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Pathology

Hand Assisted Transperitoneal versus Retroperitoneal Laparoscopic Nephrectomy (A Comparative Study): Our Experience in Prince Hussein Urology Center

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Abstract | **Original Research Article**

***Aim*:** Hand assisted laparoscopic nephrectomy could be an excellent alternative option to the open approach for benign renal conditions. Besides that, renal malignant processes can be managed by the previous mentioned hand-assisted laparoscopic technique of nephrectomy. In this research the outcomes and the complications of transperitoneal and retroperitoneal approaches of hand assisted laparoscopic nephrectomy were estimated for the differences. ***Methods*:** Retrospectively (223) hand assisted laparoscopic nephrectomies (transperitoneal grid iron incision (group1, N= 112) vs. retroperitoneal Pfannenstiel incision (group2, N=111) which were done between September 2022 and June 2024 in Prince Hussein Urology Center were enrolled in this study. Demographic and categorical data of both groups were compared herein. Follow-up period is between 3 and 18 months. ***Results*:** Patients' ages were between (35 and 62 years). There were no differences in patient demographic, and most of categorical data between the both groups. The mean duration of the transperitoneal procedure was significantly shorter than that of the retroperitoneal approach (197.3 and 238.5 minutes, respectively, $P < 0.05$). While the lower incidence of incisional hernia, blood loss, solid organs impact, and bowel injury were in group2 ($P < 0.05$). ***Conclusion*:** Hand-assisted laparoscopic retroperitoneal nephrectomy is superior to transperitoneal approach in regards to incisional hernia incidence, operative blood loss, and organs injury. Due to the steeper learning in the retroperitoneal approach, the operative period can be equal to or shorter than that of the transperitoneal technique after the surgeons used to and getting more experience in this approach.

Keywords: Hand assisted, laparoscopic nephrectomy, transperitoneal approach, retroperitoneal approach.

INTRODUCTION

Nephrectomy is indicated for many benign and malignant reasons like pyelonephritis (emphysematous or xanthomatous), nonfunctioning symptomatic kidney due to (stones, congenital dysplasia, and vesicoureteral reflux), renal sever trauma, donation, pretransplant recipient nephrectomy, malignant and benign tumors. Nephrectomy can be applied by laparoscopic or open techniques [1].

Laparoscopic nephrectomy nowadays has a considerable advantages like decrease hospital stays, earlier recovery postoperatively, decreased postoperative morbidity, and more cosmetic wise in comparison to open approach [2].

There are two approaches of laparoscopic nephrectomy either transperitoneal or retroperitoneal [3].

The benefit of transperitoneal laparoscopic nephrectomy is wider working space with identification of anatomical landmarks, while retroperitoneal technique leads to early recovery and less hospital stays because of earlier recovery of bowel function [4].

Hand assisted laparoscopic nephrectomy was first applied in 1998 to improve the safety of laparoscopic technique due to the sophistication of this approach, conversion to open after active bleeding intraoperatively, and for harvesting the kidney [5].

With the advantage of (the tactile sensation, 3-dimensional spatial orientation, and en bloc removal of the renal specimen), hand assisted laparoscopic nephrectomy became more useful in advance cases of radical nephrectomy and expand the role of laparoscopy [6, 7].

In the first, hand assisted transperitoneal laparoscopic nephrectomy was described. However, due to a longer postoperative ileus, and less direct contact to retroperitoneal structures in the transperitoneal approach, hand assisted retroperitoneal approach has been demonstrated to be efficacious and safe especially after the development of dissecting ballons [8].

In this article, we compared between the two methods of hand assisted laparoscopic nephrectomy regarding the outcomes and complications.

METHODOLOGY

Retrospectively we reviewed the medical records of (223) patients who underwent hand assisted laparoscopic nephrectomies in Prince Hussein Urology Center, part of Jordanian Royal Medical Services between September 2022 and June 2024. These patients were divided into two groups: group1(N= 112 patients) who underwent transperitoneal approach via grid iron incision which is best approach to decrease the bowel injury and the incidence of incisional hernia, and group2 (N= 111 patients) who underwent retroperitoneal approach via Pfannenstiel incision. However, 6 cases were converted to open approach, 4 cases in transperitoneal technique (due to large tumor sizes with sever adhesions to neighboring structures (2 cases), one case of large renal hydatid cyst not diagnosed by preoperative renal triphasic CTscan or MRI, and one case of xanthomatous pyelonephritis with sever adhesions to the inferior vena cava (IVC)), and two cases in retroperitoneal approach (one case xanthomatous pyelonephritis with sever adhesions to neighboring structures, and the second case in donor nephrectomy due sever adhesions of the upper pole of the donor kidney after previous partial nephrectomy).

All cases were selected before the hand assisted laparoscopic procedures according the following criteria; no previous abdominal surgeries, localized renal tumors with no nodal or distant metastasis (T1 and T2), no extension of the renal tumor to the renal vein (< T3), no renal abscess or active infection of the kidney, and no active hemorrhage of the renal pathology (cystic lesion, angiomyolipoma, or renal tumor).

Hand-Assisted Transperitoneal Nephrectomy

After the patient was anesthetized by general anesthesia and Foly catheter was inserted, the site of the procedure (right or left) was positioned in the same side high-up position. Then grid iron incision (4-5 cm) at the same site of operation was made to open the peritoneum and hand port was attached to the wound for pneumoperitoneum, introducing of the laparoscopic lens 5 or 10-mm\30 degree, and for easy hand assistance manipulation. Under laparoscopic visualization, a second 5 or 12-mm trocar was inserted in the mid-clavicular line lateral to the rectus and at the level of the umbilicus. A third 12-mm trocar was placed in the subcostal area at the level of the anterior axillary. The surgeon's hand (left or right according the procedure side) was inserted thorough the hand port. An incision was made along the line of Toldt, and the ipsilateral colon was reflected medially and the upper pole attachments, and either the splenic or hepatic attachments to the kidney were taken off. Under the direct vision with laparoscopic assistance, dissection around Gerota's fascia, ureter, and hilum was performed when possible. After the renal artery was isolated, surgical clips were applied and the artery was divided. The renal vein was divided with a vascular Endo gastrointestinal anastomosis (GIA) device. The ureter was dissected, clipped, and transected but in donor nephrectomy the ureter was transected firstly. Then, the kidney, adrenal gland, and Gerota's fascia were removed en bloc through the hand port in case of renal tumors but in the other cases the sample was either simple or radical nephrectomy according to the case and the surgeons' preferences.

Hand-Assisted Retroperitoneal Nephrectomy

After anesthetizing the patient, Foly catheter insertion, and positioning the patient like transperitoneal approach. A 4-5 cm Pfannenstiel incision was made above the pubic symphysis 1-2 cm. Then, the retroperitoneal space was bluntly dissected using the index finger and 12-mm trocar was inserted in the mid-clavicular line lateral to the rectus and at the level of the umbilicus with protection by the assistant hand. After pneumoperitoneum and under laparoscopic visualization an additional 12-mm trocar was placed subcostally on the mid-axillary line. Then, the hand port was attached to the Pfannenstiel incision and the surgeon inserted his hand according the procedure side to perform the dissection of the kidney like transperitoneal approach without reflection of the colon which was already reflected after the dissection of the retroperitoneal space.

Demographic and categorical data of both groups were compared herein. Follow-up period was between 3 and 18 months.

Data were expressed as mean ± SD. Statistical analysis was done. A *t* test was used for continuous variables and a chi square test was used for categorical

variables by using SPSS v26 program. P values < 0.05 were considered to be statistically significant.

Ethical approval was gained from our ethical approval institution in Jordanian Royal Medical Services.

RESULTS

The total number of hand-assisted laparoscopic nephrectomies was 223 (transperitoneal n= 112 vs. retroperitoneal n= 111), there were 120 males and 103 females. The left sided nephrectomies were 116, while the right sided nephrectomies were 107. Patients' ages were between (35 and 62 years). Simple nephrectomies for benign conditions were 87 cases, while radical nephrectomies were 136 cases. Regarding the demographic data there were no significant differences between both groups. The significant P-value < 0.05. Table 1.

Table 1: The demographic data

Variables	Transperitoneal (group1) N®= 112	Retroperitoneal (group2) N= 111	P-value
(Median age ± SD*) N\years	55.3 ± 9.1	53.5 ± 9.7	0.1543
Males N\%©	62\55.4%	58\52.25%	0.3185
Females N\%	50\44.6%	53\47.75%	0.3185
Right side N\%	53\47.3%	54\48.6%	0.4231
Left side N\%	59\52.7%	57\51.4%	0.4231
Simple nephrectomy N\%	46\41%	41\37%	0.2705
Radical nephrectomy N\%	66\59%	70\63%	0.2705
Conversion to open N\%	4\3.6%	2\1.8%	0.2041

*SD: Standard deviation. ©%: percentage of the number of patients regarding the total number of each group. ®N: Number of the patients.

Regarding the categorical data between the both groups, there were no significant differences in some data (postoperative infection, postoperative recovery state, and postoperative hospital stay days). However, the other categorical data like the operative time was significantly shorter in the transperitoneal approach than the retroperitoneal technique (mean= 197.3 vs. 238.5 minutes, respectively, P < 0.05), and there was a lower incidence of the following categorical data (incisional hernia, blood loss, solid organs impact, and bowel injury) in the retroperitoneal group, P < 0.05. The significant P-value < 0.05. Table 2.

Table 2: The categorical data

Variables	Transperitoneal Group1 N®= 112	Retroperitoneal Group2 N= 111	P-value
Operative time (Mean ± SD*) \min.	197.3 ± 12.43	238.5 ± 14.64	0.0001
Blood loss (Mean ± SD) \ml.	248.13 ± 142.6	186.7 ± 102.9	0.0003
Intra and postoperative complications N\%©			
Infection	3\2.7%	2\1.8%	0.325
Solid organ injury	5\4.5%	1\0.9%	0.049
Bowel injury	6\5.35%	1\0.9%	0.029
Postoperative recovery state N\% ASA score			
1	32\28.6%	31\28%	0.460
2	67\59.8%	69\62.1%	0.363
3	13\11.6%	11\9.9%	0.341
Mean length of hospital stay ± SD\ days	3.2 ± 1.7	3.3 ± 0.82	0.5770
Incisional hernia incidence N\%	6\5.35%	1\0.9%	0.029

*SD: Standard deviation. ®N: Number of the patients. ©%: Percentage of the patients regarding the total number of patients of each group.

DISCUSSION

Regarding the demographic data between group1 and group2, no significant differences were found. However, there were significancy in some categorical data between both groups (shorter operative time in the transperitoneal approach, while the incisional hernia incidence, intraoperative blood loss, and organs injury were lesser in the retroperitoneal approach than the transperitoneal one).

Although hand-assisted retroperitoneoscopic nephrectomy took a longer time than transperitoneoscopic approach in our research, other literatures reported short operative time < 100 minutes with hand-assisted retroperitoneoscopic technique [9].

Some articles concluded that hand-assisted retroperitoneoscopic nephrectomy when compared to transperitoneal approach; had the advantages of elimination of intraperitoneal contamination with cancer

cells, restriction of urinoma or seroma collection to the retroperitoneal space, decreased the paralytic ileus because of the absence of bowel manipulation or injury, and decreased intraoperative blood loss because of the smallness of the retroperitoneal space [10].

Regarding the risk of abdominal visceral injury, hand-assisted retroperitoneoscopic nephrectomy reducing this risk because of the procedure doesn't require intraperitoneal manipulation [11].

Another advantage of hand-assisted retroperitoneoscopic nephrectomy is the safety of the procedure for those who has intraabdominal adhesions or ascites [12].

When taking about the intraoperative blood loss, retroperitoneal approach is better than transperitoneal approach because of the quicker renal hilar control and the previous mentioned smaller retroperitoneal space, also operative time and warm ischemia time (in donor) are shorter in the retroperitoneal technique [13, 15].

Inspite of that retroperitoneal approach in hand-assisted laparoscopic nephrectomy can be safely performed in extremely obese patients [14], other authors reported that if there is abundant tissue around the kidney, then nephrectomy should be done by transperitoneal approach [15].

CONCLUSION

Hand-assisted laparoscopic retroperitoneal nephrectomy is superior to transperitoneal approach in regards to incisional hernia incidence, operative blood loss, and intraperitoneal visceral injury. Due to the steeper learning in the retroperitoneal approach, the operative period can be equal to or shorter than that of the transperitoneal technique especially when urologists become more experienced with the former approach and in the future we need more studies to document the role of the hand-assisted retroperitoneoscopic nephrectomy in decreasing the operative time, and warm ischemia time in kidney donors beside the feasibility of this approach in obese patients and lowering the rate of incisional hernia via Pfannenstiel incision.

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