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Outcomes of robot-assisted transperitoneal pyeloplasty: Case series

Robot yardımlı transperitoneal piyeloplasti sonuçları: Vaka serisi

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Abstract

Aim: Ureteral pelvic junction (UPJ) obstruction, which restricts the passage of urine from the pelvis to the ureter may cause progressive destruction of the kidney if left untreated. Causes of UPJ obstruction include various intrinsic and extrinsic factors. Symptomatic UPJ obstruction should be treated without delay. We herein aimed to present the results of robot-assisted pyeloplasty (RAP) that we performed in our clinic.

Methods: Data of 15 patients who underwent RAP between January 2017 and 2019 in our clinic were examined. The diagnosis of ureteropelvic junction obstruction (UPJO) was based on intravenous pyelography (IVP), and diuresis renography (DTPA) was performed during follow-up. Dismembered pyeloplasty was performed on all patients with the DaVinci XI 4-arm robotic system. The results were retrospectively evaluated.

Results: The mean age of all patients was 41.3 (8.2) years. There were 7 males and 8 females. None of the cases had previously undergone pyeloplasty. While 6 of the patients had intrinsic obstruction, 9 had extrinsic obstruction associated with aberrant vascular compression. The mean operation time and duration of anastomosis were 155.3 (29.8) and 33.4 (8.1) minutes, respectively. The mean amount of intraoperative bleeding was 48 (10.2) ml. The mean hospital stay was found as 3.6 (1.1) days. There was no conversion to open surgery in any of the patients. None of the patients had intraoperative or postoperative complications. The mean follow-up time was 12.7 (5.4) months. Postoperative IVP and DTPA of all the patients were found to have improved.

Conclusion: RAP is a minimally invasive method with successful surgical and functional outcomes in the treatment of UPJO.

Keywords: Robotic Surgery, Ureteropelvic Obstruction, Pyeloplasty

Öz

Amaç: Üretero pelvik bileşke (ÜPB) darlıkları idrarın renal pelvisten üretere geçişini kısıtlayan ve gerekli durumlarda tedavi edilmezse kademeli olarak böbrek fonksiyonlarında kayıba yol açabilen bir durum olarak kabul edilir. ÜPB darlıklarını dıştan başı yada iç tıkanıklığa bağlı olabilir. Semptomatik ÜPB darlıkları tedavi edilmelidir. Biz bu çalışmamızda kliniğimizde robot yardımlı piyeloplasti (RYP) yaptığımız hastaların sonuçlarını sunmayı amaçladık.

Yöntemler: Kliniğimizde Ocak 2017 - 2019 tarihleri arasında RYP yaptığımız 15 hastanın verileri incelendi. Üretero pelvik bileşke darlığı (UPBD) tanısı, intravenöz piyelografi (IVP) ve diürez renografisi (DTPA) ile hasta muayenesi veya olası kontrolleri takiben yapıldı. Da Vinci XI 4 kollu robotik sistem kullanan tüm hastalara dismembred piyeloplasti yapıldı. Sonuçlar retrospektif olarak değerlendirildi.

Bulgular: Hastaların yaş ortalaması 41,3 (8,2) idi. Cinsiyet dağılımı 7 erkek, 8 kadındı. Tüm işlemler birincil olgularda yapıldı. Hastaların 6' sında intrinsik obstrüksiyon, 9' unda dıştan dammar basısına bağlı ekstrinsik obstrüksiyon vardı. Ortalama ameliyat süresi 155,3 (29,8) dakika idi. Ortalama anastomoz süresi 33,4 (8,1) dakika idi. İntraoperatif kanama miktarı 48 (10,2) cc olarak bulundu. Ortalama hastanede kalış süresi 3,6 (1,1) gündü. Hiçbir hastada açık cerrahi müdahale olmadı. Hiçbir hastada intraoperatif veya postoperatif komplikasyon gözlenmedi. Ortalama takip süresi 12,7 (5,4) aydı. Postoperatif IVP ve DTPA tüm hastaların düzeldiği tespit edildi.

Sonuç: Çalışmamızda tespit edildiği gibi, RYP UPBD tedavisinde başarılı cerrahi ve fonksiyonel sonuçları olan minimal bir invaziv yöntemdir.

Anahtar kelimeler: Robotik Cerrahi, Üreteropelvik obstrüksiyon, Piyeloplasti

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Introduction

Incidence of ureteropelvic junction obstruction (UPJO), the most common congenital anomaly of the urinary system, is about 1 in 20000 live births [1]. By its mechanism of occurrence, UPJO can develop due to intrinsic, extrinsic, and secondary causes. Intrinsic UPJO may occur due to changes in collagen content and the amount in muscle cells in the intercellular area or retardation of circular muscular development. The most common causes of extrinsic UPJO include lower polar vessels leading to aberrant, accessory, or early branching polar veins, which cause mechanic obstruction through external compression in ureteropelvic junction or upper part of ureter [2]. Secondary UPJO is often associated with severe vesicoureteral reflux.

The aim of UPJO treatment is to ensure appropriate transport of urine from renal pelvis, to improve renal functions if possible and to help relieve symptoms. Dismembered pyeloplasty, introduced by Anderson and Hynes, meets all these criteria, and is considered the gold-standard therapy today [3]. However, with open surgery-associated morbidities and developments especially in laparoscopic surgery, laparoscopic pyeloplasty has become the standard therapeutic approach in several European countries and the USA [4,5]. With recent technological developments, laparoscopic surgery is now being replaced by robotic surgery for its advantages such as easier intracorporal suturing and 3-D imaging [6,7].

The aim of this study was to evaluate the surgical and functional outcomes of UPJO patients who underwent robot-assisted pyeloplasty in our clinic, in line with the literature.

Materials and methods

A total of 15 patients who underwent robot-assisted pyeloplasty in our clinic between January 2016 and 2019 were included in the study. Approval was obtained from the ethics committee of Health Sciences University, Erzurum Education and Research Hospital (App. No. 2019/13-129). The same experienced surgical team performed all surgeries. Demographic data, intraoperative parameters and postoperative follow-up results of the patients were evaluated. The diagnosis of UPJO was based on patient complaints, urinary system ultrasonography (USG) and intravenous pyelography (IVP) results. Deterioration in renal functions and degree of obstruction were evaluated with diuresis renography (DTPA). For postoperative evaluation, T ½ being under 20 min. in DTPA or complete or nearly complete excretion at the 2nd-hour IVP images were considered clinical success. Patients who had previously undergone renal or upper abdominal surgery and those with bleeding diathesis were excluded from the study. Da Vinci XI (Intuitive Surgical Inc., USA) robot was used in all cases. Anderson-Hynes dismembered pyeloplasty was performed with the transperitoneal approach. All results were retrospectively evaluated.

Surgical preparation

Detailed consents were obtained from all patients prior to the surgical procedure. Anticoagulant and/or antiaggregant medication were discontinued after consultation with the relevant departments. Complete urine analysis and urine cultures were obtained from all patients to exclude urinary system infections. All patients underwent general anesthesia (GA). Bladders were catheterized with Foley catheters suitable for urethral calibration. Following surgical site cleaning, the patients were positioned with a 60^0 angle for flank approach. Pneumoperitoneum was achieved with a Veress needle or the Hasson technique through an incision approximately 1 cm lateral to the umbilicus. A 12 mm camera port was placed through the first entry point. Next, trocars were placed 4 cm cranio-medially to the spina iliaca anterior superior (SIAS) and in the intersection point of the mid-clavicular line and arcus costalis respectively under direct vision. The assistant port was placed 2 cm medially to the intersection of lines through the camera and final ports. Port placement was performed in the same way for the right or left kidneys. A trocar was placed about 2 cm below the SIAS under direct vision if the 4th arm was to be used, depending on the surgical choice. Docking was achieved by approaching the robotic unit from the back of the patient.

Surgical technique

Adhesions within the abdomen in the surgical site were removed with blunt and sharp dissections. Colon was medialized by freeing along Toldt's line. Ureter was found in the retroperitoneal region to access the renal pelvis with its guidance. All patients were subjected to Anderson-Hynes dismembered pyeloplasty. If the cause of UPJO was an aberrant vascular compression (Figure 1), anterior transposition of the pelvis was ensured to protect the vessel. All compressing tissues were excised. Severely enlarged, excessive pelvic tissue was excised and prepared for to anastomosis (Figure 2). A 4.8F, 28 cm-long ureteral stent was placed anterogradely (Figure 3). The ureteral stent was inserted into the abdomen via the 10-mm assistant port and pushed towards bladder through the open ureter with the help of the robotic arms. Ureteropelvic anastomosis was performed in the form of continuous suturation with 4/0 Vicryl sutures. Gerota's fascia was closed onto the pelvis following the anastomosis. In the final stage, intraabdominal gas pressure was decreased to perform hemostasis. Drain without a vacuum was placed in the surgical site to finalize the procedure. Port entries were closed anatomically.

Postoperative follow-up

All patients were mobilized on the first postoperative day and oral feeding was initiated following bowel movements. Foley catheters of the patients were removed after the amount of drained fluid had dropped below 50 ml. Once the drainage of fluid stopped following the removal of a foley catheter, patients' drains were removed, then they were discharged. Ureteral stents were removed with the help of a flexible cystoscope under local anesthesia at the 1st postoperative month. The patients were evaluated with IVPs or DTPAs performed in the 3rd month.

Statistical analysis

Descriptive statistics were used for the analysis of data. Continuous variables were presented as mean and standard deviation, and categorical data as number and percentages.

Results

The mean age of the patients included in the study was 41.8 years (Table 1). There were 7 are males and 8 females. Flank pain was detected in 9 of the patients. 3 had pyelonephritis. UPJ was detected incidentally in 3 patients. 3 surgical arms were utilized in all patients. The mean duration of

operation and anastomosis were 155 and 33.4 minutes, respectively. The mean amount of bleeding was 48 ml. Stasis stones were found in 3 patients. Stones were removed to ensure appropriate conditions before the anastomosis. Severely enlarged pelvic tissue that might affect urine transit time was found in 7 patients and excised to accommodate the pelvis to anastomosis. External aberrant vascular compression on the ureter was observed in 9 patients. None of the patients had intraoperative or postoperative complications. The mean hospital stay was 3.6 days, and the mean follow-up duration was 12.7 months. In postoperative follow-ups, 9 patients were evaluated with DTPA and 6 with IVP. DTPA evaluation revealed that $T_{1/2}$ had improved compared to the preoperative period and dropped below 20 minutes. During IVP imaging, complete or nearly complete excretion from the kidney was observed in the late images obtained at the 2nd hour.

Table 1: Demographic, preoperative and postoperative data

	Patient (n=15)
Age mean (SD) (year)	41.3 (8.2)
Gender (male/female)	7/8
Side (Right/Left)	6/9
UPO etiology	9
Aberrant vascular compression	6/15
Intrinsic Obstruction	
Operation time mean (SD) (minutes)	155.3(29.8)
Duration of anastomosis mean (SD) (minutes)	33.4 (8.1)
Amount of intraoperative bleeding mean (SD) (ml)	48 (10.2)
Stay hospital time mean (SD) (day)	3.6 (1.1)
Follow-up time mean (SD) (month)	12.7 (5.4)

SD: Standard derivation, UPO: Ureteropelvic obstruction

Discussion

Open pyeloplasty has managed to remain the gold-standard technique in UPJO treatment with a success rate of 90-100% for years [8,9]. Despite successful results, there has been a search for alternative minimal invasive treatments due to long recovery time associated with open surgery and high morbidity. With the development of laparoscopic surgery in parallel with technological developments, pyeloplasty found its place among surgeries as of 1993. Success rates of laparoscopic pyeloplasty are comparable to open surgery. In addition, it has various advantages such as lower morbidity and shorter recovery time [9,10]. Studies have shown that success rates of laparoscopic pyeloplasty were 88-100% [11]. Despite all these positive developments, widespread use of laparoscopic pyeloplasty has been limited due to long learning curve and difficulty of intracorporal suturing.

Robotic surgery began to be used in pyeloplasty due to advantages such as 3-D imaging, convenient intra corporal suturing techniques and mobility. A comparison between the urological use of robotic surgery (robot-assisted radical prostatectomy, robot-assisted pyeloplasty, robot-assisted partial nephrectomy) and open and laparoscopic methods found that robotic and laparoscopic methods had lower mortality and morbidity and shorter hospital stay while robotic surgery cost higher [12]. In another study comparing RAP with open and conventional laparoscopic pyeloplasty, RAP was found to be an efficient procedure with shorter hospital stay, shorter recovery time, lower morbidity and with successful surgical outcomes and robotic methods were criticized for their higher costs [13,14]. All these studies have shown that robotic pyeloplasty has important advantages such as high success rates, low amount of bleeding and shorter hospital stay [15-20]. Today, lack of obstruction and presence of urinary drainage are considered success indicators in the 3rd-month DTPA and/or IVP examinations during post-pyeloplasty follow-up [21]. In our study, none of the patients had obstructive findings in their postoperative 3rd-month follow-ups, either.

An important disadvantage that can be encountered during robot-assisted pyeloplasty is that it is not possible to use fluoroscopy due to the robotic tower. Failing to fluoroscopically evaluate patients, who have undergone stone extraction or ureteral stent placement, in terms of residual stone and stent's location during the procedure would cause that any problem that can be solved at the moment cannot be detected, leading to morbidity [22]. A study on this situation found extended duration of urinary drainage associated with the migration of ureteral stent to kidney in 3 patients and presence of residual stone in 2 patients after the RAP follow-ups of 86 patients in total. In our study, no stent migration and no residual stone in the patients with stasis stone was observed in the perioperative period. We believe that the reason is that our series had a small number of patients. Limited number of patients and lack of long-term follow-ups are limitations of our study.

Conclusion

RAP is an efficient minimally invasive treatment method in ureteropelvic junction obstructions with shorter hospital stay, lower morbidity rates and high successful surgical outcomes.

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