Efficacy of Laparoscopic retroperitoneal deroofing of simple renal cyst in comparison with open surgery

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الخلاصة

الهدف من هذه الدراسة هو لتقييم كفاءة وسلامة عمليات إزالة سقف كيس الكلية البسيط بواسطة العمليات المنظارية ومقارنتها مع العمليات التقليدية.

المرضى وطرق العلاج خلال الفترة مابين شهر شباط من عام٢٠٠٨ إلى شهر تشرين الأول عام٢٠١٠ ،تم علاج١١ مريض وكان لديهم أكياس الكلية البسيطة ويعانون من الألم المقاوم للمسكنات المتوفرة وقد اجري لهم عمليات منظارية ومن جانب آخر تم علاج ١٥مريض يعانون نفس الأعراض،وقد اجري لهم عمليات تقليدية.

النتائج من خلال العمل لكلتا المجموعتين، لم يتم مشاهدة فرق في ما يتعلق بالوقت المستغرق لإجراء العملية وكمية فقدان الدم ومعدل عودة أو رجوع كيس الكلية مع ظهور نتائج أفضل تابعة للعمليات المنظارية في ما يتعلق بفترة رقود المريض في المستشفى وسرعة الشفاء وعودة المريض إلى نشاطه اليومي مع جروح بسيطة تاركةً ندباً صغيرة.

الاستنتاج العمليات المنظارية ، عمليات آمنة وناجحة مع مضاعفات بسيطة بالمقارنة مع العمليات التقليدية.

Abstract

Objective: to evaluate efficacy and safety of laparoscopic retroperitoneal deroofing in comparison with open deroofed cases.

Patients and methods: over period of 3 years , 11 patients with symptomatic simple renal cysts , underwent laparoscopic retroperitoneal deroofing and another 15 patients with same symptoms, underwent open deroofing.

Results: Insignificant difference between both procedures regarding operative time, blood loss, recurrence rate, with better results for laparoscopic retroperitoneal deroofing regarding hospital staying, convalescence period and wound complication.

Conclusion: Laparoscopic retroperitoneal deroofing of simple renal cyst is safe and effective procedure with minimal complication in comparing with open one.

Introduction

Simple renal cyst is the commonest benign cystic lesion of the kidney. Asymptomatic renal cyst is a common incidental image finding, particularly with increased use of ultrasound(US). Of incidence from birth to 18 years ranges from 0.1% to 0.4%, with an average incidence 0.22% [(1)]. In adults, incidence gradually increases with age and by age of 40 years, is about 20%, while at age 60, it rises to 35% [(1)]. Most reports show no gender predilection; however, in at least two studies, men were affected more frequently than women [(2-3)].

The SRC in adults seems to be mainly an acquired disorder. Micro-dissection of the nephron in the adult kidney points to the presence of diverticula on the distal tubule as the starting point of affection . A degree of obstruction in the urinary tract together with normal involutional phenomena of the basal membrane , both typical of the aging process, are believed to be precipitating factors [(4)].

Majority of renal cysts are asymptomatic, some renal cysts can cause symptoms such as flank pain, palpable lump in the abdomen , repeated infections, hematuria (secondary to rupture into the pelvicalyceal system),

hypertension (secondary to segmental ischemia) or rarely urinary tract obstruction [5-9]. They may or may not increase in size with time, 74% remained unchanged in size[1], Longitudinal study of more than 1700 individuals demonstrated a mean growth rate of 2.8mm per year, and these lesions tended to grow more rapidly in younger individuals[2-4]. Cysts can rupture into the pelvicalyceal system, maintain a communication and become a pseudocalyceal diverticulum. The reverse is also possible: closure of the communication of a diverticulum can create a simple cyst. These two sequences of events can be distinguished only by histological examination. Theoretically, diverticula should have linings of transitional epithelium, whereas simple cysts should be lined by a single layer of flattened or cuboidal epithelium [2].

The diagnosis is made with US, CT scan, MRI or nonspecifically IVU.US represents the most cost effective modality to confirm the presence of SRC. when all the criteria of a benign SRC are present, further evaluation is not indicated [10].

Typical features of SRC on US are shown in following points :

1-Arounded homogeneous echo-lucent mass.

2-Sharp interphase with the surrounded renal parenchyma.

3-Acoustic enhancement posterior to the lesion.

4-Afew thin septa may occasionally be seen within the lesion.

5-Bleeding will produce internal echoes and these may be mobile [11-12].

6- A simple renal cyst is avascular on color or power Doppler US [11-14].

If these ultrasonic features are not met, we have to exclude malignant cyst or benign hydatid cyst.

US features of hydatid cyst are usually multicystic or multiloculated mass, thick wall, fluid-filled spherical cyst, often with a calcific cyst wall . A sudden change in position may demonstrate bright falling echoes corresponding to hydatid sound , which can be observed during real-time evaluation of hydatid cyst[13-14] .

Presence of heterogeneous mass with irregular margin, thick septa give suspicion of malignancy and should be excluded by further imaging.

CT scan of kidneys performed before and after the administration of intravenous contrast is used for characterizing renal lesions when US has been indeterminate or suspicion of neoplastic lesion. It is extremely important to determine the presence or absence of contrast enhancement, to distinguish benign cyst from neoplasm, typically greater than 10 Hounsfield units increase in density after contrast enhancement is only seen in neoplastic process [15-17].

A simple renal cyst at plain CT scan (present as a well defined lesion of water density, slightly lower in density in comparison to adjacent renal cortex) [15-17].

Thin wall calcifications occasionally seen but more often encountered in neoplastic lesion, may occasionally present as a homogeneously high density well defined lesion, this is due to bleeding within the cyst. A high density benign cyst does not show enhancement after contrast medium injection. Post contrast scanning (well defined uniform water density, the lesion is often in the cortex, no septations, or solid elements or enhancement, thin septa without contrast enhancement may occasionally be seen).

CT scan provide the most reliable means of diagnosing renal cyst [15-17].

When evaluating a possibly infected cyst, one must be aware that the wall may be thickened and sometimes calcified. Debris is often present [17]. Calcification may also be present in the absence of infection or malignancy; 1% to 3% of simple renal cysts are calcified [18-19]. Such calcification is dystrophic

and usually occurs secondary to hemorrhage, infection, or ischemia. Also, 6% of simple cysts can have hemorrhage [20]. 31% of hemorrhagic cysts were reported to be malignant [21], but it was deemed necessary at that time to explore the majority of such cysts. Today, even if blood is present, the decision to operate usually can be made on the basis of sonographic or CT findings.

Renal MRI can be used as an alternative to CTscan when the patient is uremic or have allergy to contrast . A simple renal cyst will be of low signal intensity on T1 and very high signal intensity on T2-weighted images. It appears as a homogeneous rounded mass with a thin wall and a sharp interface with the surrounding renal parenchyma, no enhancement is seen in the wall or septa of SRC on T1-weighted imaging after intravenous injection of extracellular gadolinium based contrast medium [15-17].

Asymptomatic renal cysts may be followed up and often do not require treatment; however symptomatic renal cysts must be treated, initially beginning with analgesia , although poor responders may require other more invasive techniques [15-17].

At present, the commonly used treatment methods include :
[1] Percutaneous aspiration with or without sclerosing agent (instillation after aspiration) particularly if fluid has reaccumulated after an earlier aspiration. Several sclerosing agents have been used, including glucose, phenol, iophendylate (Pantopaque) , acetic acid, povidone-iodine, minocycline hydrochloride, bismuth phosphate, and absolute ethanol, but none has been sufficiently impressive for its use to become dominant [24]. In one study was compare between cyst aspiration and cyst aspiration with sclerosing agent was found; the cysts disappeared in 10% of patients if aspiration was only done and the cysts disappeared in 44% of patients when aspiration with injection of bismuth phosphate was done [24-25]. A significant proportion of cysts treated by aspiration will recur [30].

[2] Laparoscopic deroofing, either transperitoneally [27] or retroperitoneally [28,42].

[3] Cysto-retroperitoneal shunt; a new technique using cysto-retroperitoneal catheter and removal of catheter after 3 months with high success in comparison with aspiration [30].

[4] Antegrade percutaneous nephroscopy with the cyst marsupialization into the collecting system in posterior cysts [25].

[5] Open surgical resection.

A large symptomatic SRC more than 5cm usually treated by more invasive techniques; the current world literature on laparoscopic cyst deroofing has demonstrated efficacy, minimal complications, reduced operative time, minimal blood loss, minimal hospital stay, and satisfactory cosmetics [31].

Laparoscopy was first performed by kelling 1901 as a method to view the abdomen of a dog. The retroperitoneum is a familiar space for all urologists. John Wickham in 1979 was the first to perform retroperitoneoscopy to remove a ureteric stone. William Schuessler was first to perform pelvic lymphadenectomy in 1989. After a long period of 10-12 years it became a viable alternative to the transperitoneal approach. After being popularized by Ralph clayman (first laparoscopic total nephrectomy in 1991) [31]. The use of laparoscopic surgery to treat renal cysts was first proposed by Hulbert in 1989. It combines a high success rate of open surgery with low invasiveness and has thus gained wide acceptance [32].

Gaur D.D. developed the new concept of using a balloon to distend the retroperitoneal space (RPS) before pneumoinsufflation , which is widely practiced now [34-36].

Many procedures can be done by retroperitoneal approach such as simple

nephrectomy, radical nephrectomy, partial nephrectomy, decortication of SRC, pyeloplasty, pyelolithotomy and ureterolithotomy.

Its advantages are better access to renal hilum and avoid bowel manipulation and injury, but its disadvantages are narrow working space and difficulty in patient with previous retroperitoneal surgery [32-36].

Patients and Methods

Eleven patients with symptomatic SRC diagnosed by US were included in this interventional prospective clinical study in which we evaluated the efficacy of laparoscopic retroperitoneal deroofing of the cyst in comparison with open deroofing in 15 patients who were the controls over a period from February 2008 to October 2010. The US diagnostic criteria for SRC were a well defined, thin walled, round shaped, homogenously anechoic lesion with posterior wall enhancement. We had excluded any malignant or hydatid cyst by US.

All of them were associated with a flank pain that is refractory to analgesia, complained for many months, some patients for many years, and insist on surgical intervention (no patient had hematuria or a pelvicalyceal obstruction by history, physical examination and investigations including urinalysis and imaging). We classified these patients into 2 groups ;

Group(1) open surgical deroofing.

Group(2) laparoscopic retroperitoneal deroofing .

In open surgical deroofing group(1); 15 patients underwent open deroofing. In laparoscopic deroofing group, group(2); 11 patients underwent laparoscopic retroperitoneal deroofing , these patients were placed in the lateral flank position .

The patients criteria are summarized in table[1].

Table 1: patients criteria for both groups:

Patient criteria	open deroofing	Laparoscopic deroofing
Age(years); mean	50.867	46.636
Laterality(%) Rt Vs Lt	46.67 Vs 53.33	45.45 Vs 54.55
Site(%) Lower Vs Mid.-Upper	53.33 Vs 66.67	20.73 Vs 79.37
Gender(%); Male Vs Female	60 Vs 40	54.54 Vs 45.45
Size(cm); mean	11.8	9.1

Laparoscopic technique

After choosing the patients with SRC for surgery (whether open or laparoscopy) all patients underwent routine laboratory tests such as blood urea , serum creatinine , hemoglobin, urinalysis. The patient´s consensus was taken and informed on possibility of conversion to an open procedure.

Our work consist of the following basic operative laparoscopic instrumentations which were used .

The incision of the 1st trocar (10mm) size is made below tip of 12th rib at the mid-axillary line at length of 1.5cm transverse incision. Using a blunt finger dissection (with index finger) a space is created anterior to the psoas muscle and outside Gerota´s fascia .

The working space in the retroperitoneum is created by modified balloon (similar to Gaur´s balloon) and inflation of about 800 ml of room air (35 pumps by sphygmomanometer bulb) .

The balloon is removed and CO2 insufflation was made to create pneumoretroperitoneum up to 15 mmHg .

Usually 2 secondary ports are inserted. During port placement , a care must be taken to avoid pleural, peritoneal, visceral or vascular injury. Ports must be placed in away to prevent clashing of trocars and instruments that might occur when the trocars were placed too close.

A2nd and 3rd trocars (5mm) are placed under laparoscopic vision , one along the anterior axillary line and the other was placed posterior to 1st trocar (placed in an angle between the 12th rib and lateral border of paraspinal muscles).

The wound was closed around the port using a silk suture to prevent gas leakage. The posterior portion of Gerota´s fascia was opened by laparoscopic dissector, then we dissected the perirenal fat to find the cyst. When the cyst had been located , we puncture the dome of the cyst by hook, grasping and incising the wall of the cyst, and the cyst is drained for decompression . Then the cyst wall was excised along the junction between the cyst and cortex. All specimens were sent for histopathological examination . The inner wall of the cyst was electro - cauterized, and the base of the cyst was carefully inspected for any suspicious lesions. Tube drain was left in situ. Lastly the appearance of wounds and tube drain were shown in.

We had 2 cases converted to an open surgery due to anatomical difficulties and these difficulties include excess and adhesion of retroperitoneal fat which made the dissection more difficult.

Results

Patients characteristics are listed in table [2,3]. There were no significant differences in age, gender, laterality, position, or preoperative size between 2 groups. Of 15 patients group (1) who underwent open deroofing(n=15), one case was recurred during the mean follow up period (11.8) months by US with resolution of symptoms for other cases. Mean blood loss was (83.6) ml (calculated by weighing of gauze and adding of contents of urine bag from tube drain to gauged bottle). The mean hospital stay was (3.6) days, the mean operative time (excluding anesthetic time) was (57.7) minutes. Analgesic requirement was high frequent doses. The patients discharged with long wound , it´s length rated from 10cm to 20cm with disfigurement. There were 2 postoperative complications in different patients (wound infection in case number 4 and incisional hernia in case number 9). No fistula was seen.

In patients treated with laparoscopic retroperitoneal deroofing group(2)(n=11), one case was recurred during mean follow up period (14.09) months by US with resolution of symptoms for all other cases, mean blood loss was (82.7) ml . The mean hospital stay was (1.2) days, and the mean operative time (excluding anesthetic time) was (58.9) minutes. The analgesic requirement was low doses. The patients discharged with 3 very small wounds, their lengths ranged from 1-1.5cm without disfigurement, Two cases were converted to open procedure due to anatomical difficulties(one case ; number 3 due to excess fat led to difficult dissection and another case ; number 7 due to opening of peritoneum led to no progression in dissection) .

Comparison of Perioperative criteria between the 2 groups are listed in table [4].

Table 2: patients criteria for 2 groups

Patient characteristics	Open deroofing n=15 No(%)	Laparoscopic deroofing n=11 No(%)	P- value
Laterality			
right	7(46.67)	5(45.45)	0.777 NS
left	8(53.33)	6(54.55)	
position (pole)			
lower	5(53.33)	3(20.73)	0.055 NS
middle or upper	10(66.67)	8(79.37)	
Gender			
male	9(60)	6(54.54)	0.474 NS
female	6(40)	5(45.45)	

Table 3: patients criteria for 2 groups

Patient characteristics	Open deroofing n=15	Laparoscopic deroofing n=11	P- value
Age (years)			
mean	50.867	46.636	0.367 NS
Standard Deviation	9.242	12.917	
cyst diameter (cm)			
mean	11.8	9.1	0.077 NS
Standard Deviation	3.749	2.729	

Table 4: perioperative criteria for 2 groups

Parameters	Open deroofing n=15	Laparoscopic deroofing n=11	P- value	
Operative time (min.)				
mean	57.733	58.909	0.860 NS	
Standard Deviation	14.557	19.175		
Blood loss (ml)				
mean	83.667	82.727	0.935 NS	
Standard Deviation	31.308	26.397		
Hospital stay (day)				
mean	3.6	1.273	0.000**	p≤0.01
Standard Deviation	0.632	0.467		
Follow up (months)				
mean	11.8	14.091	0.201 NS	
Standard Deviation	3.876	4.678		
Post operative Complication Complicated No.(%) Uncomplicated No.(%)	2(19.36) 13(80.64)	1(6.67) 10(93.33)	0.019*	

Discussion

Management of renal cysts include reassurance if they are asymptomatic and if they are symptomatic the treatment include conservative treatment, percutaneous aspiration with or without sclerotherapy, laparoscopic deroofing, and deroofing by open surgery[3].

Minimally invasive surgical techniques are more frequently used in treatment of various urological conditions. A previous trend for the treatment of SRC consist of percutaneous aspiration with or without instillation of a sclerosing agents, or of an open deroofing[24-26].

Okeke, Hanna, Bean, and Ozgur in period between 1986-2003 mention the percutaneous aspiration with or without sclerosing agents associated with recurrence rates may reach up to 90% in case of aspiration alone and up to 78% if the aspiration is combined with sclerosing agents [37-39].

Open surgery is now rare because of its invasiveness, and more complications regarding wound infections, incisional hernias, more pain, and more hospital staying with delayed convalescence period and disfiguring scar.

On the other hand, laparoscopic treatment is an attractive alternative to open deroofing with same effectiveness and less complications(regarding wound infection, hernias), better cosmoses, hospital staying, and early convalescence, the laparoscopic deroofing proved to be safe, reliable, and efficacious[16,37,40,41].

The laparoscopic treatment was proposed as 1st line treatment in renal cyst more than 6cm in diameter as recommended by Rane´ [42] or more than 8cm in diameter as recommended by Gubta [43]. In the current study, the patients were randomly chosen (the least cyst size was 5.3cm).

In early 90s , retroperitoneoscopic approach was less popular than transperitoneal approach (due to smaller working space) but 1999, Keeley mentioned that the main advantages of retroperitoneoscopy over transperitoneoscopy are better exposure of renal hilum, avoidance of intraperitoneal organ injury, avoidance of paralytic ileus and confinement of postoperative hematoma and urinoma into retroperitoneum , but the main disadvantage is a relatively small working space and this may cause difficulty in mobilizing the kidney to enable complete deroofing of the cyst.

Retroperitoneoscopy can be performed by (a gaseous) technique with pneumoretroperitoneum or by(gasless) technique[42] as both of them are described by Ou Y-ch et al, we have adopted the gaseous pneumoretroperitoneum in our hospital as a safe surgical technique for 11 cases.

Many studies show efficacy, safety, and advantages of laparoscopic retroperitoneal deroofing. Yi- Hsiu Huang from Taipei, Taiwan(2007) compare cases underwent aspiration, open, laparoscopic deroofing and found better results with laparoscopic retroperitoneal deroofing. Abhay Rane´ from East Surrey hospital, UK(2004), He was evaluate 10 cases laparoscopy with 5 open surgical cases found the laparoscopic retroperitoneal deroofing of SRC is more effective with less complications[42].

In current study, Despite of no difference between open and laparoscopic retroperitoneal deroofing regarding criteria which are mentioned in results (age, gender, position, laterality, size of the cyst) and expense of laparoscopic instruments, Our study explains advantages of laparoscopic retroperitoneal deroofing of SRC. Although the recurrence rate and operative time are comparable with open deroofing($p \geq 0.05$) but with the advent of laparoscopic technique, 11 cysts were safely managed with less complications regarding length of wound and its related complications inform of infection and

pain which needs less analgesia($p \leq 0.05$, significant) and short hospital staying($p \leq 0.01$, highly significant) , early convalescence period and small scars, and these results are similar to results of Rane study . So, our aim is to decrease operative time (we think it is a matter of experience which is accumulated with time), decreasing need for analgesia, avoidance of wound complications, shortening of hospitalization and early returning of daily activities.

In the current study also, 2 cases were converted from laparoscopy to open surgery due to anatomical difficulties (because of presence of excess retroperitoneal fat, difficulty in dissection and opening of peritoneum) and primitive experience which necessitate prolonged operative time and risk of complications, that led to conversion. Our aim is to encourage laparoscopic working beginning with simplest cases.

Conclusion

The majority of symptomatic simple renal cysts can be treated by minimally invasive techniques as alternative to open deroofing and the laparoscopy is superior as it safe and effective technique. Although the high cost of laparoscopic instruments and comparable duration of operation and recurrence rate; the complication rate, pain, days of hospital staying are shorter; convalescence, and return to normal daily activities are faster.

Recommendations

We recommend the establishment of referral urological centers in Iraq to take care of laparoscopic urological surgery training for treatment of various urological conditions that to begin with simplest cases which are simple renal cysts .

References

1. Mc Hugh DA K , stringer DA, et al . SRC in children : Diagnosis and follow up with US Radiology 1991;178:383-5.
2. Bearth and Steg, 1997 ;Tada et al, 1983. Bearth K, Steg A: On the pathogenesis of simple cysts in the adult: A micro-dissection study. Urol Res 1997; 5:103.
3. Tada et al., 1993. Tada S, Yamagishi J, Kobayashi H, et al: The incidence of simple renal cyst by computed tomography. Clin Radiol 1993; 150:207.
4. L.Baert and A.steg. ON pathogenesis of SRC in adult vol.5 number 3,103-108 Urological research, Midlineplus.
5. Homberg G,Hietala SO treatment of SRC by percutaneous puncture and instillation of bismuth phosphate; Scand Urol Nephrol 1989;23:207-12.
6. Hinman F Jr. obstructive renal cysts . J urol 1998;119:681-3.
7. Rockson S G ,stone RA, Gunnels JC Jr . solitary renal cysts with segmental ischemia and hypertention . J urol 1994 ;112:550-2.
8. Rockson SG, Stone RA, Gunnels Jr JC: Solitary renal cyst with segmental ischemia and hypertension. J Urol 1994; 112:550-1.
9. Wahlqvist L, Grumstedt B: Therapeutic effect of percutaneous puncture of simple renal cyst: Follow-up investigation of 50 patients. Acta Chir Scand 1996; 132:340.
10. Lingard DA, Lawson TI: Accuracy of ultrasound in predicting the nature of renal masses. J Urol 1999; 122:724.
11. Dunn MD,clayman Rv(2000) laparoscopic management of SRC world J Urol 18:272-277.
12. Pearle MS,Traxer O,cadeddu JA(2000) renal cystic disease:laparoscopic management Urol cli 27:661-673.
13. Saint Martin and Chiesa, 1984. Saint Martin G, Chiesa JC: “Falling snowflakes,” an ultrasound sign of hydatid sand. J Ultrasound Med 1984; 3:257-260
14. Horchani et al., 2001. Horchani A, Nouira Y, Chtourou M, et al: Retrovesical hydatid disease: A clinical study of 27 cases. Eur Urol 2001; 40:655.
15. Thomas F. Whelan, MD, FRCSC,Guidelines on the management of renal cyst disease. Can Urol Assoc J 2010;4(2):98-9.
16. Roberts ww,blue bond-langer R boyle KE,et al(2001) laparoscpic ablation of symptomatic

parenchymal and parapelvic renal cyst.urology 58:165-169.
17. Rubenstein SE,Hulbert Jc, pharand D.et al.(1993) laparoscopic ablation of symptomatic renal cyst .J urol 150:1303-1306.
18. Israel GM, Bosniak MA: Calcification in cystic renal masses: Is it important in diagnosis?. Radiology 2003; 226:47-52.
19. Hartman DS: Cysts and cystic neoplasms. Urol Radiol 1990; 12:7.
20. Daniel Jr WW, Hartman GW, Witten DM, et al: Calcified renal masses: A review of 10 years' experience at the Mayo Clinic. Radiology 1992; 103:503.
21. Bree BL, Raiss GJ, Schwab RE: The sonographically ambiguous renal mass: Can surgery be avoided?. Radiology 1994; 153(Suppl):212.
22. Jackman RJ, Stevens JM: Benign hemorrhagic renal cyst: Nephrotomography, renal arteriography and cyst puncture. Radiology 1994; 110:7.
23. Gross M, Breach PD: The simultaneous occurrence of renal carcinoma and cyst: Problems in management. South Med J 1991; 64:1059.
24. Holmberg G, Hietala S: Treatment of simple renal cysts by percutaneous puncture and instillation of bismuth-phosphate. Scand J Urol Nephrol 1989; 23:207.
25. Westberg G, Zachrisson L: Proceedings of the Swedish Society of Medical Radiology, 1995, p 4.
26. Hubner W, Pfaf R, Porpaczy P, et al: Renal cysts: Percutaneous resection with standard urologic instruments. J Endourol 1990; 4:61.
27. Morgan Jr C, Rader D: Laparoscopic unroofing of a renal cyst. J Urol 1992; 148:1835.
28. Raboy A, Hakim LS, Ferzli G, et al: Extraperitoneal endoscopic surgery for benign renal cysts.
In: Das S, Crawford EW, ed. Urologic Laparoscopy, Philadelphia: WB Saunders; 1994:145-149.
29. Onder Canguven, Cemal Goktas, Faruk Yencilek, Cihangir Cetinel, and Selami Albayrak (2009)cystoretroperitoneal shunt. Advances in Urology Volume 2009 (2009), Article ID 906013, 5 pages doi:10.1155/2009/906013.
30. Clayman RV, McDougall EM, Kerbal K, Anderson K, Kavoussi LR (1993) Laparoscopic nephrectomy: transperitoneal vs retroperitoneal. J Endourol S228(suppl 7):abstract V 116.
31. Hulbert JC, Shepard TG, Evans RE. Laparoscopic surgery for renal cystic disease (abstract). J Urol 1992; 147(Pt 2):433A.
32. Gaur DD (1992) Laparoscopic operative retroperitoneoscopy: use of a new device. J Urol 148:1137–1139.
33. Gaur DD, Agarwal DK, Purohit KC, Darshane AS (1993) Retroperitoneal laparoscopic nephrectomy: initial case report. J Urol 149:103–105.
34. Gaur DD (1993) The use of Hegar's dilators in laparoscopy. MIT 2:333–334.
35. Gaur DD, Agarwal CK, Purohit KC, Darshane AS (1994) Retroperitoneal laparoscopic pyelolithotomy. J Urol 154:927–929.
36. Cheuh SC, Chen J, Chen SC, Hsiao PJ, Chiu TY, Lai MK. Simple nephrectomy by retroperitoneoscope. J Formos Med Assoc 1996;95:487-9.
37. Okeke AA, Mitchelmore AE, Keely Jr FX, Timoney AG. A comparison of aspiration sclerotherapy with laparoscopic deroofing in management of symptomatic simple renal cyst . Brit J Urol Int 2003;92:610-613.
38. Hanna RM, Dahniya MH. Aspiration and sclerotherapy of symptomatic simple renal cyst: value of 2 injections of sclerosing agent. Amer J Roentgenol 1996;167:781-783.
39. Bean WJ. Renal cysts:treatment with alcohol . radiology 1986;138:329-331.
40. Hoenig DM, McDougall EM, Shalhav AL, Elbahnasy AD, Clayman RV . laparoscopic ablation of peripelvic renal cysts. J Urol 1997;158(4):1345-1348. 22
41. Ou Y-Ch et al. The clinical experience of gaseous and gasless retro. Assisted unroofing of renal cyst. Chi med J (Taipei) 1997;59:232-239.
42. Abhay Rane. Laparoscopic management of symptomatic SRC . Int Urol and Nephrol 2003;36(1):5-9.
43. Young Kang, Mantu Gubta. The benefits of endoscopic management of symptomatic renal cyst. Contemp Urol 2001;13:45-51.