Partial Nephrectomy For Renal Cell Carcinoma- A Case Report

Muhammed Zafar Iqbal[1], Md. Nabid Alam[2], Mohammad Abdus Salam[3], A.S.M. Shafiul Azam[4], Md. Wahiduzzaman[5], Muhammad Serajul Islam[6], Md. Enamul Hoque[7], Mahbubul Islam Khandoker[8], A. K. Al Miraj[9]

[1]Medical Officer, Department of Urology, BSMMU, Dhaka, Bangladesh
[2]Medical Officer, Department Of Urology, BSMMU, Dhaka, Bangladesh
[3]Consultant, Department Of Urology, BSMMU, Dhaka, Bangladesh
[4]Consultant, Department Of Urology, BSMMU, Dhaka, Bangladesh
[5]Medical Officer, Department Of Urology, BSMMU, Dhaka, Bangladesh
[6]Medical Officer, Department of Urology, BSMMU, Dhaka, Bangladesh
[7]Medical Officer, Department Of Urology, BSMMU, Dhaka, Bangladesh
[8]Medical Officer, Department of Urology, BSMMU, Dhaka, Bangladesh
[9]Research Assistant, Department of Vascular Surgery, BSMMU, Dhaka, Bangladesh

Corresponding Author: Muhammed Zafar Iqbal
Medical Officer, Department of Urology,
BSMMU, Dhaka, Bangladesh

***Abstract*—Open partial nephrectomy (PN) is the standard technique for organ- sparing resection of renal tumors. A 25-year-old male presented to the urooncological services of the hospital with vague abdominal complaints. Normotensive and non-diabetic male presented to us with left loin pain for 6 months which was fixed dull aching intermittent, with no aggravating factors and relieved by medications. There was 3 episodes of pain each lasting for about 2 days. He has no history of hematuria, pyuria, lithuria, fever, dysuria, weight loss and jaundice. For this reason, he underwent a sonographic evaluation and diagnosed as left renal mass. Then he was referred to BSMMU for further management. General and systemic examination revealed normal findings. DRE was normal. Provisional diagnosis PN traditionally was done (if technically possible) in patients with renal cell carcinoma in a solitary kidney, if bilateral tumors are present, in chronic renal insufficiency or for patients with hereditary renal cell carcinoma. Today, indications for PN have considerably widened to include most renal masses that can be safely and completely removed independent of their size.**

Keywords—Partial Nephrectomy, Renal Cell Carcinoma, Kidney Sparing, Operative Steps.

I Introduction

Historically, partial nephrectomy (PN) was performed under restricted, essential conditions for patients with a tumor in a solitary kidney, bilateral kidney tumors, or for patients with chronic renal insufficiency due to intrinsic renal dysfunction or calculus disease. Due to the increased use of cross-sectional imaging for nonspecific musculoskeletal or abdominal complaints or during unrelated cancer care, approximately 70% of renal tumors are now detected incidentally at a small size (<4 cm) [1]. Although the traditional radical nephrectomy (RN) was liberally used to resect these small tumors in patients with a normal contralateral kidney, the realization that at least 20% of these tumors were benign and 25% were indolent coupled with equivalent oncological outcomes whether RN or PN was performed, lead to the current era of kidney-sparing or nephron-sparing surgery.[1] Recent data associating RN with the development of chronic kidney disease (CKD), cardiovascular morbidity, and worse overall survival when compared to PN have led to the recommendation by the 2009 American Urological Association Guidelines Committee that PN should be performed whenever technically feasible for the management of the T1 renal mass [1].

II Case Report

Open partial nephrectomy (PN) is the standard technique for organ-sparing resection of renal tumors. A 25-year-old male presented to the urooncological services of the hospital with vague abdominal complaints. Normotensive and non-diabetic male presented to us with left loin pain for 6 months which was fixed dull aching intermittent, with no aggravating factors and relieved by medications. There was 3 episodes of pain each lasting for about 2 days. He has no history of hematuria, pyuria, lithuria, fever, dysuria, weight loss and jaundice. For this reason, he underwent a sonographic evaluation and diagnosed as left renal mass. Then he was referred to BSMMU for further management.

General and systemic examination revealed normal findings. DRE was normal. Provisional diagnosisAbdominal ultrasonography revealed a left-sided renal mass lesion. Computed tomography (CT) scan confirmed a left-sided mid-polar mass of about 5 cm in diameter [Figure 1a and b]. A clinical diagnosis of renal cell carcinoma was made, and the patient was posted for partial cystectomy. PN was done under general anesthesia.

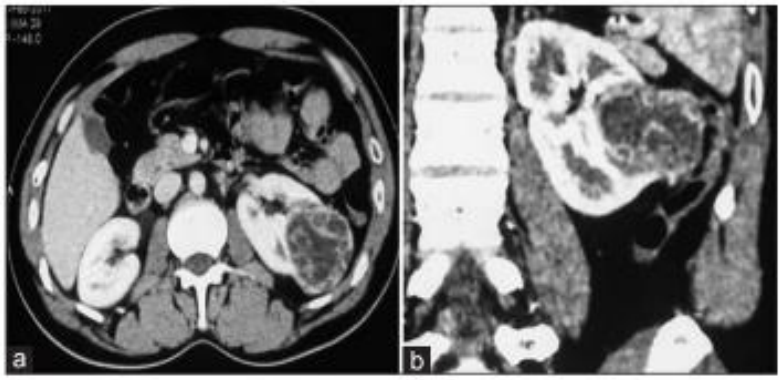

Figure-1: (a and b) Computed tomography scan shows a left-sided mid-polar mass of the size 5 cm×5cm.

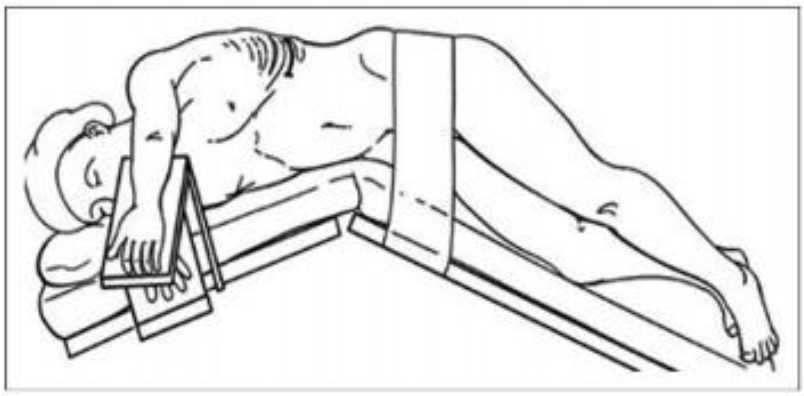

Figure 2: Standard flank position.

Preoperative Assessment And Surgical Planning:

Medical comorbidities especially affecting the cardiovascular system and kidney were investigated in detail. History of heavy cigarette smoking, hypertension, diabetes, and coronary artery disease was noted in detail, and a detail physical examination was performed preoperatively. These factors are known to contribute to perioperative complications and may also be etiological factors in the development of kidney cancer. Cardiac status was evaluated by performing echocardiogram, stress test, and carotid duplex studies. In addition, estimated glomerular filtration rate was calculated as it is well known that

approximately 26% of patients undergoing PN have CKD which they were unaware of. [2] A careful evaluation of all imaging pictures was done. It is very important to note that a renal mass should not be operated without a noncontrast CT image to rule out the possibility of detecting macroscopic fat indicative of angiomyolipoma[3], and a contrast-enhanced study (magnetic resonance imaging, CT, or renal perfusion/ excretion scan) indicating bilateral renal function. "Renal protocol" CT imaging, consists of 3 imaging sequences including precontrast, corticomedullary phase, and late nephrogenic excretory phase, provides a high degree of diagnostic accuracy in diagnosing renal cortical tumors (100% specificity, 95% sensitivity)[4] but cannot determine if the mass is benign or malignant. Ultrasound can fully characterize cystic lesions and serves as an effective template for intraoperative ultrasound which can be highly effective in locating small subcortical renal tumors.

Technique Of Open Partial Nephrectomy:

An effective flank incision is the supra-11th rib "mini-flank" retroperitoneal approach which provides rapid and excellent exposure to the kidney without the need for a rib resection [5]. With the patient in the standard flank position [Figure 2], a 8–10 cm extraperitoneal incision is performed between the bed of the 10th and 11th ribs. The latissimus dorsi, external oblique, and internal oblique muscles are transected, and the transversus abdominis is divided in the direction of its fibers while preserving the intercostal neurovascular bundle. Using blunt dissection, the peritoneal cavity is mobilized medially, the perinpehric soft tissues laterally, and the diaphragmatic fibers and pleural superiorly. A small incision in the plane between the soft tissues overlying the psoas muscle and Gerota's fascia is then bluntly developed exposing the kidney, ureter, and ipsilateral great vessel (vena cava, aorta). The Bookwalter retractor (Codman and Shurtleff, Inc., Raynham, MA, USA) is placed using the bladder blade attachment to retract the 10th rib and rib cage superiorly, while the short right angle blade retracts the 11th rib inferiorly. A malleable blade retracts the peritoneal cavity and its intestinal contents medially. Careful dissection is conducted to isolate the ureter, renal artery, and renal vein, each of which is surrounded by a different colored vessel loop. On the left side, division of the gonadal vein and adrenal vein liberate the renal vein more fully, facilitate identification and isolation of the renal artery, and allow for substantial upward mobilization of the renal hilum and easy access to the entire kidney. Dense lymphatic vessels that commonly surround the renal artery are ligated and divided further facilitating upward mobilization of the kidney which allows a decrease in venous bleeding during the tumor resection and allows easy identification and repairs of rents in renal sinus veins. After the renal hilum has been fully dissected, the upper pole of the kidney is separated from the adrenal using blunt dissection between the two, and perforating vessels and soft tissues are ligated and divided. With the kidney completely mobilized, careful palpation and inspection of its entire surface are performed to confirm the presence of the tumor and seek any satellite lesions. All preoperative imaging is available in the operating room, and intraoperative ultrasound is routinely utilized to confirm the presence of the tumor, seek satellite lesions, and assess the proximity of the tumor to intrarenal veins and to determine if there is an intrarenal vein thrombus or tumor encroachment upon the renal collecting system [5]. Occasionally, a polar segmental artery may feed the exact tumor-bearing area of the kidney. Ligation and division of this artery allow for a "regional ischemia" and precise resection with little damage to nontumor-bearing kidney. When there is a completely intrarenal tumor without any evidence on the renal cortical surface, measurements from each pole of the involved kidney in millimeters are made using the preoperative CT scan with subsequent corresponding marks made on the renal cortex; the position of the endophytic tumor is then confirmed precisely with the intraoperative ultrasound. For a purely exophytic tumor or in a patient with significant underlying CKD, resection of the tumor without renal artery occlusion is carried out.[6] For other patients with large, endophytic, or perihilar tumors who require renal artery occlusion, renoprotective measures including mannitol infusion (12.5 g/200 ml of normal saline) and ice slush are routinely used. It is no longer necessary to place the kidney in a plastic bag before ice slush placement since the small surgical mini-flank incision does not lead to patient hypothermia. In no cases of open PN is renal artery occlusion used without such renoprotective measures recommended (warm ischemia). Once the tumor is isolated with its surrounding perinephric fat, the renal cortex is scored with a 1 cm margin using the electrocautery [Figure 3].

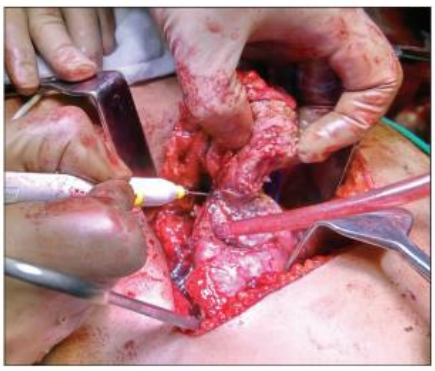

Figure 3: A 5mm margin created around the exophytic tumor and the tumor excised with sharp dissection.

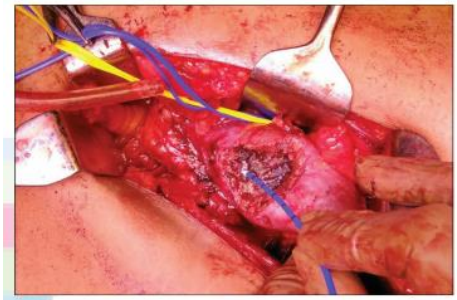

Figure 4: Following excision of the tumor, the bed is sprayed with argon beam coagulator.

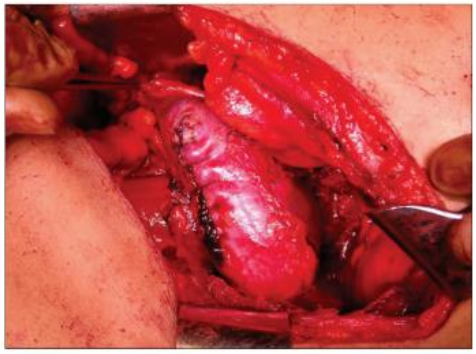

Figure 5: The parenchymal margins approximated over surgical.

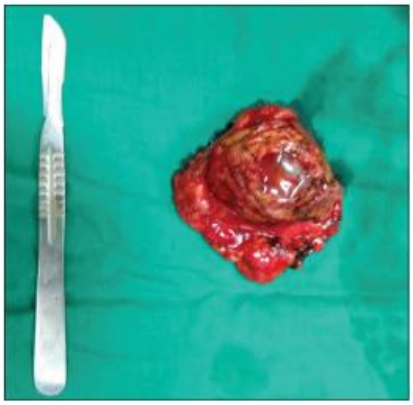

Figure 6: Excised specimen.

Sharp scissor dissection is utilized with a careful eye to keep the plane of surgical dissection within the renal cortex (pink kidney tissue) and not get too close to the renal tumor and its pseudocapsule. If dissection is too close, readjustment to a deeper plane of dissection is made. Once the renal sinus is entered beneath the tumor, 3–0 absorbable sutures are used to close any open small veins and arteries or breaches in the collecting system both to secure these structures and provide upward traction on the kidney. A later search for venous bleeding can be accomplished by simply dropping the kidney into the wound and then raising it again. Once the specimen is delivered, it is carefully inspected to be certain that the lesion is intact and that there is a complete covering layer of kidney and soft tissue. The deep tumor surgical margin is marked with a silk suture to orient the specimen which is then delivered to the pathology department fresh and in sterile condition. Frozen section of the deep margin and specimen can provide immediate reassurance to the surgeon and family, but a final pathological diagnosis of the renal cortical tumor may not be available by frozen section due to the need to perform immunohistochemical or cytogenetic analysis. With the aid of ×2.5 loupe magnification, defects in collecting system and small vessels are easily identified and closed/ligated using 3–0 or 4–0 absorbable suture with special care taken to separately repair veins and arteries and avoid large bulky deep bites into the renal sinus which could cause an iatrogenic arteriovenous fistula or pseudoaneurysm. Endophytic tumors can emanate from elements of the renal cortex facing the renal sinus and be impalpable. Intraoperative ultrasound is essential to precisely locate the tumor and plan the nephrectomy incision. Cold ischemia with ice slush is utilized. Access to the renal sinus is achieved by going through the cortex preferably in avascular plane (Brodel's line) whereupon the renal tumor is palpated and carefully resected with care being taken not to get too close to the tumor or enter its pseudocapsule. Following ligation of all renal sinus vessels and collecting system repair, the argon beam coagulator [Figure 4] is used on the parenchymal surface and perinephric fat, and hemostatic agents such as FloSeal (Baxter, Deerfield, IL, USA) and Surgical

packing (Johnson and Johnson, New Brunswick, NJ, USA) are then placed in the resection cavity. Zero chromic blunt-tipped liver sutures are then placed between pledgets of surgicel to reapproximate the edges of renal cortex and close the resection cavity [Figure 5]. The renal artery is unclamped, and gentle pressure over the entire kidney is utilized for 3–5 min. If no bleeding is observed and the collecting system was entered, a closed suction is placed through a separate stab wound in the retroperitoneal space in a dependent position posterior to the kidney. For exophytic tumors excised [Figure 6] completely without entry into collecting system, the drain can safely be omitted. If oozing from the resection bed persists, another 5 min period of gentle compression is applied. If brisk arterial bleeding is observed, inspection of the surgicel bed and ligation of the bleeder is performed. Reclamping of the renal artery is avoided to prevent reperfusion injury to the kidney. The surgicel incision is closed in 2 layers using # 1 polydioxanone, and the skin incision is reapproximated using 4–0 absorbable sutures in a subcuticular fashion. Postoperatively, the patient had an uneventful recovery. Histopathological examination of the tumor features of clear cell carcinoma, with areas of hemorrhage and necrosis amidst the neoplastic cells. The renal capsule and compressed renal tissue beyond the neoplasm showed no invasion.

III Discussion

When technically feasible, PN is the preferred method of choice for managing most renal masses to preserve maximum renal function. While in the past, PN was reserved for specific conditions (bilateral tumors, tumor in a solitary kidney, patient at high risk of future renal failure) and small tumors <4 cm in diameter;[7] indications for PN have considerably widened to include most renal masses that can be safely and completely removed independent of their size [8,9]. NSS is considered the treatment of choice for localized small renal masses,[10] with oncological outcome comparable to RN, and advantages of preserving renal function and lowering cardiovascular mortality and morbidity [11,12,13,14]. Because chronic kidney disease (CKD, glomerular filtration rate <60 mL/min/1.73 m^2) is more prevalent in a RCC patient, [15,16] the benefit of NSS can be appreciated in this study from Memorial-Sloan Kettering that found the incidence of new-onset CKD in patients with normal serum creatinine and two functioning kidneys, who had underwent NSS and RN for small renal masses, to be 17% and 69%, respectively [16]. There is mounting evidence in the literature that tumor characteristics rather than surgical approach determine CSS and OS [17,18]. This evidence led to the expansion of the utility of NSS in tumors larger than 4 cm and locally advanced RCC. In a study by Margulis *et al*., the oncological efficacy of NSS versus RN in patients with locally advanced RCC was compared. In the comparison of 34 patients undergoing NSS and 567 patients undergoing RN, the CSS curves demonstrated comparable outcome [19]. In a recent analysis of the SEER database of RCC by Hellenthal *et al*., 15% of patients diagnosed with RCC already have metastatic disease at presentation, 13% of whom have renal tumor ≤4 cm. Only 26% of those patients were candidates for surgery. Interestingly, around 10% of the candidates underwent NSS [20]. There is a scarcity of data in the literature regarding the role of NSS in the setting of metastatic disease. Marberger *et al*. were the first to report the feasibility of NSS in three patients in 1981 [21]. Bazeed *et al*. reported on two patients with metastatic disease who underwent NSS and died of disease progression 3 years postoperatively [22]. Morgan and Zincke described six patients with metastatic disease who underwent NSS, four of whom died after 2 years secondary to disease progression [23]. Long *et al*. reported on two patients who had metachronous tumors in a solitary kidney after immunotherapy; both of them were tumor free for at least 11 months [24]. In 1996, Krishnamurthi *et al*. retrospectively reviewed 15 patients who underwent NSS for MRCC because of a solitary kidney or CKD secondary to hypertension or diabetes mellitus [25]. The benefit of NSS in mRCC was noted in 93% where the need for hemodialysis was obviated. The study was limited in its inability to calculate pooled CSS for all the patients due to the heterogeneity of their characteristics, load of metastasis and adjuvant treatment received. Nonetheless, the study concluded that NSS may confer extended survival.

IV Conclusion

Given the above-mentioned limitations, NSS, when feasible, may be a viable option for surgical debulking in metastatic RCC. For patients with primary tumors amenable to NSS, established prognostic factors can be used for patient selection. Patients most likely to benefit from a nephron-sparing approach are those for whom RN is not feasible due to preexisting renal impairment and patients with limited metastatic disease expected to enjoy prolonged survival with a combination surgical intervention and systemic therapy.

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