



Problems & Panaceas of Open Radical Nephrectomy in Massive Renal Cell Carcinoma

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Abstract

From 1969, since Robson and colleagues established radical nephrectomy, it has become the gold standard approach for Renal cell carcinoma. Open radical nephrectomy is the surgical option of choice for massive renal cell carcinomas with reported complication rates of 2-7%, with hemorrhage being the most common intraoperative complication. Injury to adjacent structures like bowel, pancreas and liver, injury to great vessels, inadequate exposure owing to massive tumor all possess major intraoperative difficulties. Prompt identification of the complication and its timely intervention are often a herculean task for the operating surgeon. Proper anatomical knowledge and adequate operative field visualization are the two cornerstones which provide a base for addressing these intraoperative difficulties. Little role of minimally invasive procedures in massive renal tumors further mandates adopting newer technical measures to decrease complication rates in open surgeries. In this article we explained the intraoperative difficulties faced in few of our massive renal cell carcinomas in tertiary care center of north east part of the nation, discussing the various other intra operative complications and possible/practical ways to deal with it.

Abbreviations: RCC (Renal cell carcinoma), ORN (Open radical nephrectomy), IVC (Inferior vena cava)

Keywords: Massive renal cell carcinoma, Open nephrectomy, Radical nephrectomy, Intraoperative complications

Introduction

From 1969, when Robson and colleagues established radical nephrectomy, it has become the gold standard approach for localized renal cell carcinoma (RCC) [1]. With the advancement in knowledge certain components have been excluded from conventional radical nephrectomy like adrenalectomy, extended lymphadenectomy, etc. without compromising oncological principles [2]. But still, the intra operative complication rate for radical nephrectomy is always on the higher side, especially in massive renal cell carcinoma. Contemporary series of open radical nephrectomies report complication rates between 2-7% [3]. Very little role of minimally invasive procedures in massive renal cell carcinoma, further mandates adopting certain technical measures to decrease complication rates in open surgeries. In this article, we analyzed the intra operative complications encountered in three massive renal cell carcinoma cases and techniques adopted to tide over those complications.

Case Presentation

Case 1

A 51-year female presented with severe hematuria and abdominal pain for 3 months. Patient underwent RT PCR for COVID 19 on admission and shifted to the ward after negative report. On abdominal examination, 20x10 cm mass was present in the right loin extending to the right hypochondrium. On imaging, heterogenous mass of size 15x14 cm involving the upper and mid pole of right kidney was present. The lesion was abutting the IVC (Inferior vena cava) medially with no frank invasion, no tumor thrombosis was seen in renal vein or IVC. Multiple liver metastasis were present in the both lobes with multiple paraaortic nodal involvement. Left kidney was found to be normal. On DTPA Scan, only 4.36 differential function was present in right kidney and 95.64 in left kidney. Patient's hemogram showed a hemoglobin of 3.8 g/dl and underwent multiple blood transfusions for the same. In view of non-functional right kidney and severe hematuria, patient was planned for a palliative nephrectomy. Transperitoneal approach was preferred due to the sheer size of the tumor. On opening the abdomen through the midline, apart from multiple liver metastasis, huge right renal mass was seen occupying the entire right half of the abdomen. The mass along with enlarged liver with multiple liver metastasis resulted in poor exposure of operative field with midline incision, warranting a right lateral extension of the incision. Hepatic flexure and transverse colon were completely displaced from their original position with mass abutting the transverse mesocolon. Careful mobilization of transverse mesocolon from the renal mass carried out meticulously in order to prevent injury to the middle colic vessels. During mobilization of the colon, multiple tortuous parasitic vessels were encountered, which resulted in bleeding. Intra operative hypotensive anesthesia helped in controlling these bleeders. Finding the renal pedicle in a huge renal mass is a herculean task. Retrograde tracing of IVC to find the renal pedicle, prevents inadvertent injury to the renal pedicle. On mobilizing the lower pole, the pedicle was found closer to it, which was then doubly ligated and divided. Pre-operative evaluation of imaging by the operating surgeon, helps in defining the renal vasculature better intra operatively. After ligating the renal pedicle and dividing the ureter as low as possible, mobilization proceeded to upper pole, with both blunt and sharp dissection. Due to large size of the mass, unintentional traction while mobilizing upper pole resulted in lateral injury of IVC near diaphragmatic hiatus (Figure 01). Specimen was taken out immediately, vascular clamps applied and primary repair was done to control the IVC bleeding. The renal lesion was closely abutting liver as well, resulting in liver injury during manipulation (of large renal mass), which was managed with hemostatic devices. Complete hemostasis achieved and wound closed in layers. The tumor weighed about 2.5 kg with 17x14x9.5 cm³ dimension. Post operatively patient shifted to intensive care unit for post-operative monitoring. Final HPE report revealed papillary renal cell carcinoma with clear cell changes.

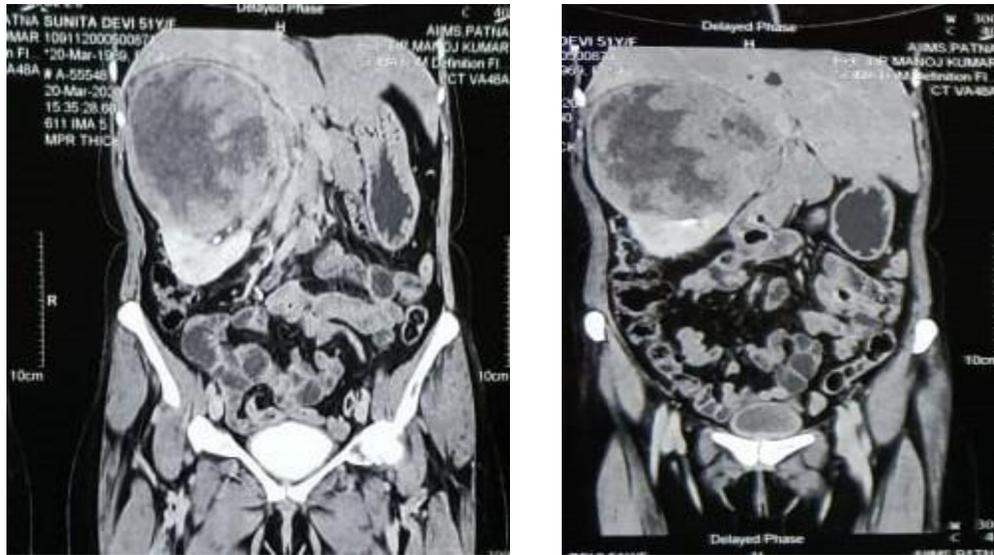


Figure 01: CECT Abdomen shows renal pedicle (red arrow) near the lower pole, this preoperative evaluation helps in intraoperative search for renal pedicle. The area of liver invasion (short arrow) and IVC abutment (dotted arrow) shown in the picture.

Case 2

A 35-year male presented with complaints of abdominal mass lump for 1 year and severe intractable pain for past 15 days. Patient underwent COVID 19 testing and on negative report, was shifted to respective ward. On abdominal examination, approximately 20x20 cm² lump was palpable occupying the entire abdomen. On imaging, 24x21 cm² heterogenous lesion was seen arising from upper pole of left kidney with few calcifications within (Figure 02). No thrombus was visualized in the renal vein. There was no evidence of nodal or distant metastasis. Patient had intractable pain due to compression by the massive malignancy, which was not controlled with analgesics. Therefore, a left radical nephrectomy was planned after informing him of the risks and benefits. On entering the abdomen, a huge mass was seen occupying the entire abdomen pushing the small bowel to pelvis; pancreas was seen compressed and stretched over the anterior surface of the mass in upper aspect; transverse colon seen stretched out over the lower part of the mass. Multiple collaterals were seen around the renal mass. As with the previous case, left lateral extension of midline incision made for adequate exposure. Hypotensive anesthesia was advised during mobilization. We encountered an inadvertent pancreatic injury (minimally in the inferolateral aspect) due to the massive malignancy stretching out the pancreatic parenchyma, which was then secured with suture ligation. Multiple parasitic vessels were encountered during posterior surface mobilization resulting in significant bleeding. Therefore, blunt dissection carried out with surgical pads, by placing it beneath the mass in a sequential manner. Modern devices like LigasureTM/Thunder BeatTM help in tackling these parasitic vessels for better hemostasis.

Renal pedicle identified by retrograde manner from IVC, ligated and divided. After specimen retrieval, the surgical pads are removed one by one and any evident bleeders were secured. The tumor weighed around 6.35 kg with 25x24x16 cm³ dimension (Figure 03). Patient had an uneventful recovery, with the final HPE revealing chromophobe variant of renal cell carcinoma.



Figure 02: Left renal mass completely occupying the left side of abdomen, with total displacement of surrounding structures.

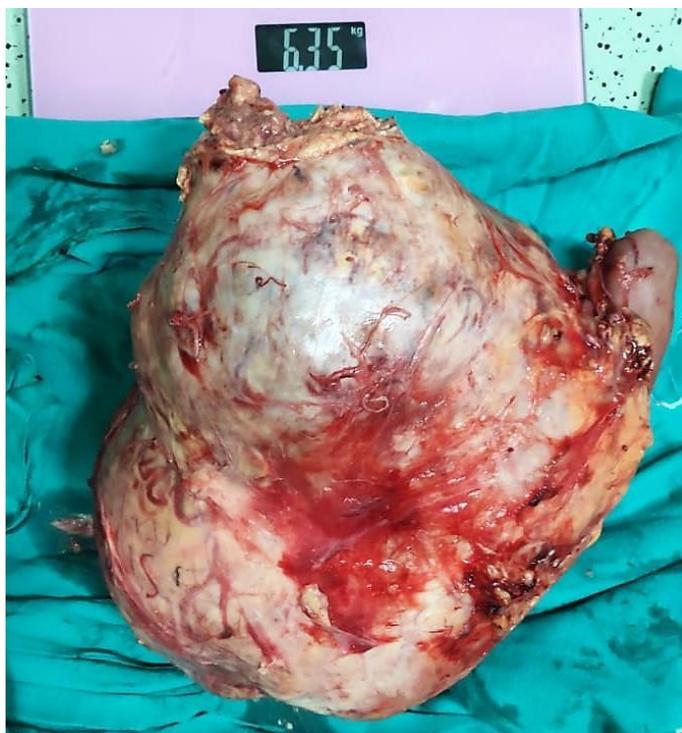


Figure 03: Postoperative specimen of massive renal tumor weighing 6.35 Kg, with area of tumor rupture near superior pole (straight arrow) and normal pole (dotted arrow)

Case 3

60-year-old male patient admitted with complaint of abdominal lump, pain and hematuria. On evaluation, the CT imaging showed 20*24 cm huge right renal mass with grossly dilated renal pelvis with heterogenous solid component predominantly on the upper pole of right kidney. Patient had multiple bilateral lung metastasis. In view of severe abdominal pain and hematuria, patient planned for cytoreductive nephrectomy. Intra operatively, grossly dilated renal pelvis noted with large renal mass of size 20* 28 cm noted. The mass found to be involving right hemidiaphragm and some part of adjacent liver bed. After adequate mobilization was done as mentioned in previous cases. Sequential mop placement technique used to separate mass abutting the liver. Resection of right hemidiaphragm done with renal mass. Hemostasis secured. Diaphragm repair was done primarily. The tumor weighed around 3.4 kg. patient had an uneventful post op recovery.

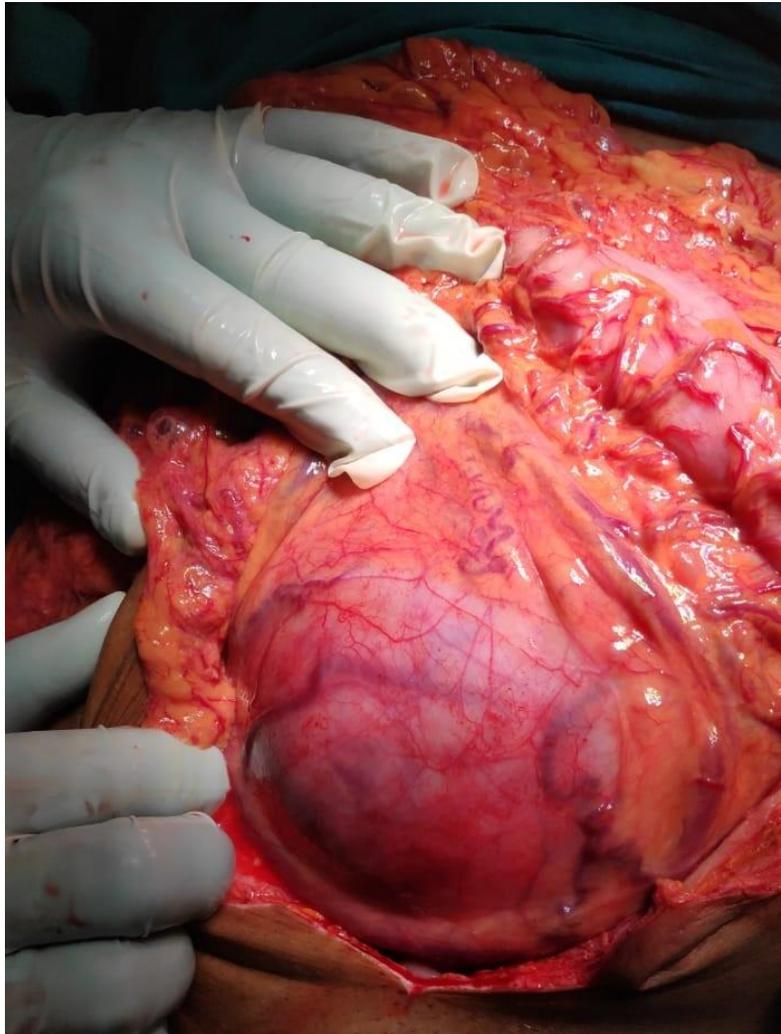


Figure 04: Massive renal tumor with multiple parasitic vessels over the surface, displaces the transverse colon to left. Note: Mesocolic vessels (dotted arrow) are running close to parasitic vessels (small arrow).

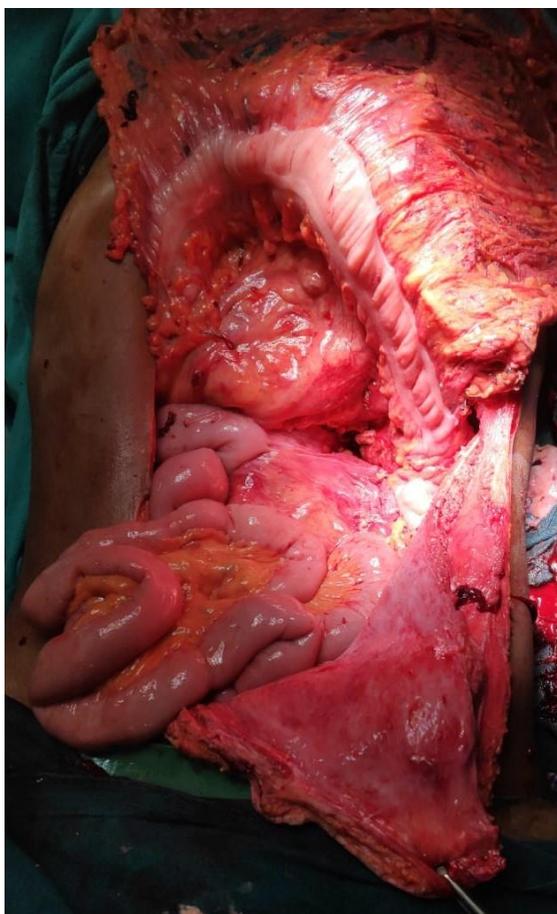


Figure 05: Intraoperative picture showing the post resection field. The lateral extension of midline incision given for adequate field visualization.

Discussion

In 1861, the first documented nephrectomy was done by Wolcott, who operated a renal tumor mistaking it to be a hepatoma. Later in 1969, when Robson and colleagues established radical nephrectomy, it had then become the gold standard approach for localized RCC (renal cell carcinoma) [1]. Currently, first choice of treatment for RCC even in the presence of metastasis is Radical (cytoreductive) Nephrectomy [4]. A broad spectrum of treatment modalities has come into role for RCC, from partial nephrectomy to thermal ablation. But radical nephrectomy still holds its place for centuries together, especially in massive tumors. Goel et al reported that the complication rate of laparoscopic nephrectomy was 11% compared with 15% in open nephrectomy [5]. The complication rate for open nephrectomy further increases for massive tumors, the most common being hemorrhage [6]. In this article, we have discussed the intraoperative difficulties faced in dealing with massive renal tumors and possible intraoperative remedies/panaceas.

A) Bleeding is the commonly encountered complication in radical nephrectomy. Venous bleeding is more common than arterial with the incidence of approximately, 1.8% and 1.0% respectively [7]. The potential sites for bleeding are

1. Entry of lumbar veins into the postero-lateral surface of IVC
2. Entry of right gonadal vein into antero-lateral surface of IVC
3. The point where lumbar vein crosses the left renal vein posteriorly
4. Short right renal vein which can avulse without care
5. Parasitic vessels on posterior surface of tumor mass

Location of the kidney and proximity to great vessels poses difficulty in attaining hemostasis, resulting in life threatening hemorrhage. The possible ways to prevent this and thereby decreasing intraoperative mortality are

Remedies

1. Hypotensive anesthesia with systolic pressure around 90 mm Hg.
2. Blunt dissection of posterior surface with sequential placement of surgical pad for adequate hemostasis
3. Use of modern hemostatic device like Ligasure™/Thunder Beat™
4. Proper identification of the renal pedicle

In massive RCC, identifying the renal pedicle is a demanding task for the operating surgeon. Improper knowledge of renal pedicle with overzealous mobilization of renal mass results in renal pedicle injury and sudden massive blood loss. Ways to proper identification of renal pedicle are

Remedies:

1. Retrograde tracing of renal pedicle from IVC. Due to distorted anatomy near the hilum owing to massive tumor, it is often advisable to start tracing the IVC from a relatively virgin field near the bifurcation of common iliac vessels and tracing it in a retrograde fashion cranially to find renal pedicle.
2. Tumor mobilization and renal pedicle identification should go hand in hand. Renal pedicle identification without initial mobilisation is not possible owing to massive size of the tumor. Overzealous mobilization of mass without adequate knowledge about the location of renal pedicle would result in devastating bleeding. Therefore, appropriate initial mobilisation done to expose the IVC, helps in retrograde tracing of renal pedicle and facilitates pedicle ligation.
3. Pre operatively, analyzing the Computed tomography (CT) imaging by the operating surgeon to identify the exact location of renal pedicle, helps in intraoperative search for pedicle (Figure 01). Arterial bleeding is less common but more lethal. Once renal pedicle identified, renal arterial ligation done first, but it is not possible always owing to multiple collaterals.

B) Bowel Injuries

While using the thermal sources for hemostasis, surgeon should be precise enough to prevent thermal injuries to bowel. Care must be taken to prevent injury to duodenum on right side. Huge renal tumor completely distorts the normal anatomy of adjacent structures, makes the anticipation of vital structures more difficult. Injury to duodenum is devastating and needs to be repaired immediately. Next common site for bowel injury is hepatic flexure and transverse colon. In massive RCC, transverse mesocolon is closely adherent to renal mass, identifying the mesocolic vessels from parasitic vessels of renal mass is often difficult, resulting in damage to mesocolic vessels and resultant ischemic bowel injuries (Figure 04).

Remedies:

1. Adequate exposure by lateral extension of midline incision (Figure 05)
2. Sharp dissection near bowel
3. Use of modern thermal device with less collateral thermal damage helps in reducing bowel injuries

C) Associated Organ Injuries:

Care must be taken to prevent adjacent structures injuries while mobilizing massive renal mass. Injury to liver on right side, pancreas & splenic vessels on left side and diaphragmatic and pleural injuries while mobilizing the upper pole of the tumor are mostly unavoidable while dealing with massive RCC. Incidence of Liver injury is 1.1%, usually controlled with hemostatic devices or sutures [7]. Pancreatic injuries should be immediately sutured with non-absorbable sutures to prevent lethal post-operative pancreatic fistula. In unavoidable circumstances, resection of distal injured pancreas with splenectomy is also needed.

D) IVC injuries carry a high mortality rate of around 65% [8]. But this high mortality depends on severity of injury and these numbers are less for nephrectomy, but still, it poses a distressing situation for the operating surgeon. Injury to IVC is more common on right side, due to the short renal vein. Presence of IVC thrombosis further increases the risk. Inadequate exposure and space to work, due to the presence of the liver, further increases the IVC injuries on right side. Smaller rents are usually repaired primarily by the operating surgeon, larger rents mandate a vascular surgery patch repair or reconstruction. Direct repair of larger injuries results in narrowing of IVC and possible thrombus formation [9]. The mortality rate during surgery in radical nephrectomy is 2.04% [10]. Anticipation, gentle handling of renal mass in medial aspect and smooth coordination with vascular team, decreases the intra operative mortality.

E) COVID 19 Influence:

As both the cases operated in COVID 19 era, despite negative results on admission, both the patients were considered as potential candidates due to ongoing hospital stay & rapid surge of COVID 19 cases in India. There were no post-operative respiratory complications (pneumonia/ARDS), wound complications, deep venous thrombosis and need for any assisted ventilatory support. To our surprise, despite being a supramajor surgery in this COVID 19 era, both the patients had a normal postoperative recovery. Though this is a small number to stretch the results, this normal recovery encourages us to conduct more oncological procedures with due precautions.

Conclusion

In massive Renal cell carcinomas, the operating surgeon is left with no options other than radical open nephrectomy. Despite being an open procedure, Radical nephrectomy comes with its own intra operative complications. Proper anatomical knowledge and adequate operative field visualization are the two cornerstones providing a base for addressing the intraoperative difficulties. As the saying goes, “experienced surgeons produce less complications because they had already done enough before”. This article was intended to provide or share those valuable experiences to young surgeons while dealing massive renal tumors and ways to minimize to these avoidable errors.

References

1. Herr HW. A history of partial nephrectomy for renal tumors. *J Urol* 2005;173(3):705-708.
2. DeVita, V. T., Jr., Lawrence, T. S., & Rosenberg, S. A. (2019). *DeVita, Hellman, and Rosenberg's cancer: Principles & practice of oncology* (11th edition.). Philadelphia: Wolters Kluwer.
3. Heldwein Flavio L., Mccullough T. Casey, Souto Carlos A. V., Galiano Marc, Barret Eric. Localized renal cell carcinoma management: an update. *Int. braz j urol.* [Internet]. 2008 Dec [cited 2020 July 20]; 34(6): 676-690.
4. Ljungberg B, Cowan NC, Hanbury DC, Hora M, Kuczyk MA, Merseburger AS, et al. EAU guidelines on renal cell carcinoma: the 2010 update. *Eur Urol* 2010; 58: 398–406 doi: 10.1016/j.eururo.2010.06.032
5. Goel MC, Modlin CS, Mottoo AM, et al. Fate Of Donor Kidney: Laparoscopic Versus Open Technique. *J Urol.* 2004;172(6 Pt 1):2326-2330.

6. Corman JM, Penson DF, Hur K, Khuri SF, Daley J, Henderson W, et al.: Comparison of complications after radical and partial nephrectomy: results from the National Veterans Administration Surgical Quality Improvement Program. *BJU Int.* 2000; 86: 782-9.
7. Sergio Fernández-Pello Montes, Ivan Gonzalez Rodríguez, Rodrigo Gil Ugarteburu, Luis Rodríguez Villamil, Begoña Diaz Mendez, Patricio Suarez Gil. Intra operative laparoscopic complications for urological cancer procedures. *World J Clin Cases.* 2015 May 16; 3(5): 450–456.
8. Paul JS, Webb TP, Aprahamian C, Weigelt JA. Intraabdominal vascular injury: are we getting any better? *Journal of Trauma and Acute Care Surgery.* 2010;69(6):1393–1397.
9. Sathiamurthy N, Tan WJ. Abdominal Stab Wound with Inferior Vena Cava Injury: A. *Med J Malaysia.* 2014;69(6):291.
10. Scott Rf Jr & Selzman HM. Complications of nephrectomy: review of 450 patients and a description of a modification of the transperitoneal approach. *J Urol* 1966; 95: 307 12.