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CASE REPORT

Acute renal failure after prolonged pneumoperitoneum in robot-assisted prostatectomy: a rare complication report

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Abstract Robot-assisted surgery has been used widely in urological surgery since 2000. In Taiwan, robotic surgery started in 2004 and progress has been ongoing since this time. Herein we report a case of acute renal failure post robot-assisted radical prostatectomy. The patient received postoperative hemodialysis and intensive care. The renal function recovered to a serum creatinine level of 2.0 mg/dl 2 months after surgical intervention. The renal function was still normal and the PSA level was nadir after one-year follow-up. The outcome is encouraging from the point of view of oncology. To our knowledge, this is the first report of postoperative acute renal failure in robotic surgery.

Keywords Acute renal failure · Laparoscopy · Pneumoperitoneum · Prostatectomy · Robot

Introduction

After the increasing use of laparoscopy, robotic surgery has provided a new era in minimally invasive surgery. Safety and clinical outcomes have been reported in various fields. The most common complications include ileus, deep vein thrombosis, and pulmonary embolism [1, 2]. However, postoperative acute renal failure (ARF) is a rare complication in laparoscopic surgery and has not been reported in robotic surgery. Herein we report a case of postoperative acute renal failure in a patient who had undergone robot-assisted prostatectomy.

Case report

A 63-year-old man presented with adenocarcinoma of prostate, clinical stage T1c, preoperative serum PSA level 7.21 ng/mL, Gleason score 3 + 2, and serum creatinine level 1.3 mg/dL and underwent a robot-assisted prostatectomy. This case was the 15th case of robotic prostatectomy in our institute. The intraoperative pneumoperitoneal pressure was 15 mmHg. The patient was placed in the Trendelenburg position at an angle of 30° from the horizontal with the legs split. The operation time was 400 min and intraoperative blood loss was less than 100 mL. Throughout the operation, systolic blood pressure was kept between 110 and 140 mmHg. The respiratory rate setting was 14 breaths per min. Tidal volume was controlled at 10 mL/kg. The end-tidal carbon dioxide (CO_2) level was maintained between 37 and 38 mmHg. No abnormal vital sign changes occurred during the operation. Intraoperative urine output was 300 mL. Postoperative immediate serum creatinine level was 1.8 mg/dL. Anuria developed in the first 12 h postoperatively. Perioperative gentamycin 80 mg was given in two doses. There was a mild increase in abdominal drainage levels to 500 mL per day. Sonography showed no hydronephrosis. Bilateral percutaneous nephrostomy tubes were placed, and patent ureters without urine extravasation found in antegrade pyelography. Cystography also did not show anastomosis leakage. The serum creatinine level rose to 3.8 mg/dL 12 h after operation. Pulmonary edema developed on the first postoperative day and the patient received

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hemodialysis and intensive care. Acute respiratory distress syndrome developed and consequently resulted in duodenal ulcer bleeding despite the use of antacid. Renal function recovered after comorbidity was controlled 2 months after surgery while serum creatinine level was 2.0 mg/dL. Urinary continence was satisfactory after removal of the urethral catheter. Serum creatinine level was 2.0 mg/dL and PSA level was less than 0.01 ng/mL after one-year follow-up.

Discussion

Laparoscopic surgery is considered minimally invasive and is widely used today. Robotic surgery adds a new dimension to this field and provides three-dimensional visualization and allows advanced freedom of instrumentation motion [3]. The da Vinci robotic system was introduced to Taiwan in 2004. Most robotic surgery has been performed in the urological and cardiological fields. Currently there are four systems being used to treat patients and the numbers are increasing. We believe that sharing the experience of this complication is informative for pneumoperitoneal procedures. The physiological effects of robotic surgery on the human body are similar to those of laparoscopy assisted surgery [1, 2]. Deterioration of renal function after laparoscopic surgery has been reported in various fields, including cholecystectomy, nephrectomy, and bariatric surgeries [4–7]. The common mechanisms of complications are related to: (1) increased intra-abdominal pressure (IAP), (2) CO_2 insufflation and (3) rhabdomyolysis syndrome. To obtain adequate working space, maintaining pneumoperitoneum status is required. In pneumoperitoneum status, the increased IAP is associated with decreased urine output and deterioration of renal function in animal models and humans [6–9]. The major physiological effects of increased IAP are direct renal parenchymal and vessel compression and decrease of renal arterial supply and venous drainage [8, 9]. This consequently stimulates the renin, aldosterone, and angiotensin systems, enhances renal vasoconstriction and decreases renal blood flow. Therefore renal function impairment may develop.

Insufflation with CO_2 may depress myocardial contractility through blood absorption effects and increase systemic vascular resistance, which results in a decrease in cardiac output and activates the renin-angiotensin system. Both IAP and insufflation with CO_2 increase plasma renin and angiotensin II and subsequently cause reduction of renal blood flow and deterioration of renal function. In our case, oliguria was found 6 h postoperatively at a rate of 20 mL/h. Anuria developed 12 h postoperatively.

Rhabdomyolysis after prolonged pelvic surgery has been reported in the literature. Reisider et al. concluded that the predisposing risk factors included diabetes, hypertension, exaggerated surgical position, body shape character (muscular frame or morbid obesity), hypovolemia, operation time of more than 5 h, and preexisting renal dysfunction [5]. In their study, they found the serum creatinine kinase (CK) level to be elevated to more than 5,000 U/L in all seven patients. Compared to our patient, the CK level was 1,831 U/L at the 12th h postoperatively and dropped to 10 U/L after 4 days. The patient was 62 kg preoperatively with a body mass index 20. There is no strong correlation between CK and ARF from literature review, and the possibility of rhabdomyolysis in this patient should still be considered.

In conclusion, we report the first case of acute renal failure after robot-assisted radical prostatectomy. The treatment outline included fluid balance, electrolyte correction, and prevention of secondary complication. Patients with prolonged surgery (>5 h), morbid obesity, and pre-existing renal function impairment are at higher risk of the development of rhabdomyolysis. Minimizing the operation time, adequate patient padding, and intraoperative circulation maintenance are helpful in the prevention of postoperative acute renal failure.

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