DISCUSSION

In the past 30 years, the therapeutic approach to children with VUR has undergone a dynamic evolution from mainly surgery, as soon as VUR was detected, to a conservative approach with antibiotic prophylaxis, to an endoscopic approach, to the currently used active surveillance approach without prophylaxis.(58)

The goals of management of the child with VUR are prevention of recurrent febrile UTIs, prevention of renal function deterioration, and minimization of the morbidity of treatment and follow-up.(29)

Open repairs prevent reflux by increasing the length of the intravesical ureter, facilitating compression of the ureter against the detrusor muscle during bladder filling. These procedures generally require inpatient hospitalization for management of post-operative pain as well as temporary urinary catheter drainage. In contrast, endoscopic repair is an outpatient procedure with minimal post-operative pain and no need for urinary catheter. The reduced morbidity of endoscopic repair, however, may come at the cost of decreased surgical success.(38)

Although open ureteral reimplantation remains the gold standard for correcting obstructive megaureter in children with high grade hydronephrosis that cannot be managed conservatively, it encounters the disadvantages of postoperative pain, long hospital stay and unpleasant scar.(53)

Laparoscopic ureteral reimplantation following the modified Lich-Gregoir technique has the following advantages: minimal bladder spasm, less morbidity because the bladder remains intact, no hematuria, and no anastomosis. In addition, decreased hospital stay with faster recovery makes it a potential 1-day surgery.(59) The Lich-Gregoir technique is associated with a high success rate.(53)

The arguments against it are that it is a highly demanding procedure and with large technical difficulties. In order to reconsider and promote this surgical approach we have conducted a prospective study to address the feasibility of laparoscopic extravesical ureteral reimplantation in case with unilateral VUR and unilateral obstructive megaureter.

Until recently only few series reported the application of laparoecopic extravesical transperitoneal approach in managing patients with VUR, and fewer series reported the application of this technique in reconstruction of obstructive megaureters. Our study reports the application of laparoecopic extravesical transperitoneal approach in reconstruction of both refluxing and obstructed ureters.

In the present study, twenty children underwent unilateral transperitoneal laparoscopic ureteral reimplantation; out of them 17 children (85%) were diagnosed to have unilateral VUR; one of them had duplicated system, and 3 (15%) with unilateral obstructive megaureter. The median age was 57 months (24-120 months).

Lopez et al. reported a series in which 30 children underwent laparoscopic extravesical transperitoneal ureteral reimplantation following the Lich Gregoir technique.(53)Out of them, 17 had unilateral VUR. The mean age was 52 months (15-183 months).

Castillo et al. published a prospective study; which to our knowledge is one of the most extensive studies published till now, evaluating the use of laparoscopic extravesical transperitoneal approach by Lich Gregoir technique for the treatment of vesicoureteral reflux.[60]50 laparoscopic transperitoneal reimplants in 42 children, 32 girls and 10 boys, aged from 9 months to 13 years old (average 68 months).

In the series published by Bondarenko; which also to our knowledge is considered the largest published series till now, 10 children underwent laparoscopic dismembered extravesical ureteral reimplantation for congenital obstructive megaureter with intracorporeal tailoring and transverse orientation of bladder tunnel.[52] The patients' median age was 18 months.

Regarding the data, the age group of the patients in the present study was comparable to that of other studies, while the number of patients was a little bit smaller; especially that of cases with obstructive megaureter. This was because only cases with unilateral VUR were enrolled in the study, the rarity of cases with obstructive megaureter requiring intervention and the relative short period of the study.

In the present study, the median operative time was 90 minutes (80 – 180 minutes) from time of skin incision to skin closure. For the cases of obstructive megaureter only; the median operative time was 120 minutes (120 – 180 minutes). This operative time is comparable to that of other studies. Out of the 20 cases two with obstructed megaureter underwent complete intracorporeal tailoring of the obstructed ureter.

Also, in the present series, Conversion to open surgery was not encountered in any case. Intraoperative complications were minimal and included four cases of bladder perforation and one case of accidental colonic serosal thermal injury (blanching).

Capozza et al. concluded that open surgery needs 60 – 90 minutes of general anesthesia and entails an abdominal incision.[61]

Yang et al. published a review that enrolled all cases of laparoscopically corrected VUR between 1993 and March 2007.[5] Six series reported the use of transperitoneal laparoscopic Lich Gregoir technique.[62–64]In the beginning of the learning curve; in series before 2004, four-trocar method was used, and then a 3-trocar method was applied in all series after 2004. In early case reports; before 2004, the mean operative time was 3 – 6 hours that was later shortened to 2 hours in series after 2004. No open conversion was reported, while 3 cases of intraoperative bladder mucosal perforation were reported.

In Lopez et al. series[53], the mean operative time was 70 minutes (38 – 120 minutes). There was no conversion to open surgery.

In Castillo et al. prospective series[60], the mean operative time was 74 minutes (ranged from 60 to 120 minutes). Conversion to open surgery was not encountered in any case.

In his study, Bondarenko reported a median operative time of 180 minutes (ranged from 150 – 210 minutes). Intraoperative complications included 2 cases of mucosal bladder perforation during creation of bladder tunnel. There was no conversion to open surgery.[52]

The perioperative outcomes of the present study were comparable to those of the previously mentioned studies [5, 52, 53, 60, 61, 65] with shorter median operative time in the obstructive megaureter cases (120 minutes versus 180 minutes).

In the present study, the median postoperative hospital stay was 2 days (2 – 7 days).

Capozza et al. reported that open surgery requires about 5 days in hospital and 3 weeks for full recovery.[61]

In the retrospective series of DeFoor et al. that compared open extravesical versus intravesical approaches for reimplantation of primary megaureter, an excisional tapering technique was performed in all cases. The main length for hospital staying was 4.7 days (range from 3 – 7 days) for the extravesical group.[65]

In Yang et al. review[5], the mean hospital stay ranged from 1 – 4 days. Lopez et al.[53] reported an average postoperative hospitalization of 24 hours (20 – 26 hours), and in Castillo et al. series the mean hospital stay was 4 days (ranged from 2 – 7 days).[60]

Comparison showed that, in our series the time of postoperative hospital stay is comparable to that of other studies and shorter than that required after open reimplantation.

In our study, postoperative complications occurred in 7 patients where 2 of them had pyogenic granuloma at trocar site, 2 cases had postoperative high grade fever, 2 cases had persistent leakage per drain and high grade fever and one case suffered from abdominal distension, ileus and raised serum creatinine level due to obstruction of the drain with subsequent urine leakage from anastomosis site and its reabsorption. Ureteral obstruction was not encountered in any case. The median follow up was 6 months (3 – 21 months).

Capozza et al. reported that, open ureteral reimplantation causes postoperative pain and possible major complications as ureteric obstruction and bleeding.[61] The incidence of these complications is very low in laparoscopically reimplanted ureters owing to less tissue and nerve injury.[62]

Yang et al. reported minimal Postoperative complications that included one case of ureteral injury, one case with febrile UTI and 3 cases with temporary hydronephrosis that required no treatment. The mean follow up period ranged from 2 – 27.6 months.[5]

In Lopez et al. series[53], Ureteral ischemia with subsequent urine leakage was reported in one case as a postoperative complication that required open surgical repair; they suggested that this was caused by excessive handling of the ureter or a burn with the monopolar cautary. They reported a mean follow up of 11 months (2 – 24 months).

Castillo et al. reported no immediate postoperative complications and mean follow up duration of 31 months.[60]

Also in the series of Bondarenko[52], no immediate postoperative complications were encountered and median follow up duration was 13.6 months (ranged from 12 – 18 months).

In the present study, postoperative complications were minimal and did not include any major complication. Also, postoperative voiding dysfunction was not encountered in

this study as only cases with unilateral VUR or unilateral obstructive megaureter were enrolled. We believe that the short duration of follow up is a point of weakness and longer follow up duration would be a crucial point in evaluation of Laparoscopic extravesical transperitoneal approach in managing cases with VUR and those with obstructive megaureter.

In the present study, de novo contralateral reflux developed in 3 cases (15%) which resolved spontaneously by the end of the 6th postoperative month, where downgrading of VUR was encountered in 2 cases that also showed complete resolution by the end of the 6th postoperative month.

In our study, the overall success rate; where success was defined as complete resolution of patient's symptoms and the ureteral pathology either VUR or obstruction, was 85% by the end of the 6th postoperative month. When paying attention to cases with VUR (n= 17, 85%) the overall success rate for them by the 6th postoperative month was 100%. Cases with obstructive megaureter developed asymptomatic refluxing ureter which was considered as improvement rather than failure as failure was defined as persistence of patient's complaint and ureteral pathology; we suspect this was due to shortening of the submucosal tunnel.

In the retrospective study of DeFoor et al.[65], the success rate was 90% for obstructive megaureters and 74% for refluxing megaureters with extravesical reimplantation.

Based on a review in 2004, open extravesical ureteral reimplantation had a surgical success rate of 98% for low grade reflux, and the rate dropped to 80% for grade III to IV disease.[66]

Yang et al. review[5] reported success rate of 81 – 100% as denoted by resolution of VUR in VCUG that was obtained 2 – 6 months postoperatively.

Also Lopez et al. reported success rate of 100% where complete resolution of VUR was identified in all patients.[53]

In Castillo et al. prospective study[60], the success rate was 100%. Only in one case, postoperative contralateral grade I VUR was shown and the child is maintained on conservative management.

Nouralizadeh et al. performed laparoscopic ureteral reimplantationin for six patients, three of whom were children.[67] In all cases intracorporeal excisional tapering and extravesical ureteral reimplantation were used. Postoperatively, one patient developed grade II VUR.

In Bondarenko series[52], one patient developed VUR and was successfully treated by endoscopic dextranomer/hyaluronic acid injection. They found that transverse orientation of bladder tunnel in comparison with anterolateral provides a longer length of tunnel for the dilated ureter.

The results of the present study are comparable to those of the previously mentioned studies reporting the use of laparoscopic extravesical transperitoneal approach in the

management of either VUR or obstructive megaureter. Comparison with other studies showed that success rate for cases with obstructive megaureter was very low or even 0%, which may be due to short tunnel length in relation to the diameter of the ureter and the infeasibility to do psoas hitch to prolong the tunnel length. Also, this may be due to the small number of cases with obstructive megaureter enrolled in this study.

Endoscopic injection has been evolved as a reasonable option for correction of VUR, particularly in cases with a low grade, although long term results into adulthood remain unknown.(68)

Callaghan et al. reported the factor involved in parenteral decision making for surgical correction in VUR and considered that the parents selecting open surgery consider the success of the procedure most important, and the majority of them are satisfied with their choice of treatment. Parents choosing endoscopic correction consider the minimally invasive nature of the procedure and the success rate most important, but the outcome may alter their satisfaction.(69)

The success rate of endoscopic techniques is correlated with reflux grade; 78.5% in VUR grade I – II, 72% in grade III, 63% in grade IV and only 51% in grade V. 77.1% of cases are resolved in the first injection; however, the success rate decreases in following sessions; from 68% in the second to 34% in third injection. The success rate achieved with single system is 73% meanwhile in duplicated systems it is only 50%.(70)

In concern of success rate, the results of laparoscopic extravesical transperitoneal approach are fully comparable or even better. In the present study success rate for cases with VUR was 100% even for grade III, IV and duplicated system.

Beside the advantage of laparoscopy over open surgical techniques; that include better cosmesis, less post-operative pain, short period of hospitalization and shorter recovery period, the results of the present study shows that laparoscopic tranperitoneal extravesical ureteral reimplantation following the Lich Gregoir technique has multiple advantages including; proved technical efficiency, minimal ureteral manipulation with decreased incidence of ureteral ischemia, no risk of meatal stenosis, bladder tunnel is easily dissected, reproducible and it also showed that mucosal injuries during tunnel dissection does not affect the success. This technique also has some disadvantages such as being a transperitoneal approach with possibility of other organ injuries or postoperative adhesions, ureteral obstruction may develop if the tunnel is tightly closed and the possibility of paraureteral diverticulum formation with poor tunnel closure.(60)

This study has two points of strength. First, it is the first study evaluating laparoscopic transperitoneal extravesical ureteral reimplantation that includes both cases with VUR and cases with obstructive megaureter. Secondly, being a prospective study adds more reliability to its results.

On the other hand, our study has some limitations. Firstly, the limited number of patients especially those with obstructive megaureter. Also, a comparative analysis with open extravesical reimplantation and minimally invasive subureteral endoscopic injection was not performed. Lastly, longer follow up is still necessary and the durability of functional and symptomatic outcomes must be determined with well-designed prospective randomized control studies.

SUMMARY

Vesicoureteral reflux (VUR) has a relatively high prevalence rate among children with urinary tract infections (UTIs). Also congenital obstructive megauretr has a high prevalence rate among children with congenital urinary obstruction.

Open ureteral reimplantation has the advantage of being fast and highly effective procedure, but it has the disadvantages of increased postoperative morbidity, long hospital stay and the possible complications of wound infection. On the other hand, the minimally invasive nature of endoscopic subureteral injection is opposed by the high cost for its effectiveness.

Laparoscopic extravesical transperitoneal approach for ureteral reimplantaion following the Lich Gregoir technique has been developed to combine the advantages of both open and endoscopic techniques for being minimally invasive and highly effective.

This study was conducted to evaluate the role of laparoecopic extravesical transperitoneal approach in the management of unilateral VUR and obstructive megaureter in children, regarding the complications and outcome.

In this study laparoscopic extravesical transperitoneal approach was successfully performed in Alexandria university hospitals in 20 consecutive patients; 17 with VUR and 3 with obstructive megaureter.

In addition to the general advantages of laparoscopic techniques; which include better cosmesis, less postoperative morbidity and short hospital stay, laparoscopic extravesical transperitoneal approach showed feasibility and high efficacy in the management of VUR, while its application in the management of obstructive megaureter is demanding especially when intracorporeal tailoring with hand-free suturing is required.

As a conclusion we can say that laparoscopic extravesical transperitoneal approach for ureteral reimplantaion following the Lich Gregoir technique is feasible, highly effective and could be considered as an alternative to open surgery in the management of VUR. The use of this technique in the treatment of congenital obstructive megaureter is feasible; even with intracorporeal tailoring, but the results are not satisfactory.

CONCLUSION

1. As parents and surgeons continue to seek for minimally invasive alternative coupled with better functional outcomes, laparoscopic ureteral reconstructive surgeries has evolved.

2. Laparoscopic transperitoneal extravesical ureteral reimplantaion is feasible and can be effectively and safely applied to manage cases of VUR.

3. In addition to cosmetic advantages laparoecopic extravesical transperitoneal approach has the potential to decrease postoperative morbidity, period of hospitalization and complications of surgical incision such as bleeding and wound infection.

4. Application of this technique in managing cases with congenital obstructive megaureter is feasible but it is demanding; especially in cases requiring tapering of the ureter where intracorporeal hand-free suturing is required. Also, the results of laparoecopic extravesical transperitoneal approach in cases with obstructive megaureter were not satisfactory.