

Autonomic Cascade Secondary to Acute Urinary Retention in a Patient undergoing Open Reduction of Forearm Fracture under General Anaesthesia: A Case Report

LISA BARMAN¹, CHAITALI PANDEY², S GOWRISHANKAR³



ABSTRACT

Acute Urinary Retention (UR) is a common perioperative complication with incidences between 5-70%. Orthopaedic patients tend to have this complication at a comparatively higher incidence rate (8-55%) than any other surgeries. Acute UR is multifactorial and can occur irrespective of any pre-existing urological condition. Acute distension due to UR is sometimes associated with comparatively rare manifestations of cardiovascular morbidity in the form of rhythm disturbances and massive haemodynamic alterations. In this case, a 62-year-old, 50 kg female with no co-morbidities was scheduled for open reduction of a fractured right forearm under General Anaesthesia (GA) in the supine position. Towards the end of the surgery, there was an abrupt change in the patient's haemodynamics, starting from hypertension with tachycardia to hypotension with tachycardia followed by extreme bradycardia. A quick inspection revealed bladder overdistension due to the blockade of the urinary catheter. After saline flushing and decompression of the bladder, the haemodynamics returned to normal within five minutes. Acute bladder overdistension is a relatively benign complication that may prove fatal if not addressed promptly.

Keywords: Bradycardia, Cardiac arrhythmia, Intraoperative complication, Open fracture reduction, Orthopaedic procedures, Urinary catheterisation

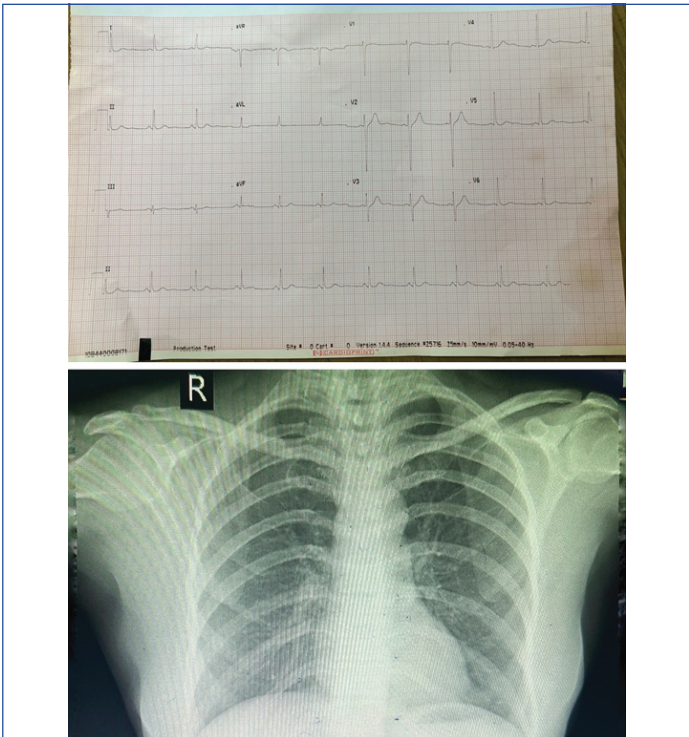
CASE REPORT

A 62-year-old, 50 kg female with a BMI of 24 kg/m² and no co-morbidities was scheduled for open reduction and plate fixation of a right-sided both bone forearm fracture following a slip and fall incident. Her preoperative clinical assessment revealed no concerning findings. The patient's investigation reports are presented in [Table/Fig-1].

Parameters	Patient's values	Normal range
Haemoglobin (gm%)	10.2	12-14
Platelets (lacs/mm ³)	3.6	1.5-4
Blood urea (mg/dL)	22	5-20
Serum creatinine (mg/dL)	0.7	0.7-1.3
Serum sodium/ serum potassium (milliequivalents/liter)	137/4.1	135-145/3.5-5
Prothrombin time (seconds)	12.7	11-13.5
INR (International Normalised Ratio)	0.9	<1.1
Urinary protein	Negative	Negative
Alanine Aminotransferase (ALT) (U/L)	29	10-40
Aspartate Aminotransferase (AST) (U/L)	32	14-40
Alkaline Phosphatase (ALP) (U/L)	67	40-125
Total bilirubin (mg/dL)	0.5	0.2-1.2
Total protein (gm/dL)	3.2	3.5-5.5

[Table/Fig-1]: Routine investigations done for the patient.

Her electrocardiogram and chest X-ray were normal as shown in [Table/Fig-2]. Initially, regional anaesthesia was planned, but the patient did not provide consent. After consultation with the orthopaedic surgeons and obtaining the patient's consent, a decision was made to proceed with general anaesthesia for an expected duration of 2.5 hours. The patient was induced with intravenous administration of glycopyrrolate 0.2 mg, fentanyl 100 µg, propofol 100 mg, and atracurium 25 mg, followed by intubation. Mechanical



[Table/Fig-2]: Electrocardiogram and chest X-ray finding of patient.

ventilation was initiated in volume control mode, and the patient was catheterised for intraoperative urine output monitoring. Initial urine output after catheter placement was 50 mL. Baseline Blood Pressure (BP) and Heart Rate (HR) were recorded as 150/90 mmHg and 76/min, respectively. The patient remained haemodynamically stable intraoperatively, despite receiving three litres of crystalloid with urine output remaining at 70 mL. Analgesia was provided with intravenous paracetamol 1 gm and diclofenac 75 mg. The patient was maintained in a supine position throughout the surgery.

Towards the end of the procedure, the patient's BP increased to 182/112 mmHg, accompanied by a heart rate of 112/min. Subsequently, BP abruptly dropped to 80/40 mmHg and did not respond to a rapid infusion of 500 mL crystalloid and intravenous mephentermine. Blood loss during surgery was estimated to be 150 mL, prompting initiation of nor adrenaline infusion at a rate of 2 µg/min to stabilise BP. With consecutive BP readings returning to normal range, nor adrenaline was discontinued. However, a subsequent BP reading after 10 minutes revealed a spike to 180/102 mmHg with the same nor adrenaline infusion rate. Nor adrenaline infusion was promptly stopped, and the following BP measurement taken after two minutes showed 60/40 mmHg with a heart rate of 138/min.

The patient experienced sudden bradycardia with an irregular heart rate of 36/min accompanied by multiple atrial ectopics. Atropine 0.6 mg was administered intravenously. Simultaneously, it was noted that the urobag collection remained at 70 mL after 2.5 hours of surgery. A brief abdominal examination indicated acute overdistention of the bladder. Following a saline flush in the catheter, 800 mL of urine was obtained in the urobag. The patient promptly recovered within seconds, and her haemodynamics returned to preoperative values within the next five minutes. The remainder of the surgery proceeded without any complications. Arterial blood gas analysis was within normal limits. The patient was successfully extubated and monitored for an hour in the Post Anaesthesia Care Unit (PACU) without any adverse events before being transferred back to the ward. Cardiology consultation was requested to investigate any potential underlying cardiac conditions contributing to intraoperative haemodynamic instability. Echocardiography revealed a normal study with mild tricuspid regurgitation and a 60% ejection fraction.

DISCUSSION

Acute bladder overdistension is a relatively common complication during and after surgery, with incidences varying widely between 5% and 70%. It is easily avoidable but often goes unnoticed [1]. UR is the inability to void in the presence of a full bladder, requiring catheterisation. It can occur after any surgery, affecting patients of both genders and all ages, irrespective of previous history of urological problems [2]. Orthopaedic patients have an increased risk of postoperative UR (8-55%) compared to other surgeries [3-5]. Acute distension may lead to undesirable autonomic symptoms such as vomiting, hypotension, hypertension, cardiac dysrhythmias, or even asystole [6]. The available literature primarily reviews lower limb surgeries, especially total joint arthroplasty of the knee and hip, creating a gap in knowledge regarding its relationship with upper limb surgeries and potentially skewing the data [7-11].

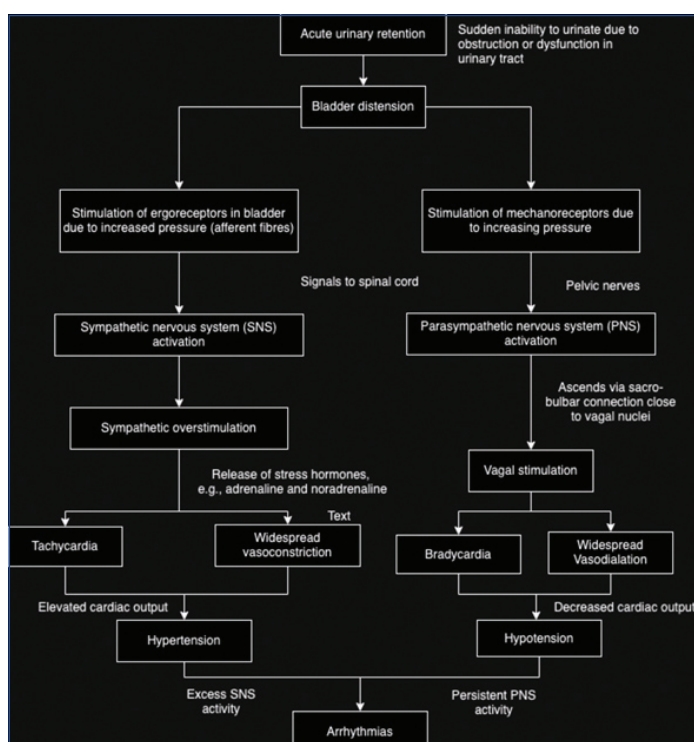
The incidence of UR is multifactorial, involving factors such as the type of anaesthesia, age, sex (with males being predominantly affected), associated co-morbidities of the patient, perioperative intravenous fluid administration, postoperative pain, requirement of analgesia, and opioids [12]. The adult bladder's capacity ranges between 400 and 600 mL. The patient experiences the first need to void at 150 mL, followed by an urge to void at 300 mL [12]. General anaesthesia affects autonomic regulation of the detrusor, causing smooth muscle relaxation, leading to retention due to atony. The sympathetic "fight and flight" response to surgical pain stimulation also results in detrusor relaxation and bladder neck contraction, contributing to retention [2].

Urinary bladder distension causing autonomic disturbances can precipitate cardiac arrhythmias [13]. In a case reported by Eggers GW Jr and Baker JJ, bladder overdistension precipitated multifocal ventricular tachycardia via neurogenic reflex [14]. Yamaguchi Y et al., reported the appearance of bigeminy in a conscious 47-year-old diabetic patient secondary to overdistension [15]. Gkoufa K et al., reported a rare case where an 85-year-old male patient with multiple co-morbidities, namely hypertension, type-2 diabetes

mellitus, benign hypertrophy of the prostate, past history of stroke, suddenly developed complete Atrioventricular (AV) block and incomplete right bundle branch block, not present beforehand, due to acute retention causing vagal stimulation. After catheterisation and complete bladder emptying, the rhythm changes resolved completely over the next 24 hours [16].

The critical aspect of the present case was that, patient was an elderly female, where UR is reported less frequently, let alone causing a range of haemodynamic changes [12,17-19]. Age is a significant risk factor for acute retention, possibly due to deteriorating neural pathways and detrusor function with advancing age, increasing the chances of retention by 1.4 times for every 10 years [17]. Another crucial risk factor for acute UR is perioperative fluid administration. Literature suggests various cut-off values for intraoperative fluid administration, but there is a general consensus that aggressive fluid management can lead to UR [12]. Firstly, in present case elderly female patient had been fasting for nearly 10 hours from the point of care and was dehydrated. Therefore, authors opted not to restrict fluid therapy as dehydration in the elderly population is quite common, and undercorrection can lead to increased morbidity [20]. Secondly, fluid maintenance was calculated according to the Holliday-Seger formula and administered fluids accordingly, considering hourly insensible losses as well.

Catheter blockage typically presents as suprapubic distension accompanied by lower abdominal discomfort, which was masked by the general anaesthesia in present case. Initially, there was a hypertensive response along with tachycardia. This can be explained by the vesico-vascular sympathetic vasoconstrictor response to overdistension, causing increased sympathetic outflow [21]. The subsequent drop in blood pressure and later bradycardia and ectopics can be explained by the vasovagal reflex due to the parasympathetic response to overdistension [22]. The pathophysiology is thoroughly discussed in [Table/Fig-3] [21,22].



[Table/Fig-3]: Pathophysiology of haemodynamic alterations and arrhythmia precipitated by acute Urinary Retention (UR).

The discussion above highlights how a seemingly insignificant issue can trigger a range of cardiovascular morbidities intraoperatively if left unrecognised. Judicious fluid management, adequate analgesia, identification of risk factors with preoperative counselling are a few preventive measures that can be routinely implemented. The next

step is to identify bladder overdistension, which can be accomplished either through the clinical method of palpating the bladder or newer modalities like ultrasonography. A bladder volume of 300-600 mL is a criterion for UR and indicates the need for catheterisation [12].

CONCLUSION(S)

Unrecognised UR leading to acute overdistension can trigger significant cardiovascular morbidity in elderly females undergoing surgery under general anaesthesia. Haemodynamic changes can present as a variety of rhythm disturbances and sudden fluctuations in blood pressure. Risk factors for UR should be identified prior to any surgery to plan for catheterisation and intraoperative fluid management. It is a benign and completely reversible condition that can potentially be fatal if not addressed promptly. It can be easily prevented through continuous monitoring, early detection, and timely catheterisation, ensuring proper function and remaining vigilant if the collected urine amount is less than expected.

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PARTICULARS OF CONTRIBUTORS:

1. Senior Resident, Department of Anaesthesiology, Pt. B.D. Sharma PGIMS, Rohtak, Haryana, India.
2. Postgraduate Student, Department of Anaesthesiology, Pt. B.D. Sharma PGIMS, Rohtak, Haryana, India.
3. Postgraduate Student, Department of Anaesthesiology, Pt. B.D. Sharma PGIMS, Rohtak, Haryana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Lisa Barman,
Department of Anaesthesiology, Pt. B.D. Sharma PGIMS,
Rohtak-24001, Haryana, India.
E-mail: barmanlisa8@gmail.com

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