enlarged urethral bulb (Figure 2). On the 2nd and 4th postoperative day (POD), bladder irrigation was done to remove blood clots which caused cystostomy catheter obstruction. On the 12th POD, cystostomy catheter was removed, and the patient could do self-voiding about six times. And he was discharged on the 20th POD.

Discussion

Oliguria refers to a condition in which there is a significant reduction in urine production; its volume is less than 0.5 mL/kg/hr. The etiology of oliguria is when 1) Dehydration and/or heart failure cause insufficient blood circulation to kidney, thereby resulting in insufficient production of urine, 2) Kidney itself is

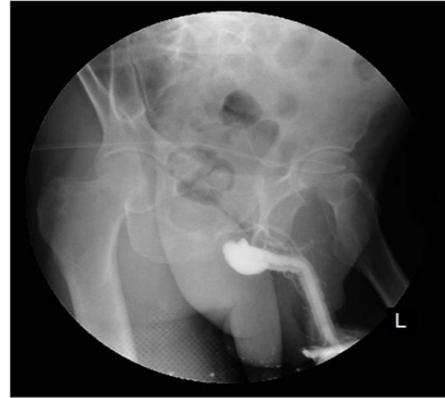


Figure 2: The Patient's urethral bulb

not producing urine, or 3) Obstruction of urinary tract affecting proper release of urine.

In this case, patient's urine out showed oliguria aspect (< 0.5 cc/kg/h) and serum creatinine was increased during thoracoabdominal aortic aneurysm surgery (0.48 mg/dL increased during surgery). It is appropriate for RIFLE risk and AKIN criteria stage 1 of AKI classification [6] (Table 1). The patient experienced oliguria as his urinary pathway was damaged by trauma and obstructed, leading to hematuria due to Foley catheter insertion caused by urethral bulb enlargement and BPH. It is assumed that hematuria led to blood clot, causing obstruction of Foley catheter.

Table 1: RIFLE and AKIN classification schemes for AKI

RIFLE	Serum creatinine criteria	UO criteria	AKIN criteria	Serum creatinine criteria	UO criteria
Risk	Increase in serum creatinine $\geq 1.5 \times$ baseline or decrease in GFR $\geq 25\%$	$< 0.5 \text{ mL kg}^{-1}\text{h}^{-1}$ for ≥ 6 hours	Stage 1	Increase in serum creatinine $\geq 0.3\text{mg dL}^{-1}$ ($26.4 \mu\text{mol L}^{-1}$) or increase $\geq 1.5 \times$ baseline	$< 0.5 \text{ mL kg}^{-1}\text{h}^{-1}$ for ≥ 6 hours
Injury	Injury increase in serum creatinine $\geq 2.0 \times$ baseline or decrease in GFR $\geq 50\%$	$< 0.5 \text{ mL kg}^{-1}\text{h}^{-1}$ for ≥ 12 hours	Stage 2	Increase in serum creatinine $\geq 2 \times$ baseline	$< 0.5 \text{ mL kg}^{-1}\text{h}^{-1}$ for ≥ 12 hours
Failure	Failure increase in serum creatinine $\geq 3.0 \times$ baseline or decrease in GFR $\geq 75\%$	$< 0.3 \text{ mL kg}^{-1}\text{h}^{-1}$ for ≥ 24 hours or anuria ≥ 12 hours	Stage 3	Increase in serum creatinine $\geq 3 \times$ baseline or serum creatinine $\geq 4.0 \text{ mg dL}^{-1}$ ($354 \mu\text{mol L}^{-1}$) with an acute rise of at least 0.5 mg dL^{-1} ($44 \mu\text{mol L}^{-1}$) or initiation of RRT	$< 0.3 \text{ mL kg}^{-1}\text{h}^{-1}$ for ≥ 24 hours or anuria ≥ 12 hours
Loss	Complete loss of kidney function > 4 weeks				
ESKD	Complete loss of kidney function > 3 months				

ESKD: End-stage kidney disease, **GFR:** Glomerular filtration rate, **RRT:** Renal replacement therapy

However, during the operation, oliguria was presented, not anuria. It is mostly because Foley catheter was obstructed partially due to blood clot. As time progressed, urine production may be reduced due to increased intravesical pressure. So it seems that the urine came out through partially obstructed folly

catheter by increased bladder pressure.

But this study limitation is that we cannot completely rule out pre-renal risk factors such as relatively long CPB time (3 hours and 30 minutes).

Oliguria and AKI during aortic surgery have multifactorial etiology [1,7]. Incidence of AKI during thoracoabdominal aortic aneurysm surgery ranges from 7.7% to 28% higher than other surgery [2]. Since hypovolemia and renal hypoperfusion is prone to occur by CPB pump in thoracoabdominal aortic aneurysm surgery, anesthesiologist is more likely to think of pre-renal factor when oliguria occurs.

So, in many studies, prerenal risk factors such as hypotension, low cardiac output, arrhythmia, cardiopulmonary bypass time, and operation time are considered to be risk factors for oliguria or AKI, but post-renal risk factors, such as Foley catheter obstruction, are not typically taken into consideration. But the authors investigated the case of a patient who experienced AKI due to Foley catheter obstruction during surgery.

During surgery, it was difficult to notice patient's bladder distention due to his unconsciousness and draping. Oliguria and AKI increase postoperative complications, so early detection is critical. If oliguria occurs during surgery and there are no prerenal factors, anesthesiologist must consider post-renal factors, such as Foley catheter obstruction. So bladder irrigation should be performed at first. If bladder irrigation is difficult to perform, checking bladder distention may be helpful to identify the causes of the patient's oliguria.

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