5 Laparoscopic Pyeloplasty

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5.1 Basic Principles

5.1.1 Introduction

Schuessler reported the first case of laparoscopic pyeloplasty in 1993 [1]. Since then several centres have taken it up and many large series on this procedure are available in literature. Today laparoscopic pyeloplasty is an established alternative procedure to standard open pyeloplasty [2]. The other minimally invasive alternative for pyeloplasty is endopyelotomy. Though less morbid, the success rate is around 75 % even in the best of hands. It is contraindicated in situations like the presence of crossing vessels, which may be associated in around 20 % of patients [3].

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5.1.2 Indications

Pyeloplasty is indicated in significant pelvi ureteric junction obstruction; in the presence of more than 10 % difference in the split renal function; infection; type II O'Reilly curve in isotope renogram and in obstruction with secondary calculus.

5.1.3 Contraindication

(a) All general contraindications to laparoscopy
(b) Intrarenal pelvis
(c) Failed pyeloplasty may be a relative contraindication.

5.1.4 Patient Preparation

1. Bowel preparation
2. Antibiotics.

5.1.5 Planning of Approach

Retrograde pyelogram (RGP) is done initially to assess the exact location and length of the narrow segment and pelvic configuration. RGP also rules out other ureteric pathology. Retrograde stent placement is an option after RGP, negating the slightly difficult antegrade stenting. The disadvantage of retrograde stenting is the difficulty in introduction of the scissors for spatulating the ureter in very narrow pelviureteric junction obstruction. In some situations the preplaced stent can impede suturing. Various minimally invasive approaches and techniques are available, like transperitoneal, retroperitoneal, transmesocolic approaches; and dismembered and nondismembered techniques. Retroperitoneal approach is preferable as it is akin to open approach. However the suturing is more difficult due to reduced space and overcrowding of instruments.

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5.1.6 Complications

General complications are bleeding, bowel injury and transient ileus. Early specific complications are prolonged urinary leak resulting in ileus, persisting drainage or urinoma. This may settle spontaneously or with ultrasound scan guided percutaneous nephrostomy which is retained for about 2 weeks.

Delayed complications include UPJ stenosis, which might need reoperation.

5.2 Transperitoneal Approach

Entry

Patient is placed in 70° lateral position without kidney bridge elevation. The port position is as described in the Fig. 5.71. 10 mm camera port has to be placed in the midclavicular line about 5 cm above and lateral to umbilicus for a good view. Secondary ports are placed four-finger breadth apart for triangulation. A 30° telescope may be preferable for better view from different angles

The line of Toldt is incised with either a hook dissector or ultrasonic shears. Colon is reflected medially until the ureteropelvic junction and part of the pelvis is well seen. Additional port (5–10 mm convertible) is inserted in the epigastrium or flank for the retraction or suction if the redundant bowel disturbs the vision or there is collection.

Once the pelvis and UPJ are adequately mobilised, a stay suture is taken through the pelvis to stabilise it and avoid frequent unwanted movements of the instrument. A nylon suture on a straight needle is used for this purpose. The suture is brought out through the flank.

5.2.1 Dismembered Pyeloplasty

Dismembered pyeloplasty is preferable in large pelvis with very narrow UPJ or crossing vessel. Pelvis is incised at an angle, extending from the lateral to the superomedial border. Subsequently, the narrow UPJ and redundant pelvis is excised and the ureter is spatulated on the lateral aspect for about one cm using curved scissors (through subcostal port). Suturing is started at the angle of ureteric spatulation and continued along the posterior wall. Interrupted or continuous sutures with 4–0 or 5–0 absorbable material is preferred. Ureteric stent can be passed down antegrade at this stage (either directly through sub costal port or using veress needle. Finally anterior layer is sutured and pyelotomy is closed with 4–0 interrupted or continuous locking sutures.

5.2.2 Non Dismembered Pyeloplasty

If the pelvis is not large and the UPJ is short without a crossing vessel, Fengerplasty or

Y – V plasty can be done because it is technically easier and can give equally good results. Suturing technique described earlier in transperitoneal approach can be followed.

5.2.3 Transmesocolic Pyeloplasty [9, 10]

In left sided UPJ obstruction in children and in thin adults, the dilated pelvis bulges through the mesocolon. Once the mesocolon is incised, the bulging pelvis can be pulled into the peritoneal cavity provided that the mesocolic arterial arcade is wide trans mesocolic approach can be used. Thus the UPJ can be approached without the need for colonic mobilisation. In our series of 102 patients, 49 patients underwent transmesocolic pyeloplasty. Ref: [10, 16].

The advantages are

(a) Very good illumination as there is not much of raw area with blood clots, which can absorb light.
(b) UPJ can be quickly accessed.

Occasional problem in this approach is injury to left colic vessel. A stay suture on the pelvis will stabilize it and prevent retraction. Rest of the procedure viz. excision of UPJ and suturing techniques are the same as described under transperitoneal approach. The mean operative time is reduced by about 15–20 min.

5.3 Retroperitoneoscopic Approach

With the patient in the 90° lateral positions, and without the kidney bridge elevated, the primary (camera) port is inserted by open technique in the renal angle i.e. lateral to erector spinae just below the tip of 12th rib.

A 1.5 cm long incision is made. A haemostat is introduced to split the muscles and the lumbodorsal fascia. The index finger is introduced through the wound into the retroperitoneal space to push away the peritoneum anteriorly, thus enlarging the potential space. The space is inflated to the required volume (150–600 ml according to the built and age of patient) using balloon technique. Alternatively commercially available balloon trocars can be used directly. This camera port has to be fixed airtight with a mattress suture to prevent gas leak. Subsequent instrument ports are introduced under vision in the anterior axillary line – one each in the sub costal area and above iliac crest. An additional 5 mm port can be placed in the subcostal area for retraction, if necessary.

The first landmark to be identified is the psoas muscle. Dissection along this plane easily leads to the ureter. If the Gerota's fascia with perinephric fat is extensive over the UPJ, it may be incised (or excised) for free movement of the hand instruments.

A preplaced stent or guidewire in ureter makes identification of ureter easier (gonadal vessel may be mistaken for ureter). UPJ and part of pelvis which need to be excised are mobilised.

5.3.1 Nondismembered Pyeloplasty

If pelvis is not very large and UPJ is short, nondismembered Y – V plasty or Fengerplasty [2] (Heineke Mikulicz) technique can be performed. One can use sharp scissors or endoknife for pyelotomy and spatulation of ureter. Suturing of anterior wall starts distally with 4–0 or 5–0 polyglactin or polydioxanone suture in an interrupted or continuous fashion. Once the anterior wall is completed, stent can be placed across the suture line (if there is no preplaced stent). Antegrade stenting can be done through an additional 3 mm port or veress needle. Subsequently the posterior layer is sutured.

5.3.2 Dismembered Pyeloplasty

This technique is similar to that of transperitoneal approach except that anterior layer is sutured first followed by the posterior layer. A peripelvic tube drain is advanced through one of the 5 mm ports. After irrigating and sucking all the collected fluids, ports are closed with 2–0 vicryl.

5.4 Special Situations

5.4.1 UPJ Obstruction in Horse Shoe Kidney

The important points to consider are the presence of isthmus and aberrant vessels. Aberrant vessels need to be dissected and preserved. The difference in the patient position and the port position is described in the figure (Fig. 5.71 in Horse shoe section). Rest of the steps are similar to the previously described transperitoneal technique.

5.4.2 UPJ Obstruction with Secondary Calculi

Various techniques can be used to remove the secondary calculi. They can be directly removed with grasper through pyelotomy. Multiple small calculi can be removed by flushing. Flexible cystoscope can be passed through one of the ports to reach the calyces and remove stones by basketing. Large stones can be dealt with by passing nephroscope through one of secondary ports to basket or grasp calculi.

5.4.3 Redopyeloplasty

The basic steps of redopyeloplasty (failed pyeloplasty), are not different from the classical transperitoneal pyeloplasty. Since open pyeloplasty is almost always retroperitoneal, retroperitoneoscopic approach may not be feasible due to extensive adhesions. So all these cases are better done by transperitoneal approach.

The adhesions around the PUJ need meticulous dissection and the surgeon should be prepared for the management of long defects. Since the UPJ is dependant and pelvis is small in secondary UPJO, non dismembered technique may be attempted (Table 5.1).

Vessel crossing UPJ, difficulties in stenting, Horse shoe kidney with UPJ obstruction and Culp flap pyeloplasty have been illustrated.

Table. 5.1 Comparison of various large series of laparoscopic pyeloplasty

References	No. Pt	Approach	Type/correction (no)	Mean hrs operative time	Mean days hospitalised follow up	Mean months	% success	No. conversions (%)	No. complications (%)
Jarrett et al. [4]	100	TP	DM (71) Y-V plasty (20,other 9)	4.4 (2–8)	3.3 (2–8)	26.4 (1–72)	96	0 (0)	13 (13)
Janetschek et al. [5]	65	RP, RP	Fengerplasty	2.1	–	25 (4–60)	98	0 (0)	7 (12)
Chen et al. [6]	57	–	DM (44), Y-V plasty (13)	4.3 (2.3–8.0)	3.3 (2–6)	17.2 (1–37)	96	0 (0)	7 (12.7)
Soulfe et al. [7]	55	TP	DM (48),Fenger plasty (7)	3.1 (1.7–4.3)	4.5 (1–14)	14.4 (6–43.6)	87	3 (5.5)	2 (4)
Eden et al. [8]	50	RP	DM (50)	2.7 (2–4)	2.6 (2–7)	18.8 (3–72)	98	2 (4)	1 (2)
Turk et al. [9]	49	RP	DM (49)	2.7 (1.5–4)	3.7 (3–6)	23.2 (1–53)	98	0 (0)	–
Ramalingam et al. [10]	129	TP (71) TM (49) RP (9)	DM (113) NDM-Fenger (12) Y-V plasty (5) Culp Plasty (6)	3.2–4 1.5–2.5	3.5 (2.7–4.6) 3.5	36 (3–68)	97 % 100 %	3	4 (6)
Viswajeet singh et al. [11]	112	TP,RP	DM (TP-56, RP- 56)	162 ± 18 188 ± 24	3.39 ± 0.28 3.14 ± 0.36	30.75 ± 4.85 30.99 ± 5.59	96.4 96.6	1 2	14.8
Moon et al. [12]	170	TP	DM	140	3.2	12	96.2 %	0.6 %	7.1 %
Castillo et al. [13]	80	TP	DM	93.2					
Singh et al. [14]	142	TP	DM	145	3.5	30	96.8 %	2 (•)	19 (•)
Inagaki et al. [15]	147	TP	106DM, 28 YV, 11 Fenger, 2 Culp	246	3.1	24	95 %	0	11 (•)

TP Transperitoneal, *TM* Transmesocolic, *RP* Retroperitoneal, *DM* Dismembered

5.5 Transperitoneal Dismembered Pyeloplasty

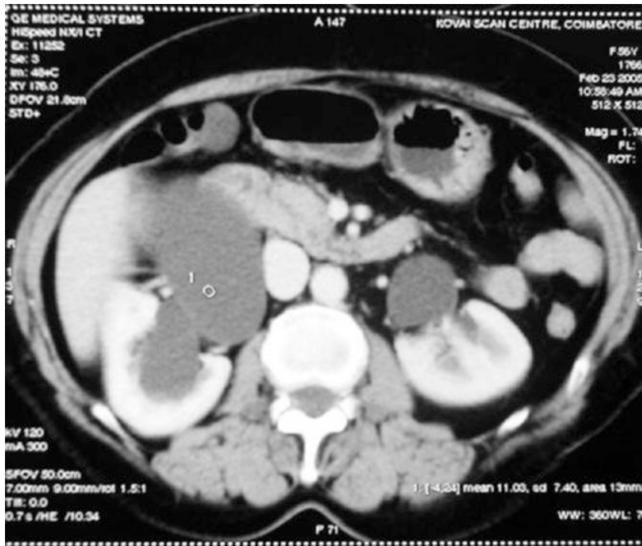

Fig. 5.1 CT image- right UPJ obstruction

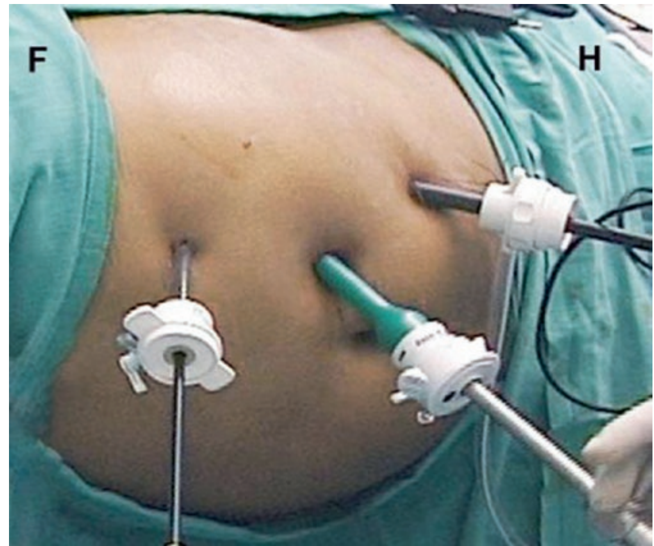

Fig. 5.2 Ports position

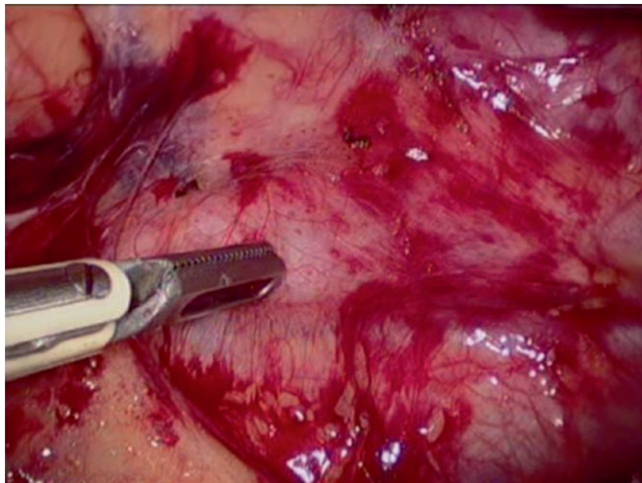

Fig. 5.3 Initial laparoscopic view showing the bulging right renal pelvis

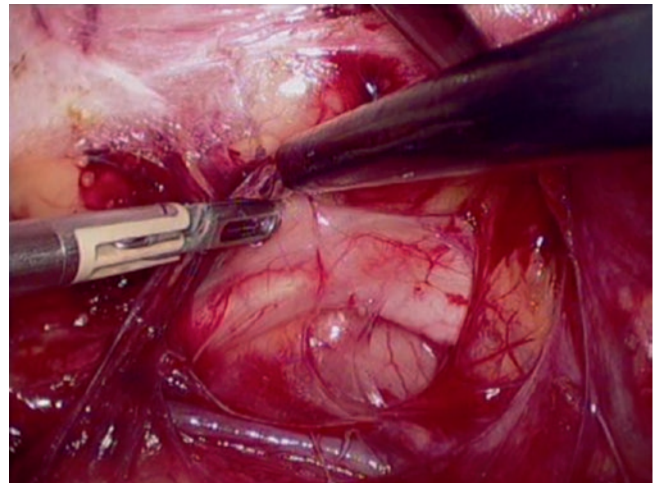

Fig. 5.4 Ureter is identified as a tubular structure, with characteristic vascular plexus, in the retroperitoneum

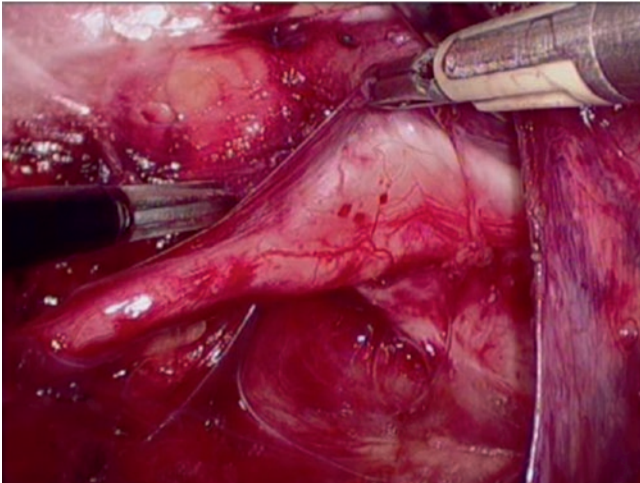

Fig. 5.5 Ureter is traced proximally till the dilated pelvis. Dissection of ureter is done outside the adventitial layer, preserving the vascular arcade

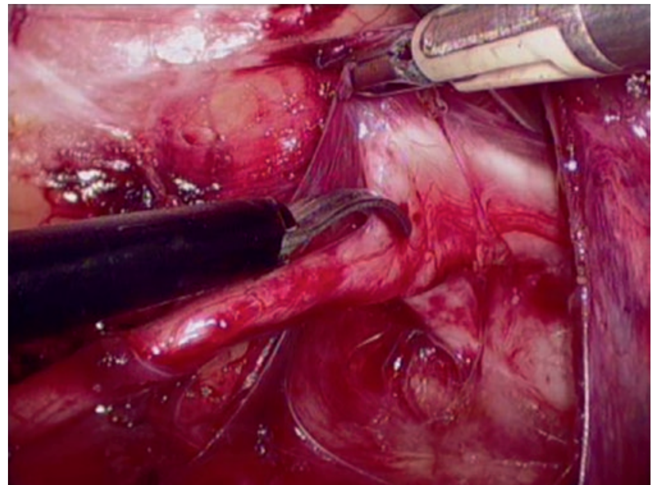

Fig. 5.6 Pelvi ureteric junction is identified as a transition between dilated pelvis and narrow ureter. Oblique pyelotomy done initially along the lateral aspect

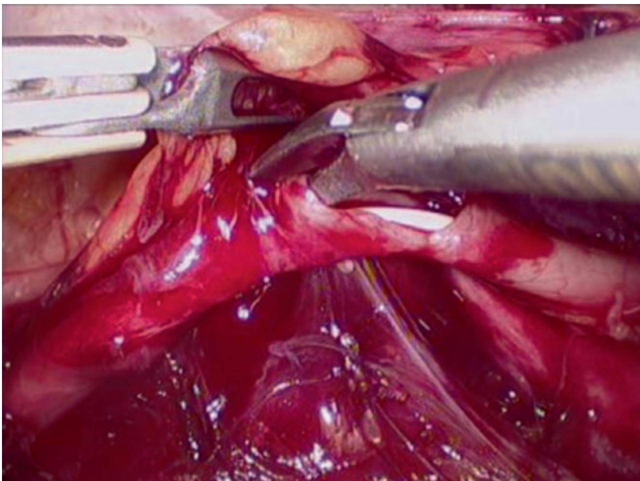

Fig. 5.7 Ureter is spatulated laterally, using curved scissors or Potts scissors

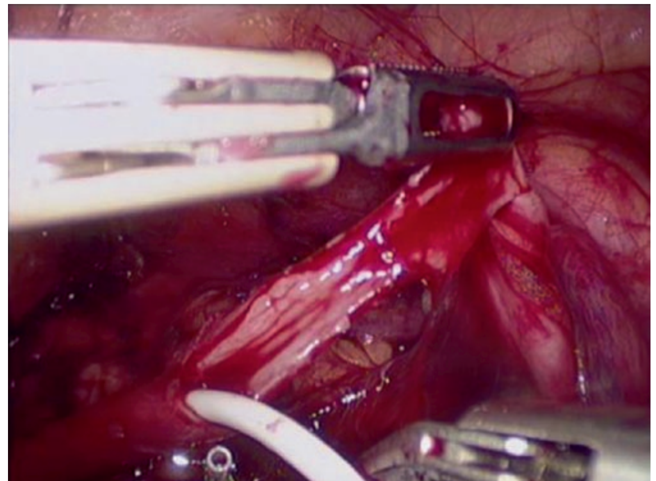

Fig. 5.8 Spatulation is complete, when the normal calibre ureter with rugosities are seen. A 'give' may be felt when spatulation extends from the narrow segment to normal segment

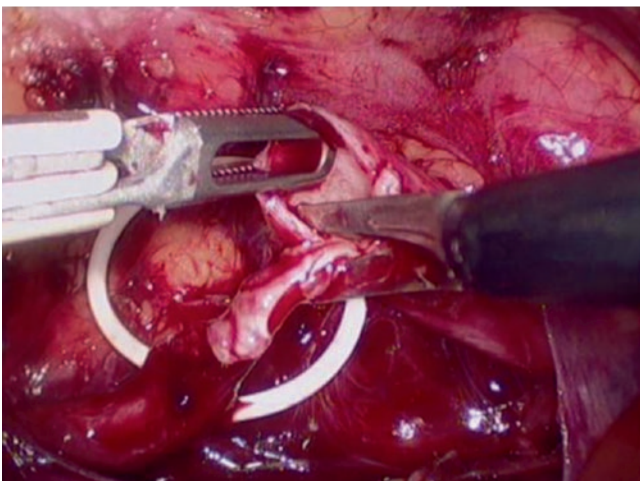

Fig. 5.9 Pyelotomy is extended with a medial spatulation. A small strip is preserved along the posterior wall for better initial orientation

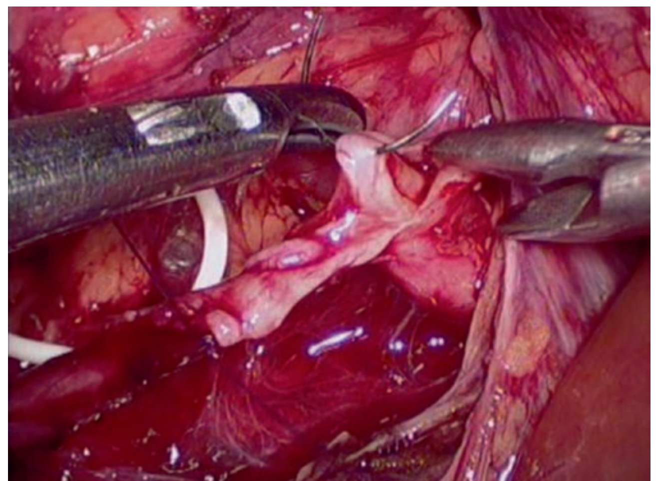

Fig. 5.10 Pelvi ureteric anastomosis started with the initial suture outside-in from the apex of pelvis using 4-0 PDS suture

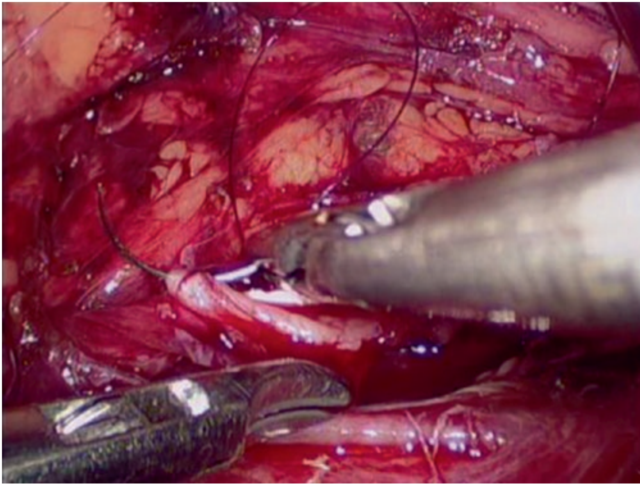

Fig. 5.11 Corresponding suture is taken through the apex of the ureteric spatulation inside-out

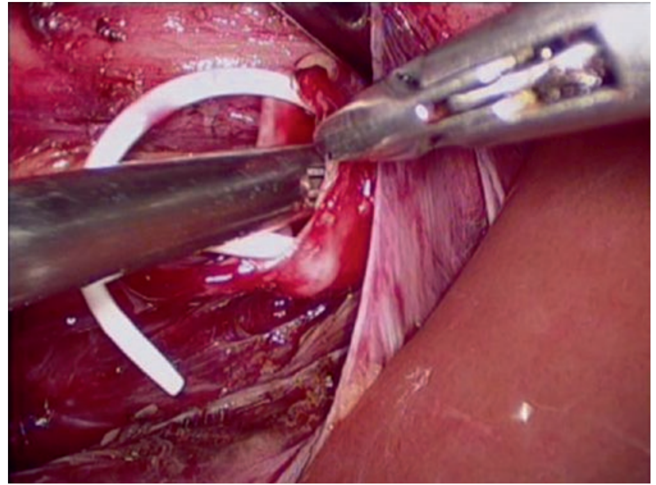

Fig. 5.12 Preplaced stent is being repositioned

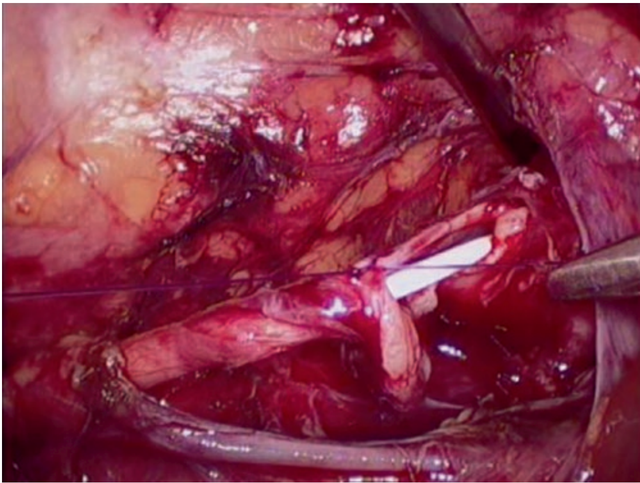

Fig. 5.13 Apical suture in place

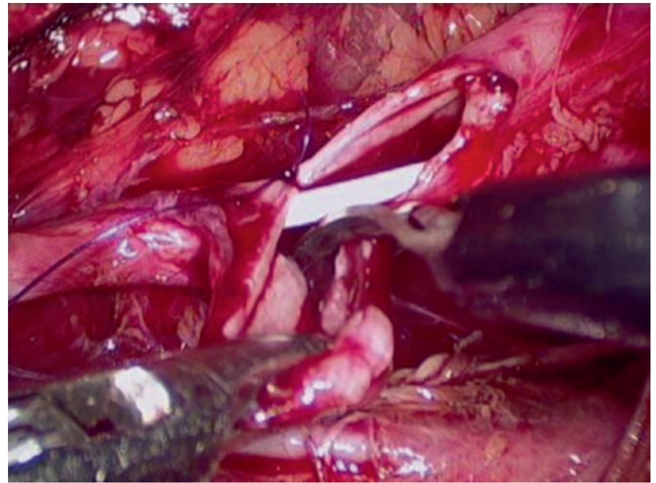

Fig. 5.14 Dividing the posterior pelvic wall strip completes division of PUJ

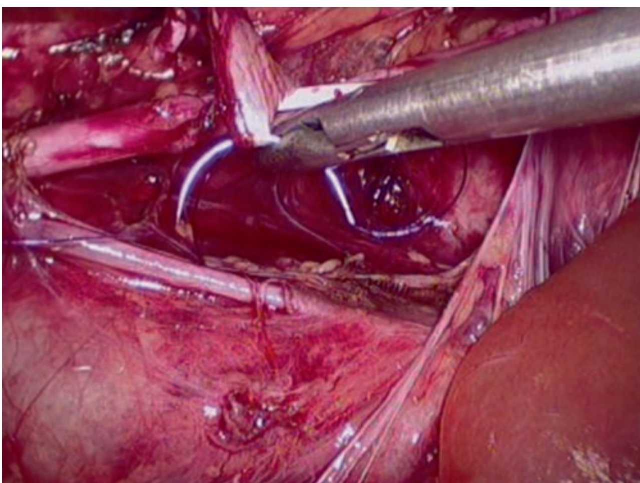

Fig. 5.15 Apical suture is continued in the posterior layer

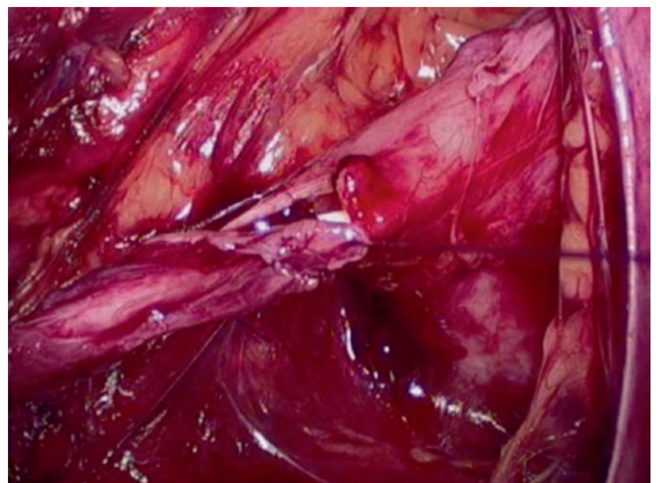

Fig. 5.16 Image shows the completed posterior wall suturing

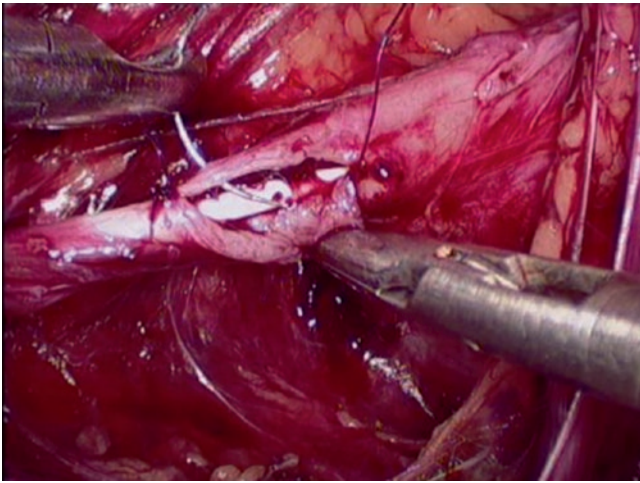

Fig. 5.17 Anterior wall suturing is done next, with the similar suture

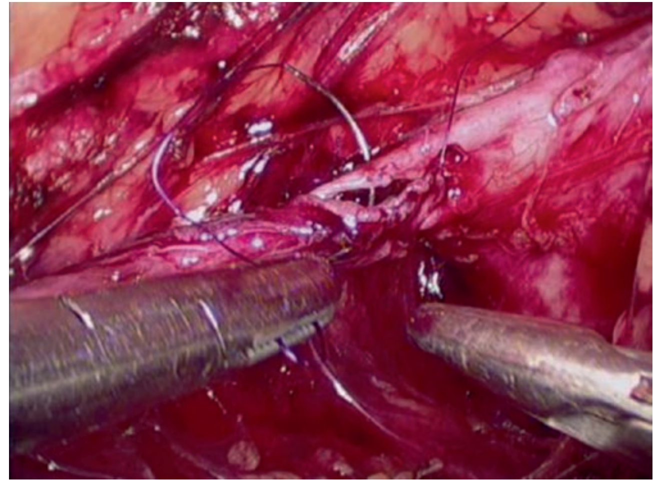

Fig. 5.18 Continuous suturing of anterior wall in progress

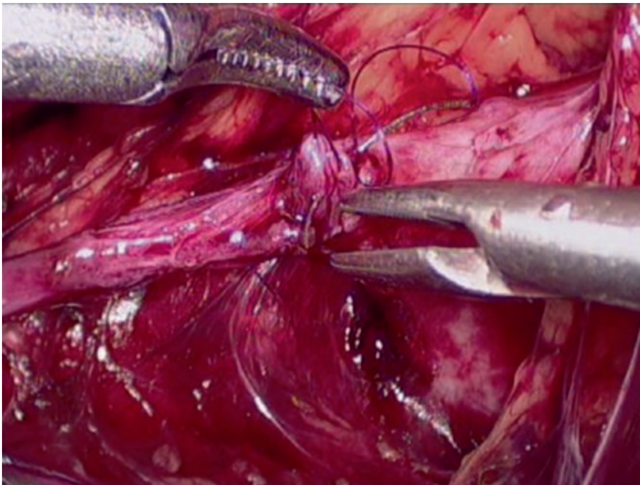

Fig. 5.19 Final stages of pelvi ureteric anastomosis

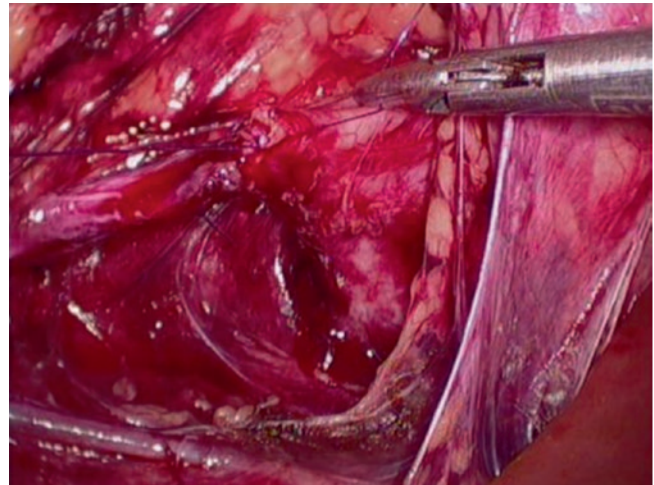

Fig. 5.20 Completed pyeloplasty

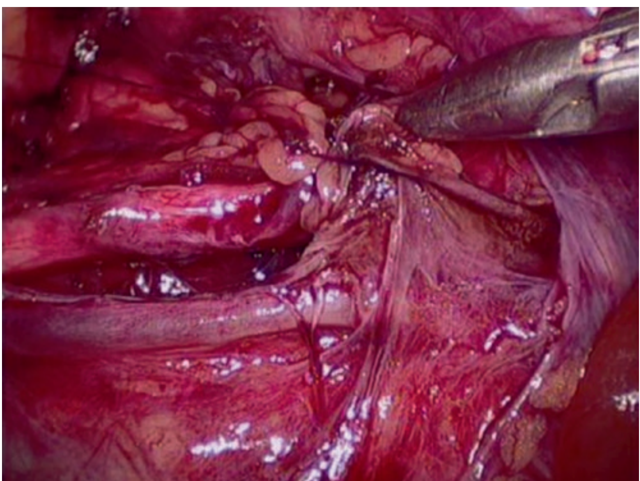

Fig. 5.21 Perinephric fat used as cover for anastomosis

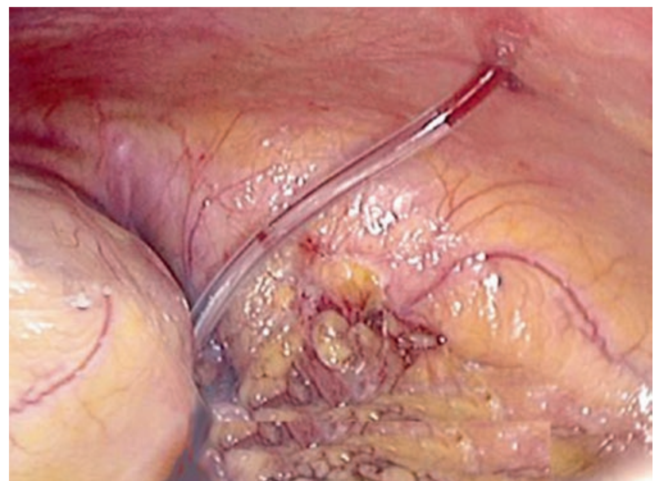

Fig. 5.22 Drain placed through lower port

5.6 Transperitoneal Non Dismembered Pyeloplasty

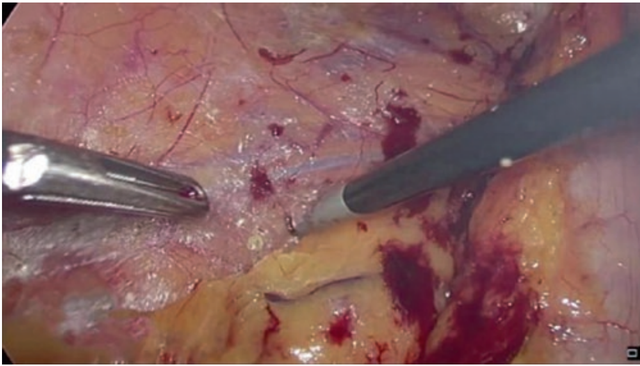

Fig. 5.23 Left colon being reflected along line of Toldt

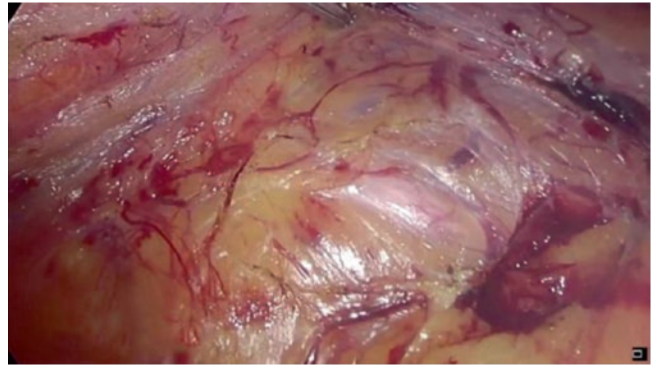

Fig. 5.24 Ureter identified in the retroperitoneum with its characteristic features

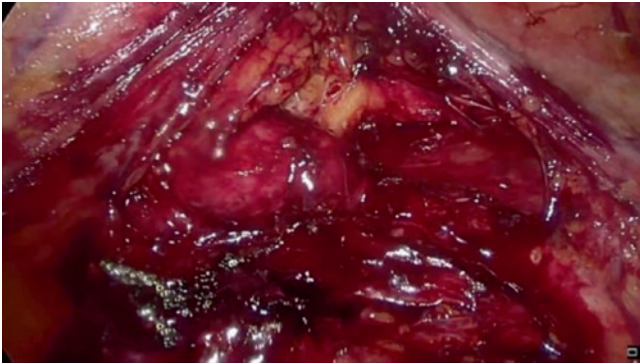

Fig. 5.25 Ureter traced proximally till pelvis

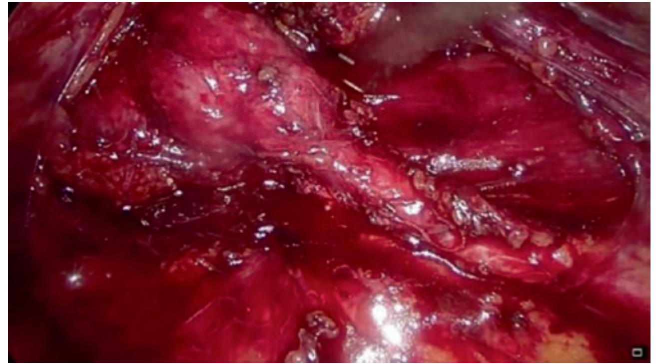

Fig. 5.26 Pelvi ureteric junction identified and dissected all around preserving adventitia around the ureter

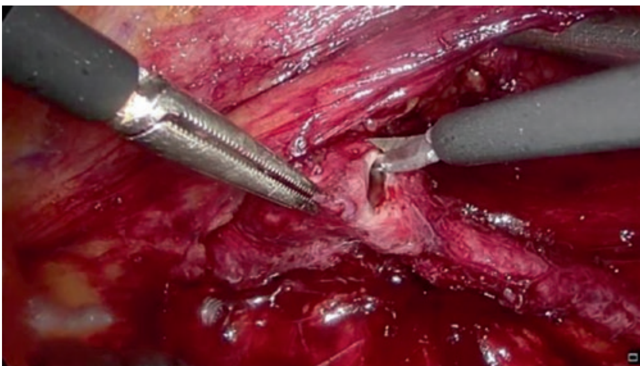

Fig. 5.27 Pyelotomy being done in the shape of 'V' with the apex of V just proximal to PUJ

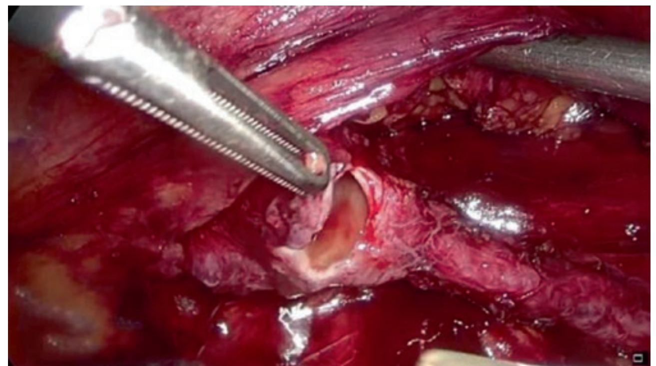

Fig. 5.28 Pyelotomy completed

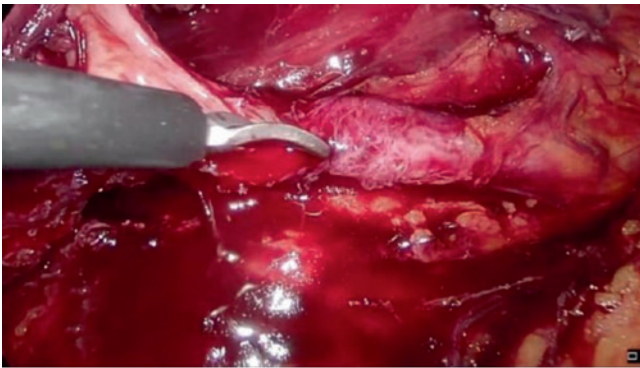

Fig. 5.29 Ureteric spatulation being done as the vertical limb of 'Y'

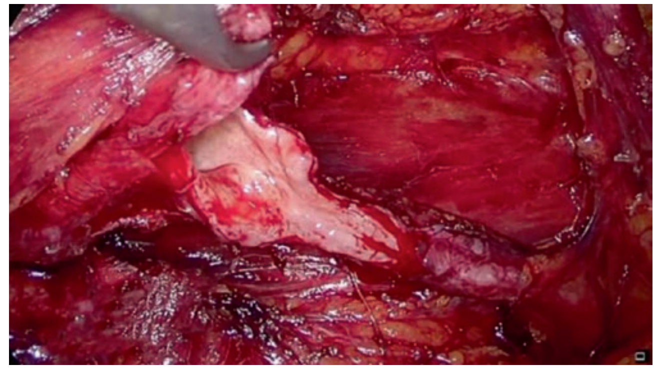

Fig. 5.30 Completed 'Y' incision

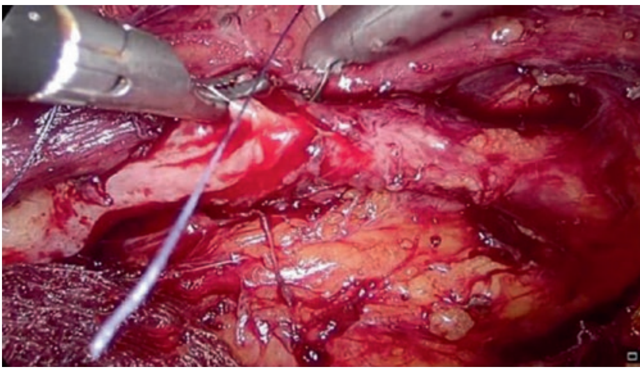

Fig. 5.31 Apical suture through the ureter with 4-0 polyglactin

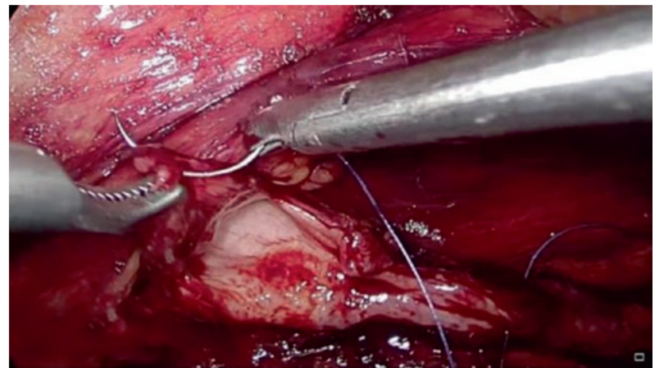

Fig. 5.32 Corresponding suture through the apex of pelvic flap

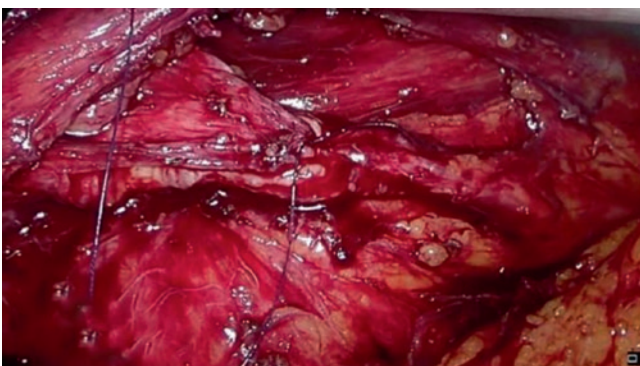

Fig. 5.33 Apical suture in place

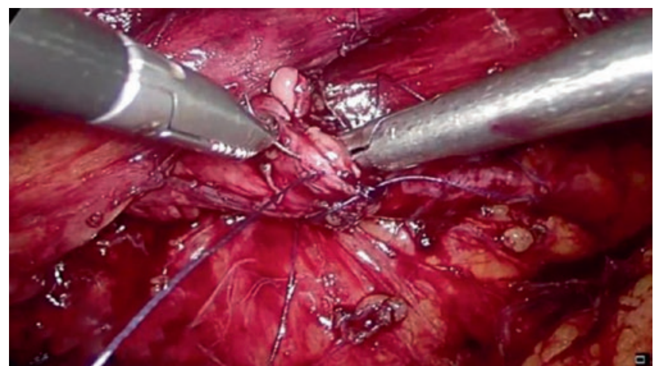

Fig. 5.34 Continuous suturing of lateral margin of flap in progress

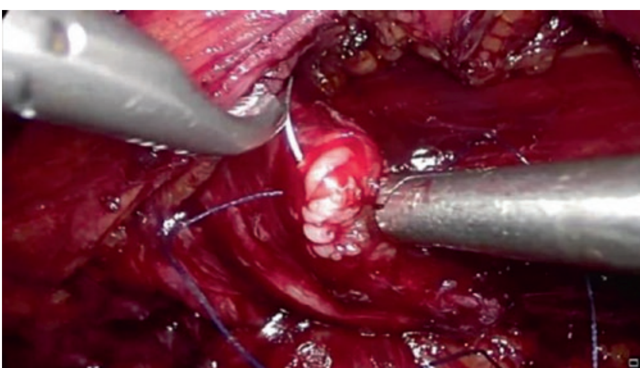

Fig. 5.35 Lateral margin suturing in progress

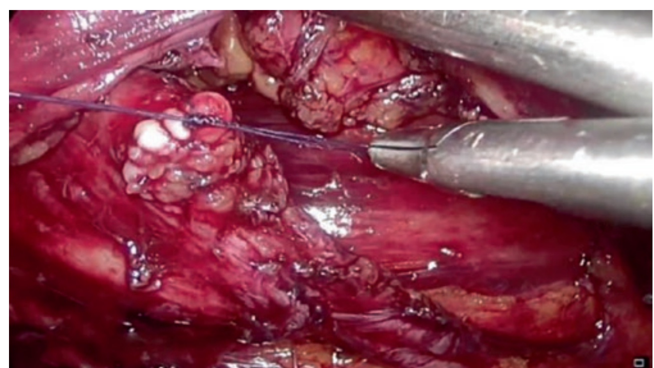

Fig. 5.36 Lateral margin suturing completed

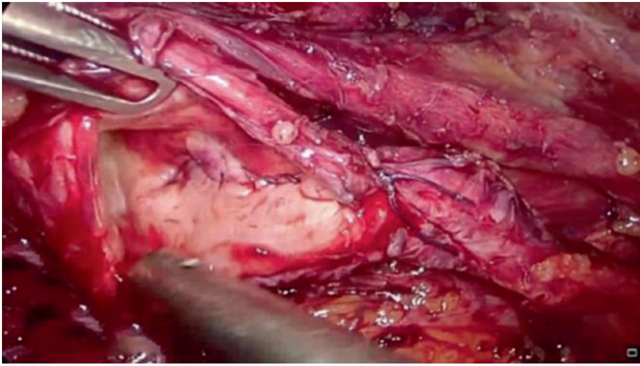

Fig. 5.37 Lateral wall suture seen through the inner aspect of pelvis

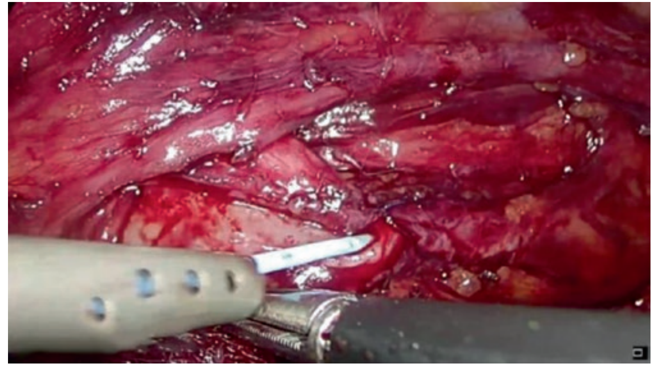

Fig. 5.38 Stent being inserted antegrade

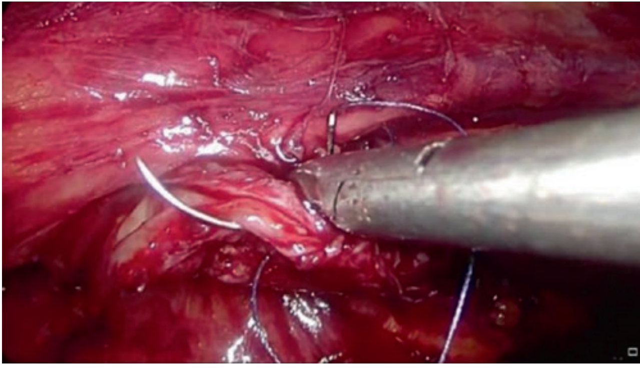

Fig. 5.39 Medial margin suturing in progress

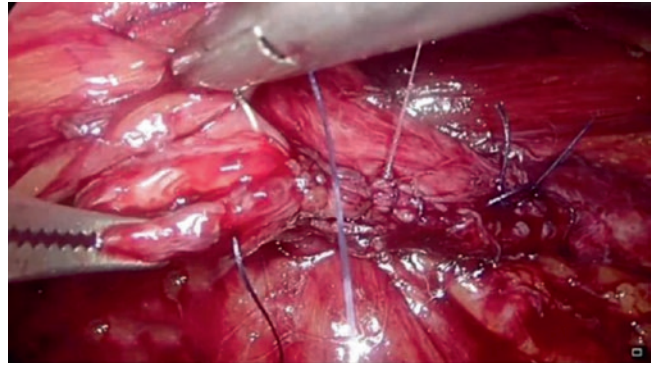

Fig. 5.40 Medial margin suturing in progress

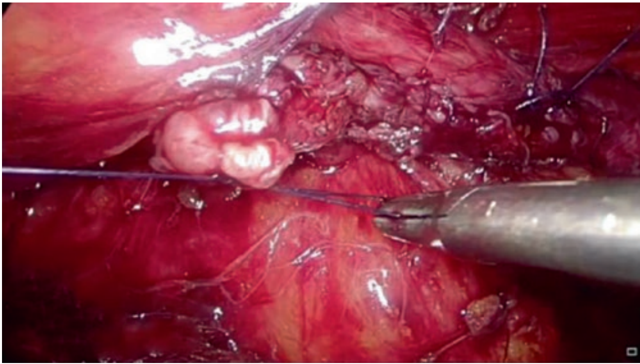

Fig. 5.41 Medial margin suturing completed

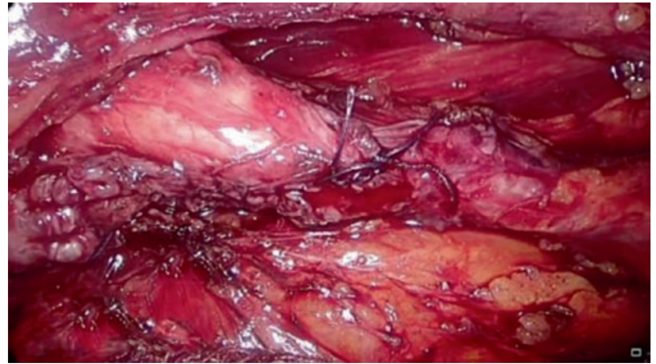

Fig. 5.42 Completed ‘Y’ – ‘V’ plasty

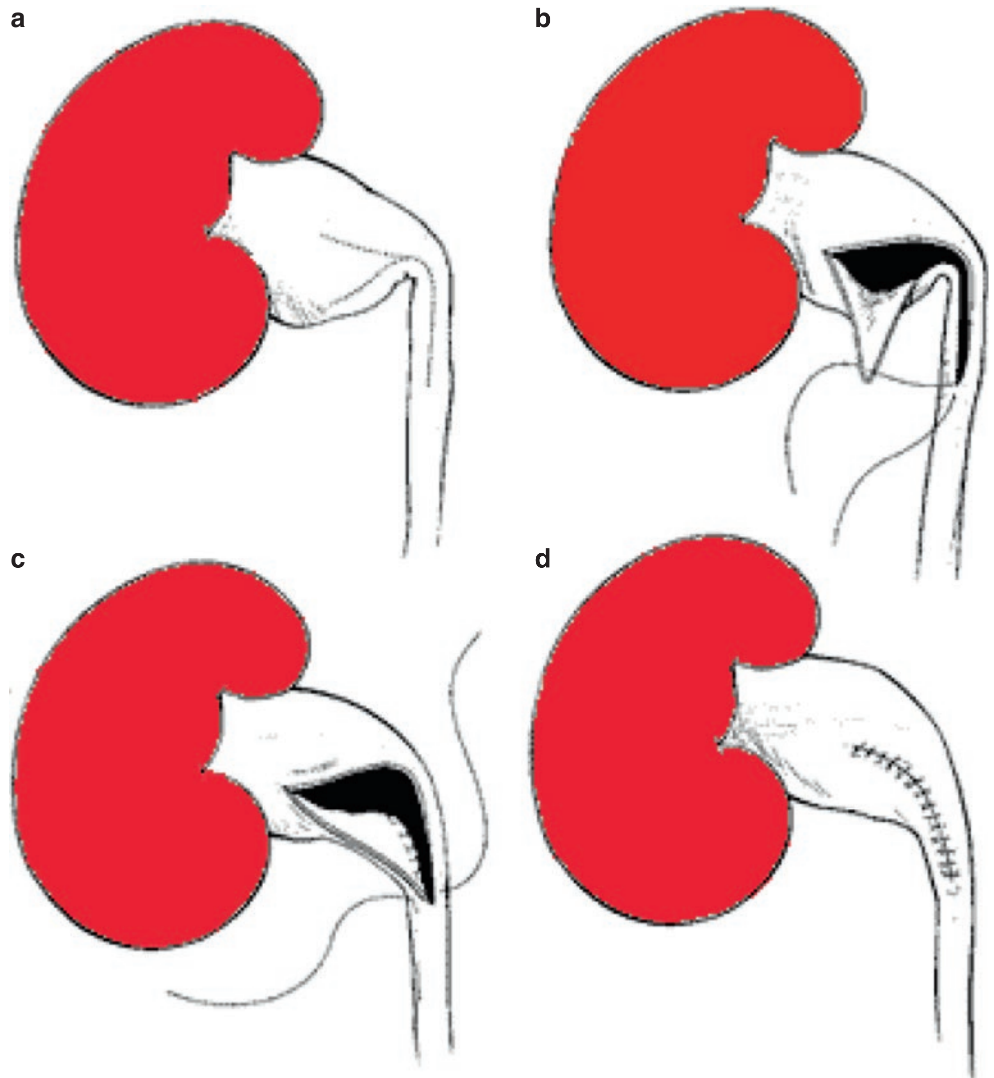

Fig. 5.43 Diagrammatic representation of Y – V plasty

5.7 Transmesocolic Pyeloplasty

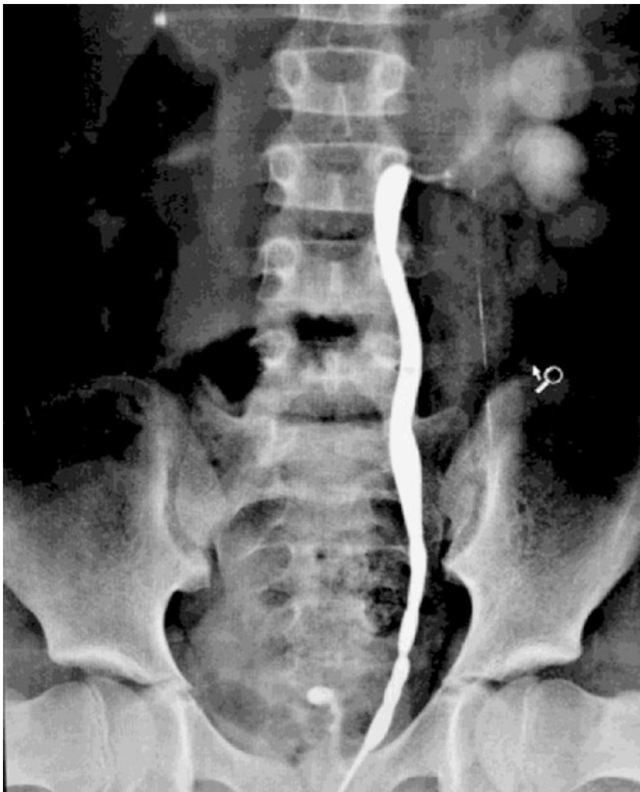

Fig. 5.44 RGP showing left UPJ narrowing

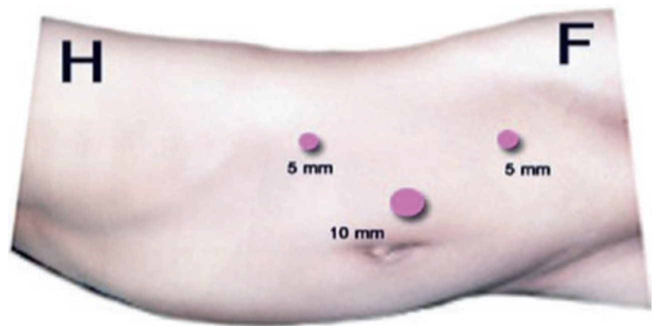

Fig. 5.45 Ports position

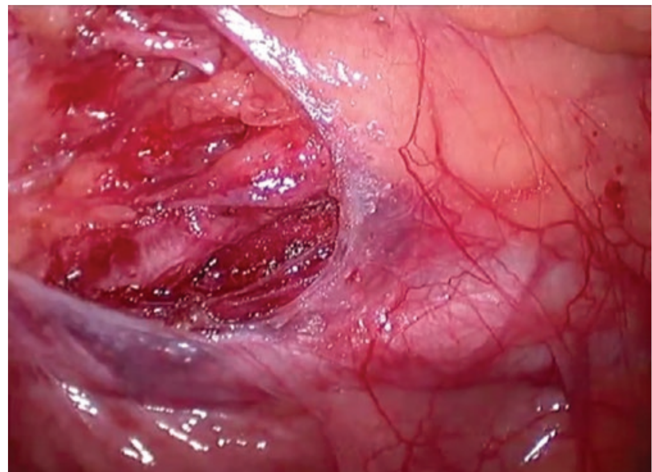

Fig. 5.47 Incision of the mesocolon over the bulge, preserving the mesocolic vessels

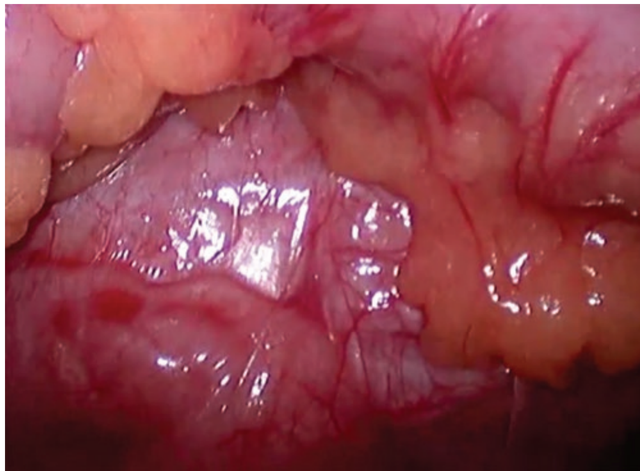

Fig. 5.46 Bulging pelvis seen through the mesocolon

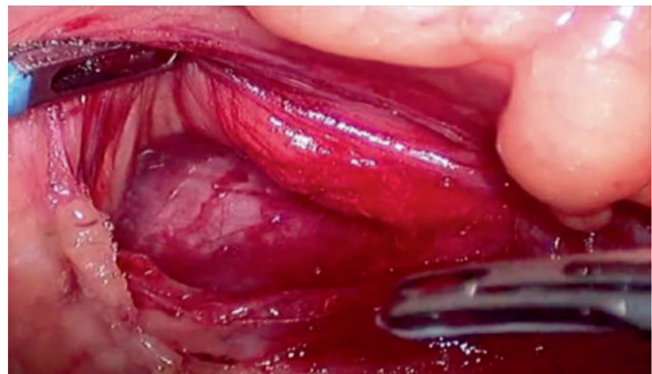

Fig. 5.48 Pelvis seen through the mesocolic window

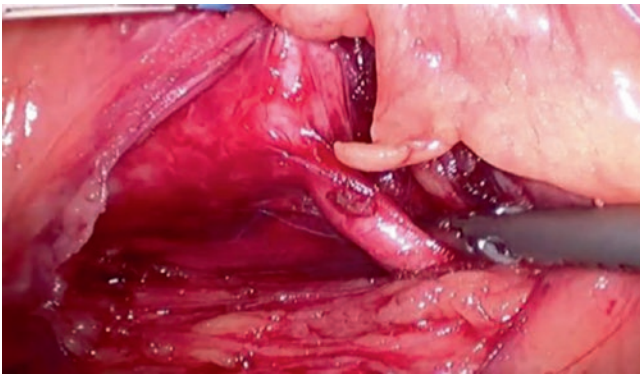

Fig. 5.49 Pelvis and upper ureter dissected through the mesocolic window and pelviureteric junction delineated

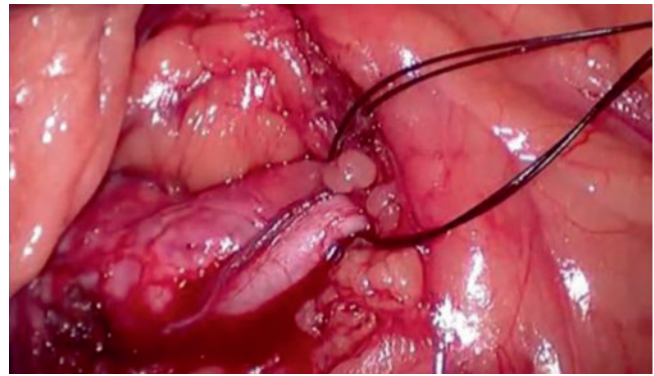

Fig. 5.50 Sling placed around the ureter for identification and retraction

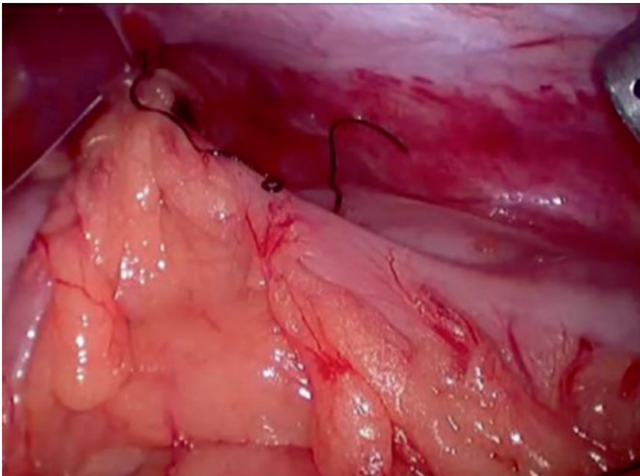

Fig. 5.51 Mesocolon tacked to the abdominal wall

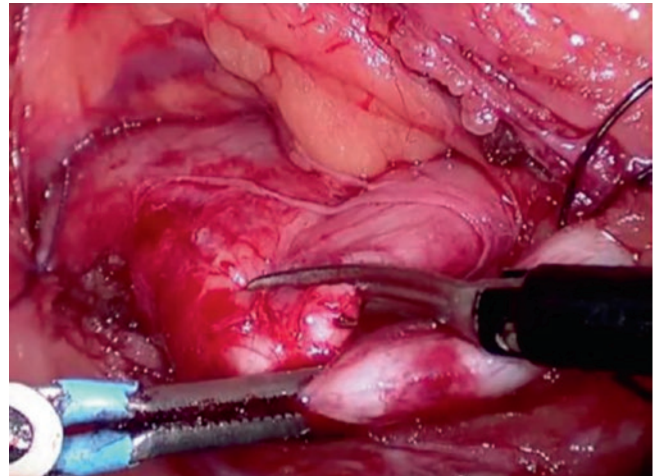

Fig. 5.52 Oblique pyelotomy in progress

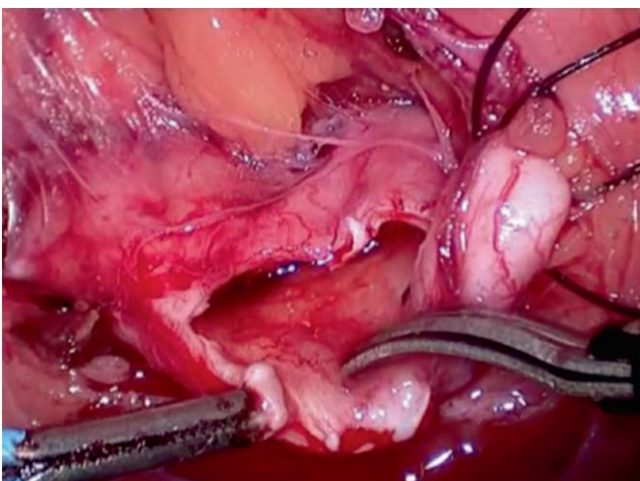

Fig. 5.53 Anterior layer of pelvis incised completely

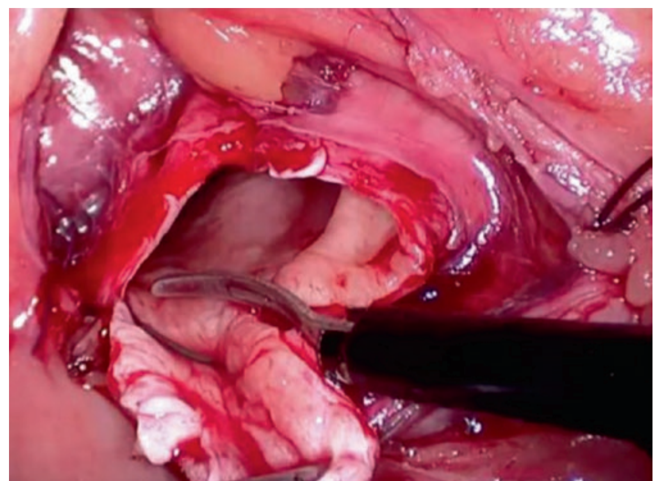

Fig. 5.54 Pyelotomy about to be completed. Note preplaced guide wire

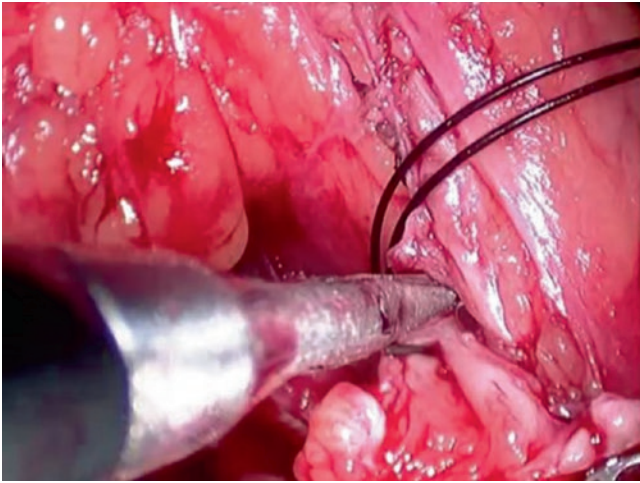

Fig. 5.55 Lateral spatulation of ureter in progress

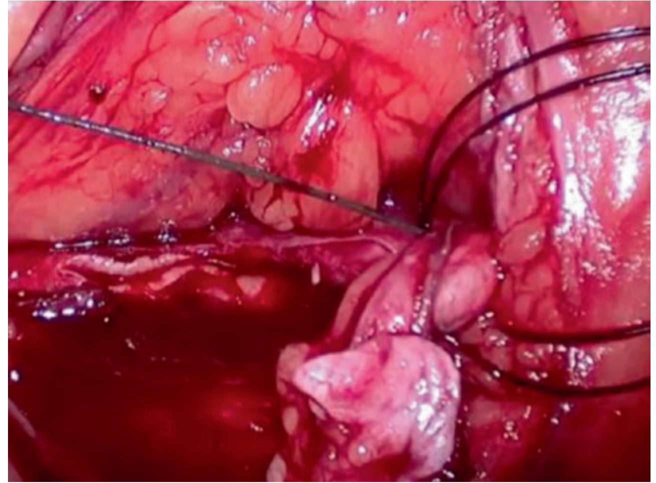

Fig. 5.56 Ureteric spatulation completed – beyond the narrowing

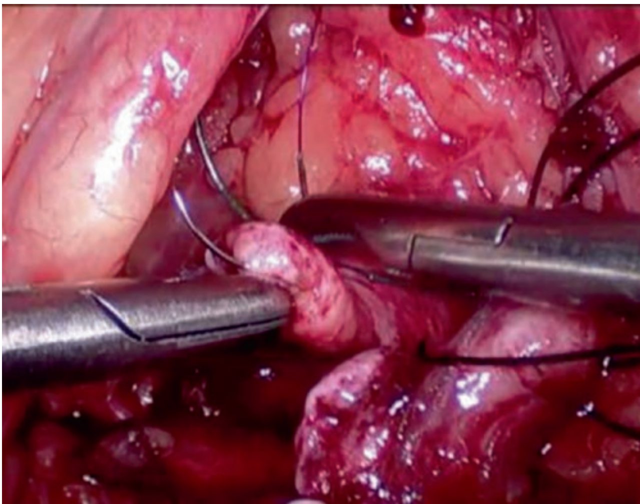

Fig. 5.57 Initial suture through the pelvis – outside-in using 4–0 Polydioxanone suture

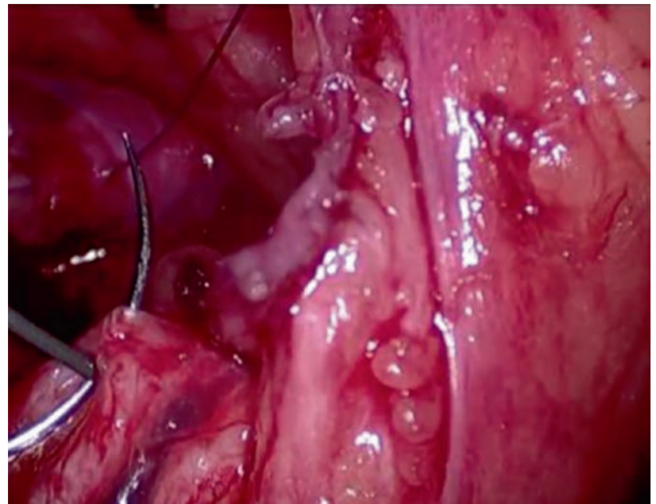

Fig. 5.58 Corresponding suture through the spatulated end of ureter

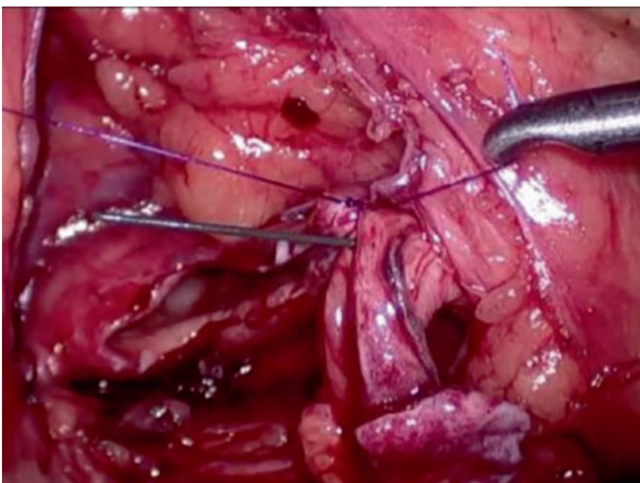

Fig. 5.59 Apical suture in place

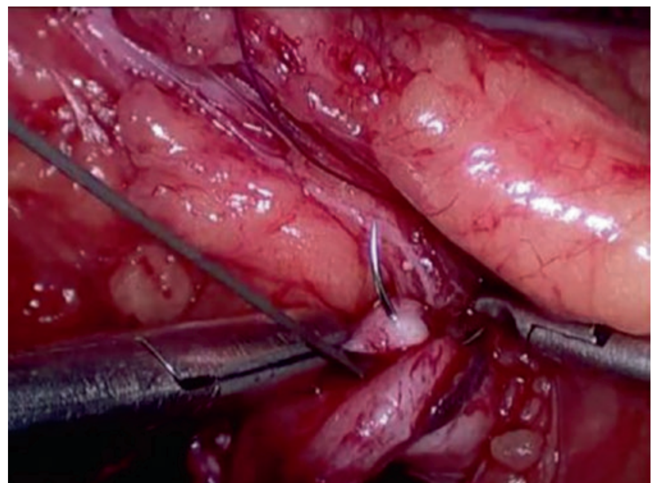

Fig. 5.60 Posterior layer suturing in progress

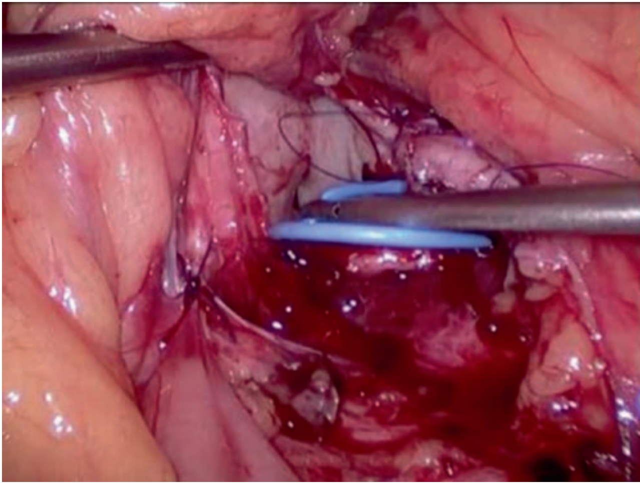

Fig. 5.61 Stent being inserted antegrade

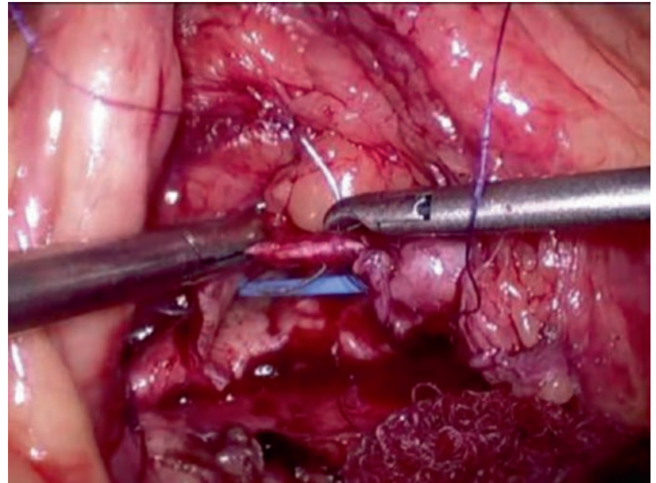

Fig. 5.62 Final suture of anterior layer in place

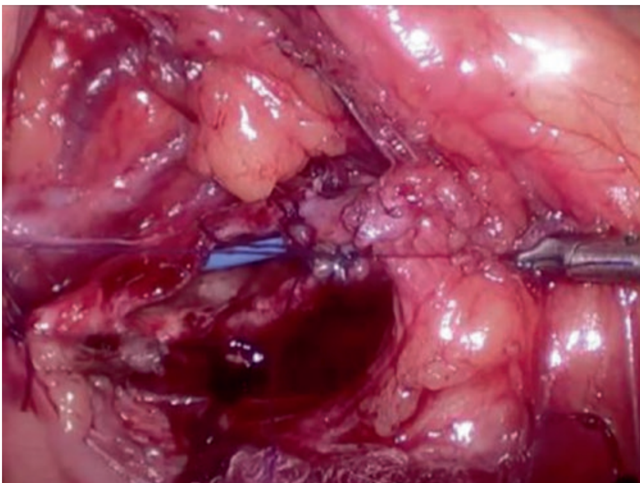

Fig. 5.63 Completed anterior and posterior uretero pelvic sutures

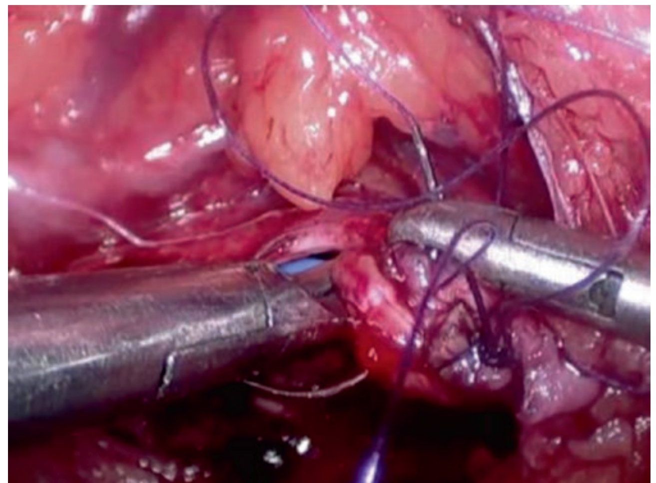

Fig. 5.64 Final suture through center of the proximal end of ureter to the pelvis

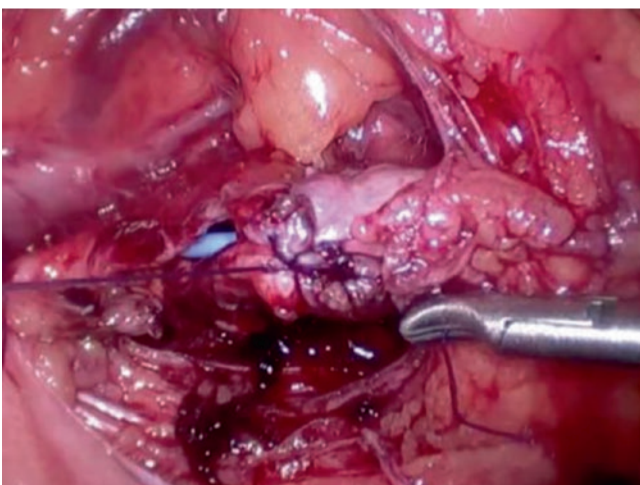

Fig. 5.65 Completed pyelo ureteric anastomosis

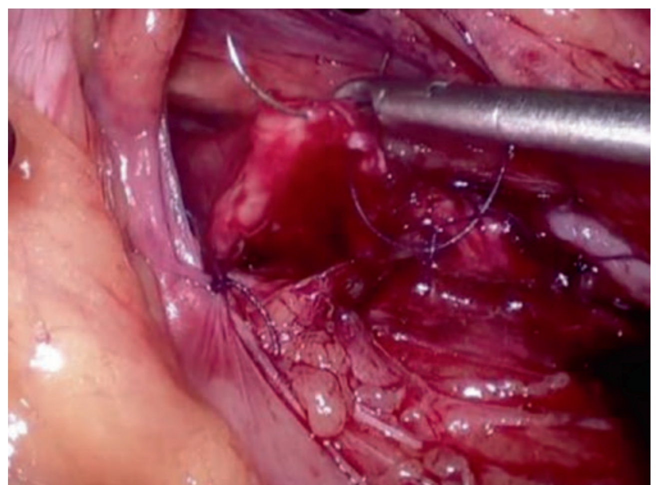

Fig. 5.66 Closure of remaining pyelotomy rent

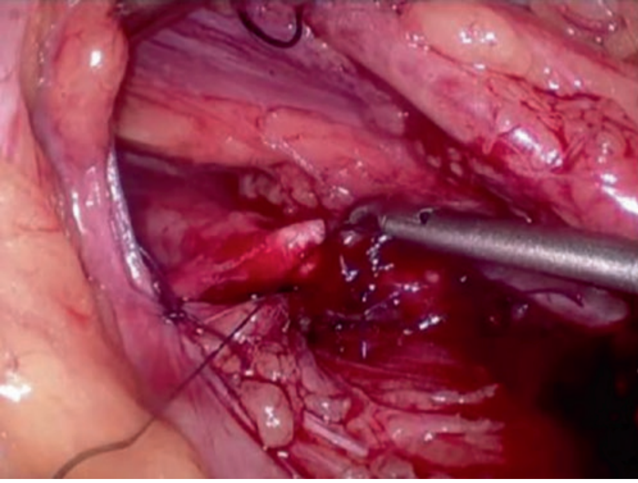

Fig. 5.67 Pyelotomy closure in progress

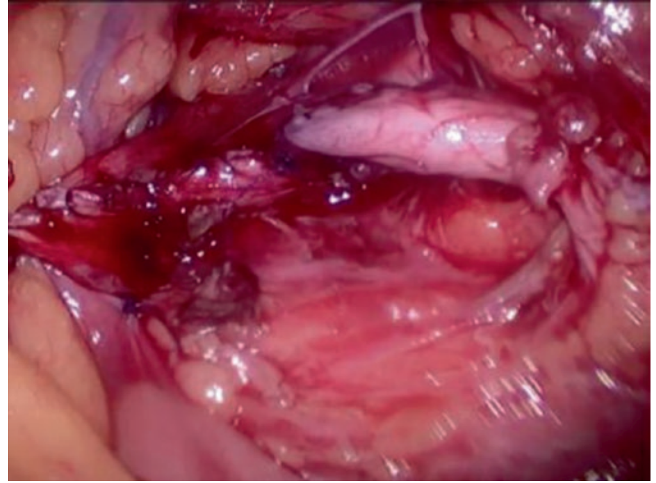

Fig. 5.68 Completed pyeloplasty

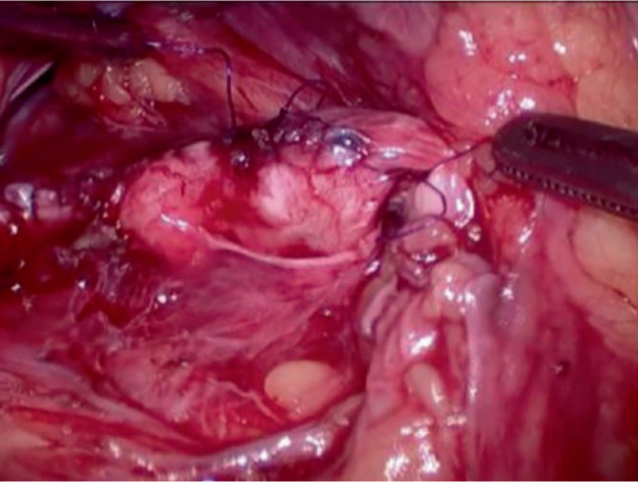

Fig. 5.69 Completed pyeloplasty

5.8 Horse Shoe Kidney with PUJ Obstruction

Fig. 5.70 CT showing malrotated RT moiety with PUJ obstruction of a horseshoe kidney

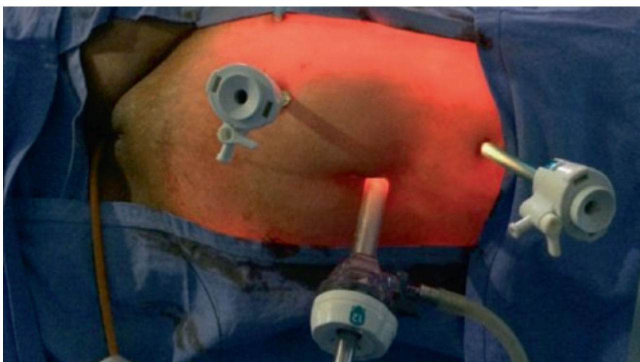

Fig. 5.71 Port placement. Camera port is at umbilicus as UPJ is at a lower and medial location

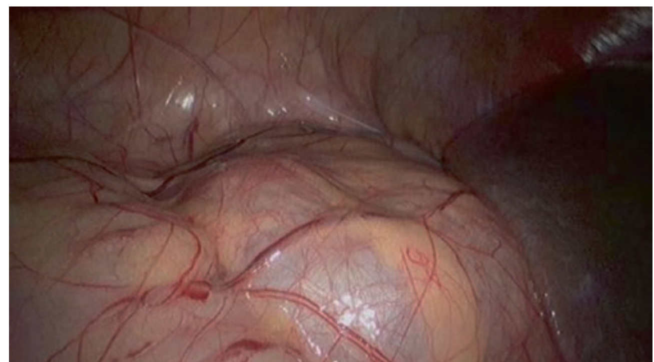

Fig. 5.72 Initial view showing the bulge caused by dilated pelvis over the lumbar region (Lower than usual)

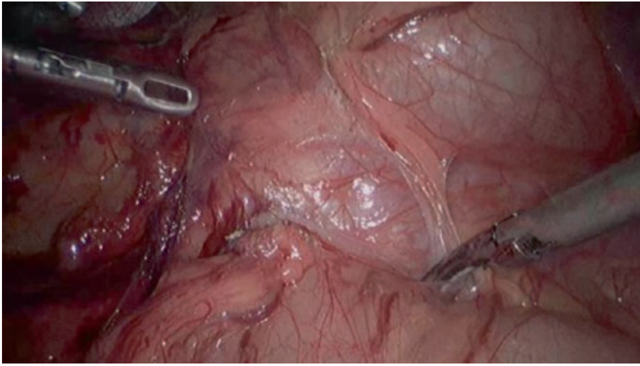

Fig. 5.73 Right colon being reflected medially along the line of Toldt to enter retroperitoneum

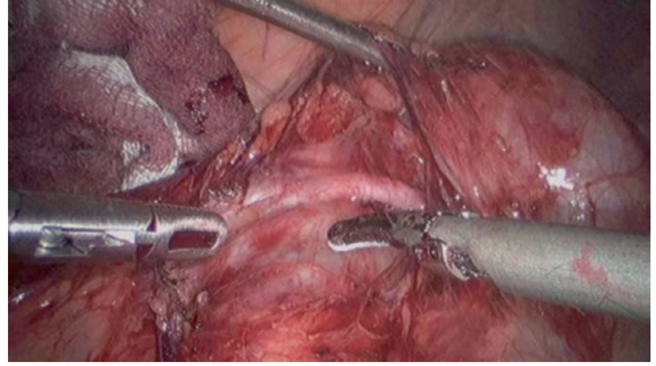

Fig. 5.74 Dilated pelvis and narrow ureter visualised

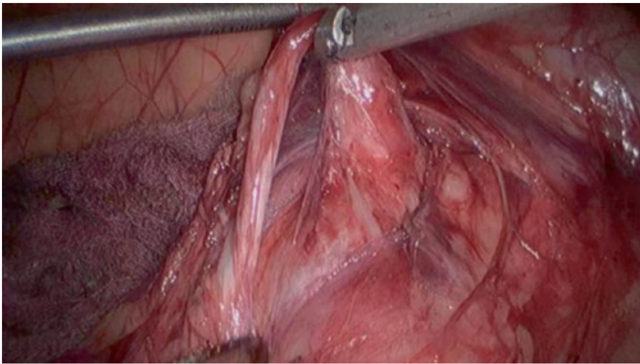

Fig. 5.75 PUJ dissected

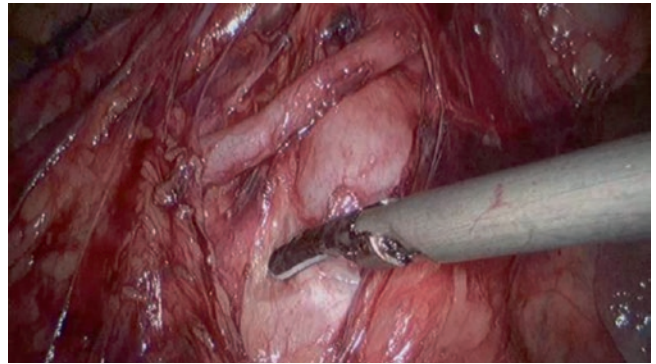

Fig. 5.76 Dialeted pelvis and the isthmus part seen

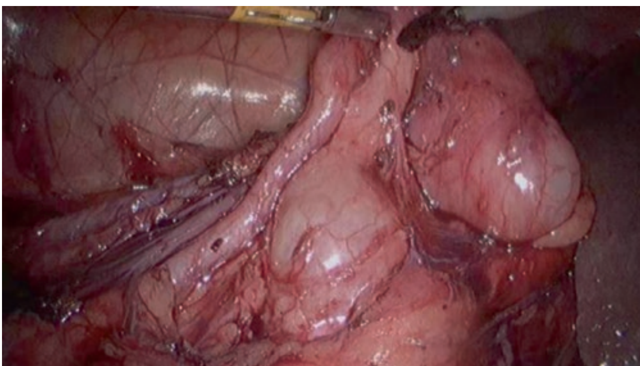

Fig. 5.77 Pelvis and grossly dilated calyces seen

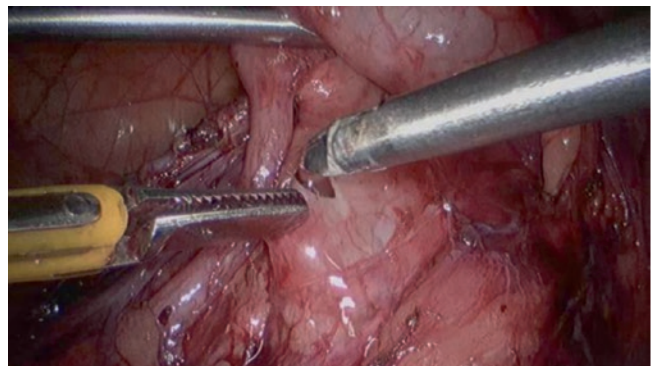

Fig. 5.78 Pyelotomy in the dependant area

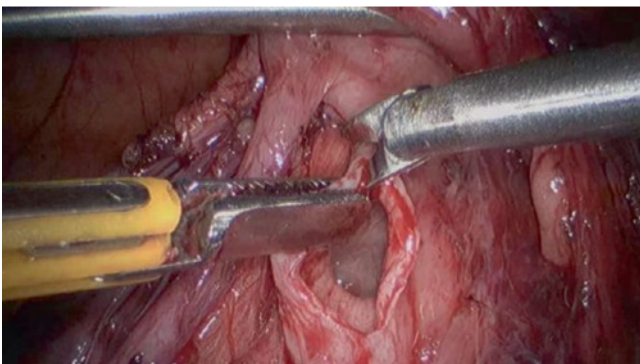

Fig. 5.79 Pyelotomy extended

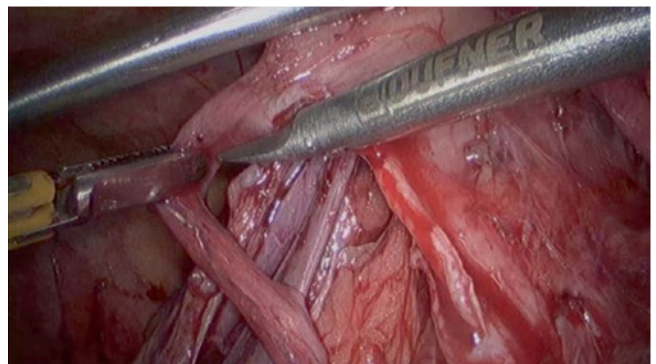

Fig. 5.80 Pyelotomy extended on to ureter in preparation for non dismembered pyeloplasty

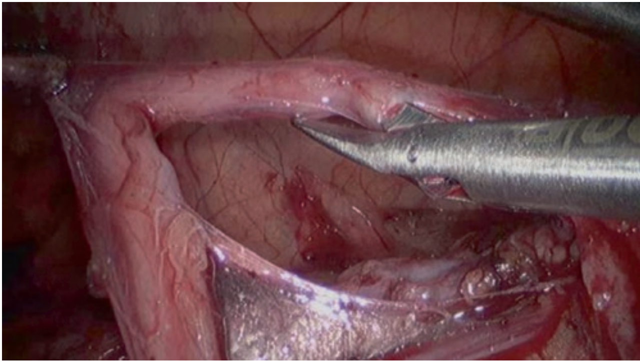

Fig. 5.81 Ureterotomy extended till normal caliber ureter

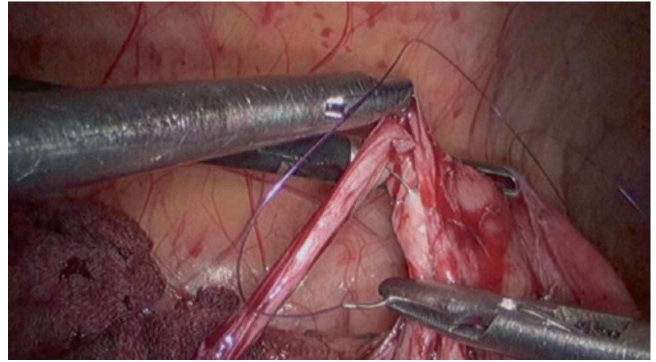

Fig. 5.82 Posterior layer suturing with 4–0 PDS suture (Non dismembered)

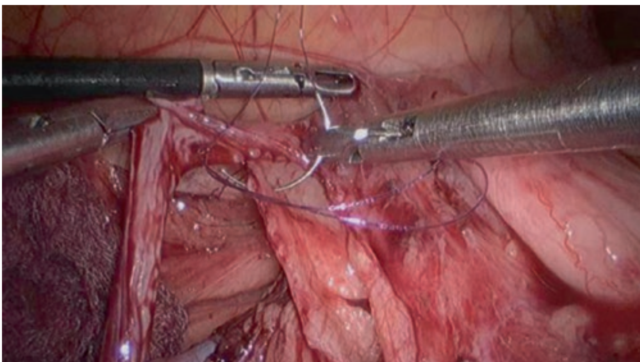

Fig. 5.83 Posterior layer suturing in progress

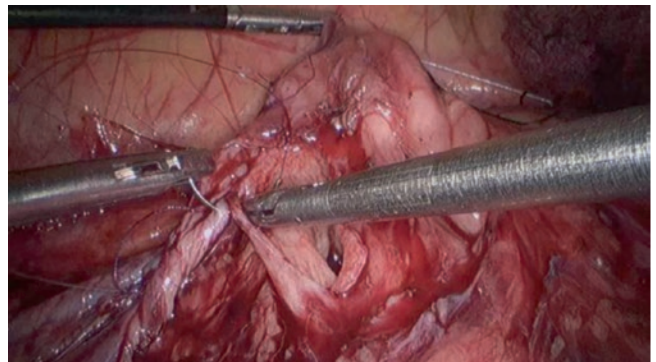

Fig. 5.84 Posterior layer suturing in progress

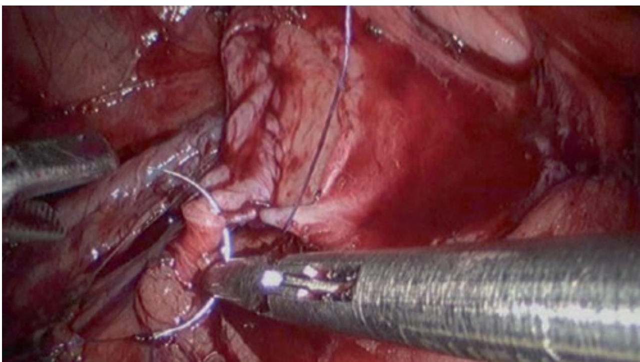

Fig. 5.85 Final sutures of posterior layer

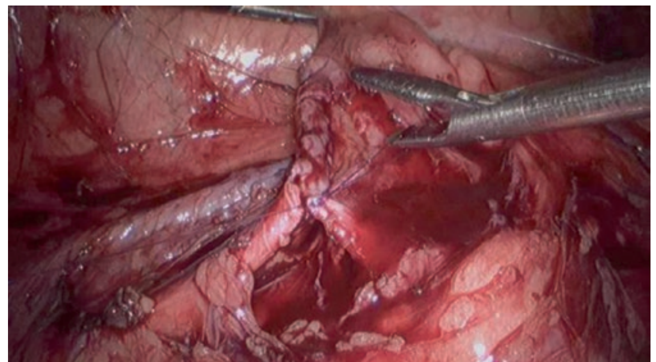

Fig. 5.86 Posterior layer suture completed

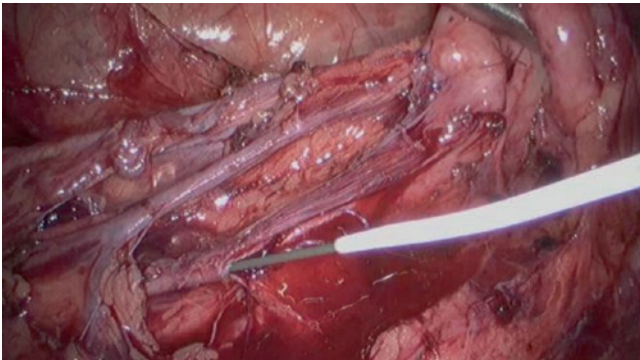

Fig. 5.87 Stent placed antegrade

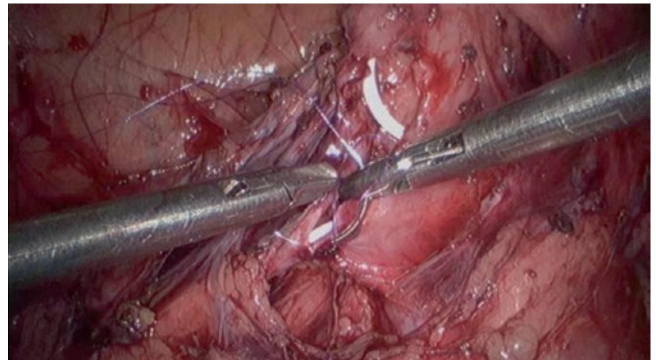

Fig. 5.88 Anterior layer suturing with same suture after knotting

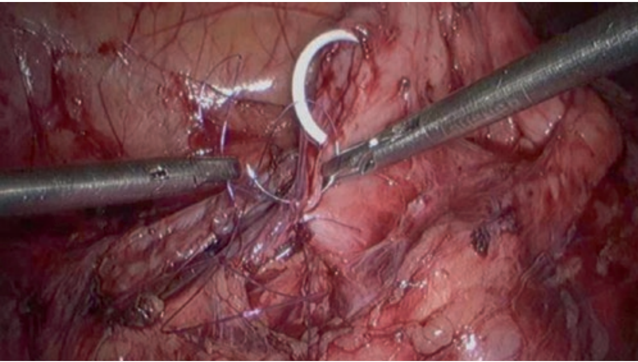

Fig. 5.89 Anterior layer suturing in progress

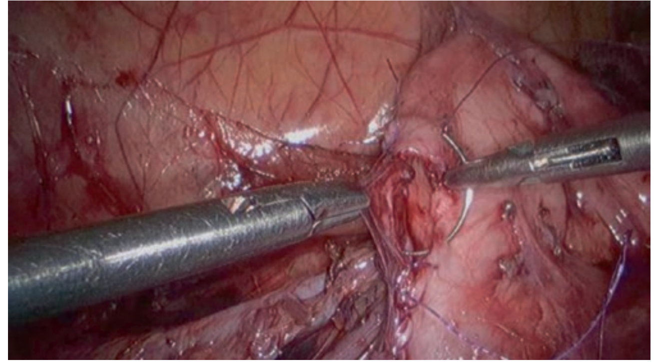

Fig. 5.90 Anterior layer suturing in progress

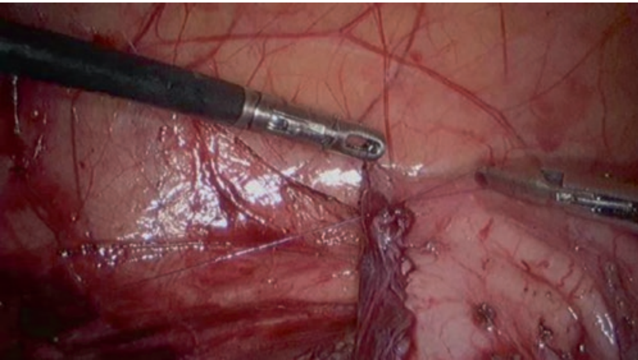

Fig. 5.91 Anterior layer suturing layer completed

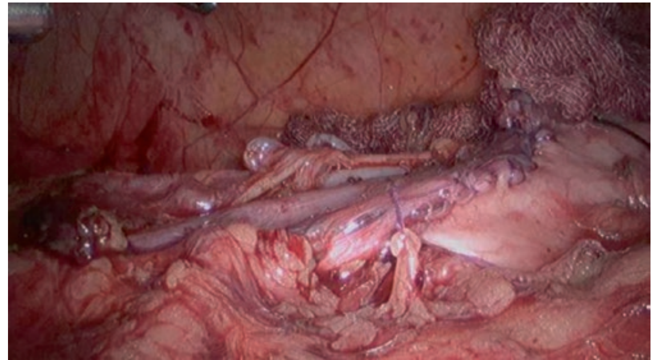

Fig. 5.92 Final view showing dependant UPJ

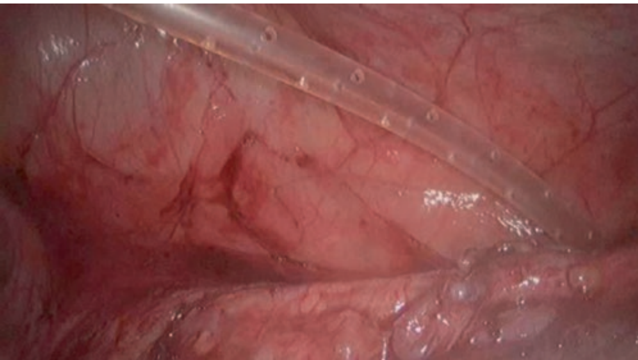

Fig. 5.93 Drain placed

5.9 Pyeloplasty in Ectopic Kidney

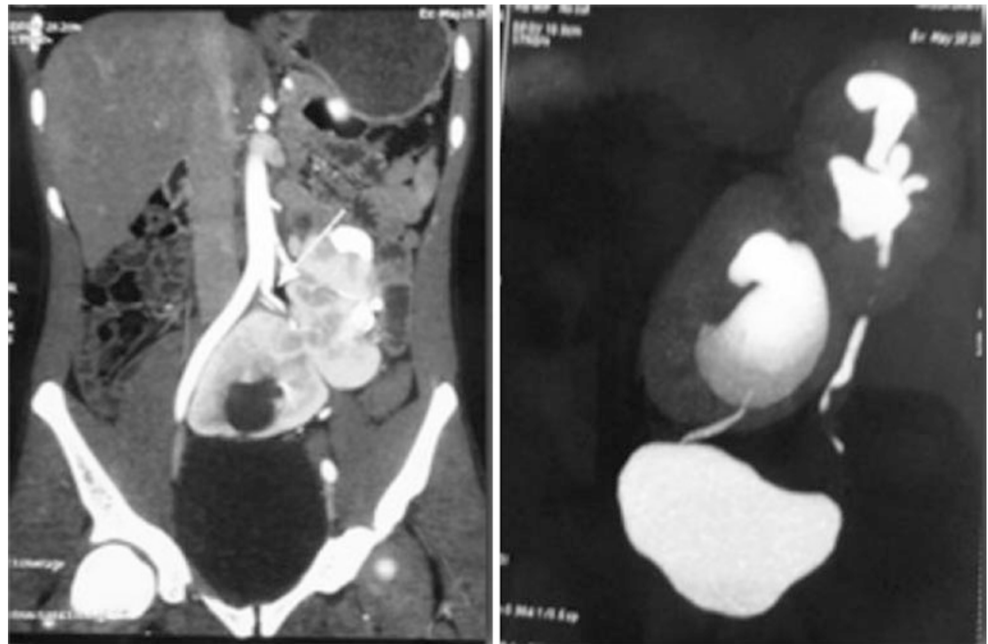

Fig. 5.94 CT urogram of right pelvic kidney with UPJ obstruction

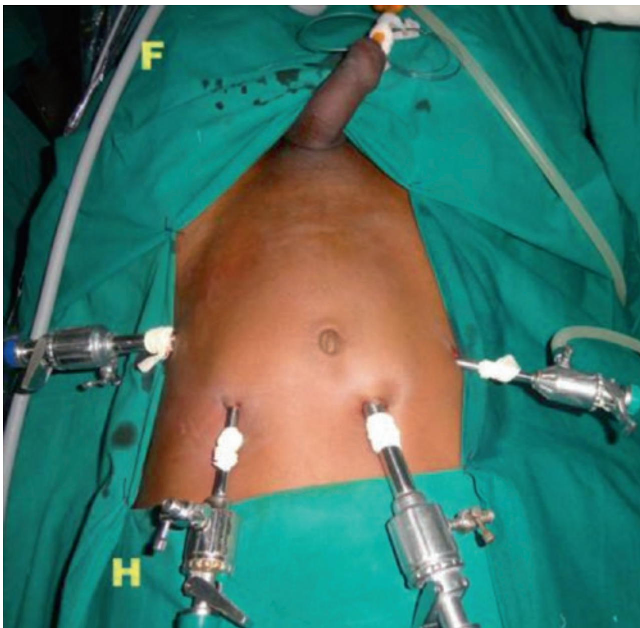

Fig. 5.95 Port positions

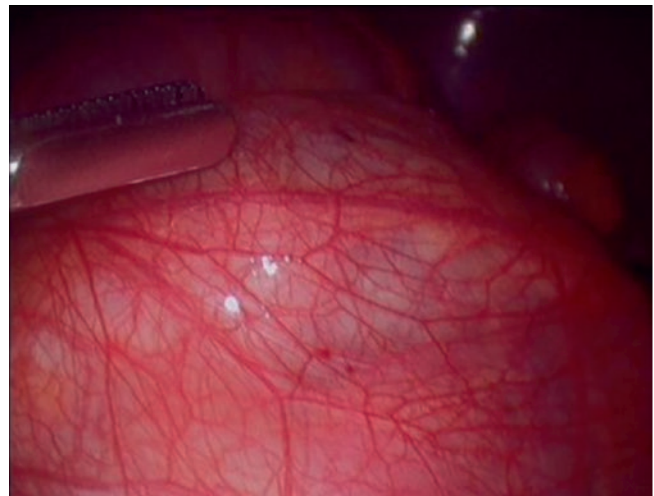

Fig. 5.96 Initial view of pelvic kidney with the bulging pelvis as seen from head end (At the level of sacral promontory)

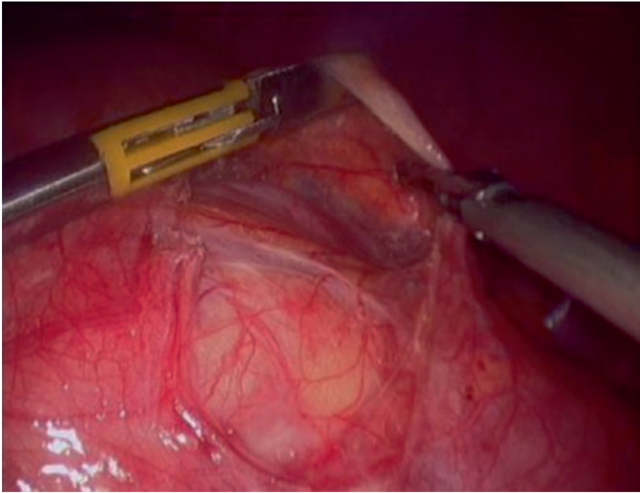

Fig. 5.97 Peritoneum over the pelvis incised

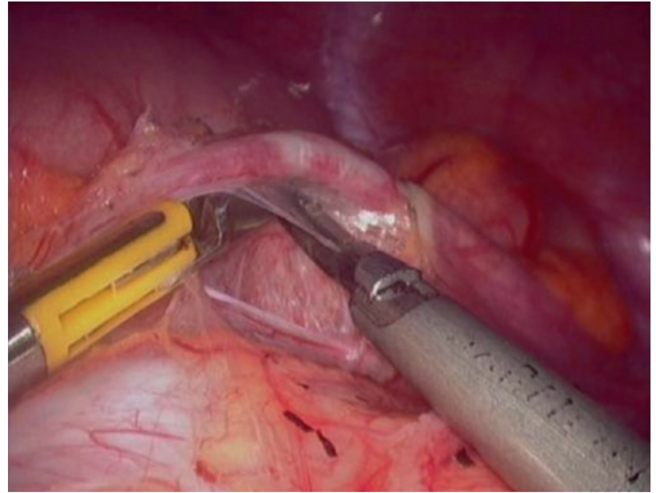

Fig. 5.98 Ureter with the ureteric catheter in situ, being dissected

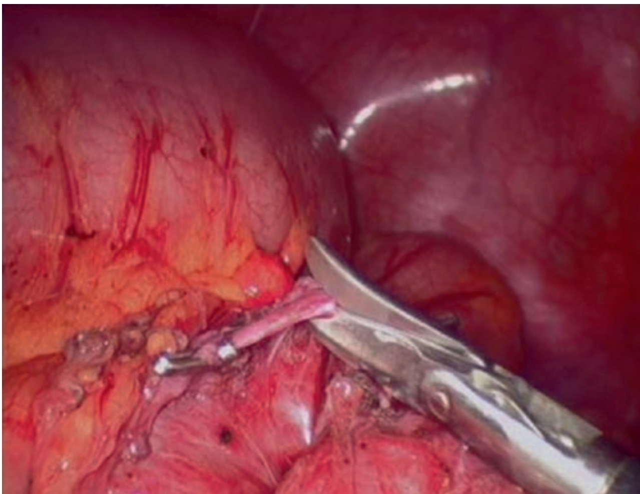

Fig. 5.99 Crossing vein divided

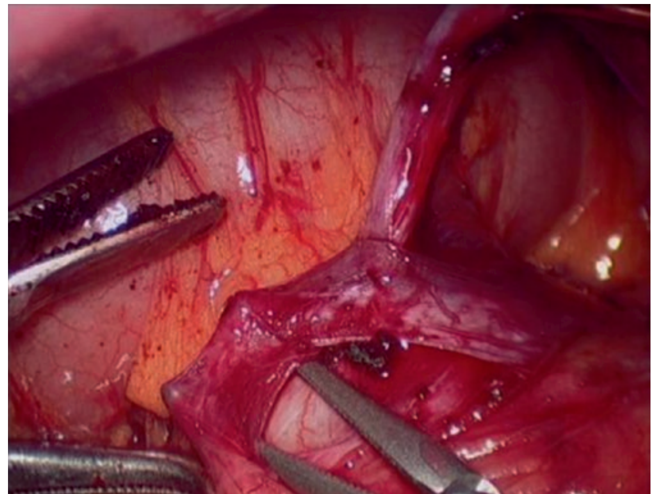

Fig. 5.100 Crossing vessel around the pelvi ureteric junction dissected

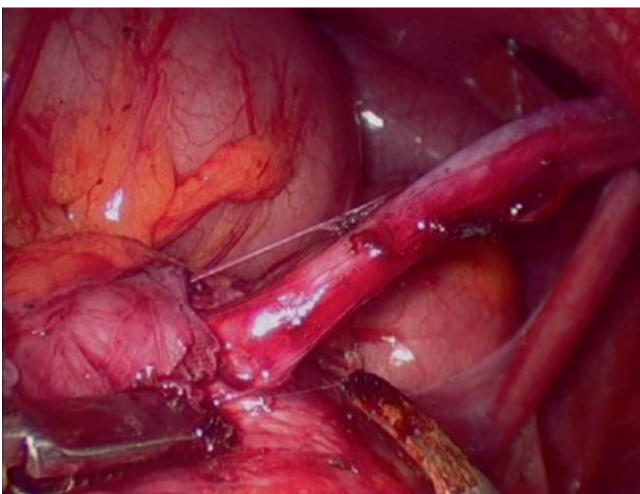

Fig. 5.101 Ureter traced proximally till pelvis

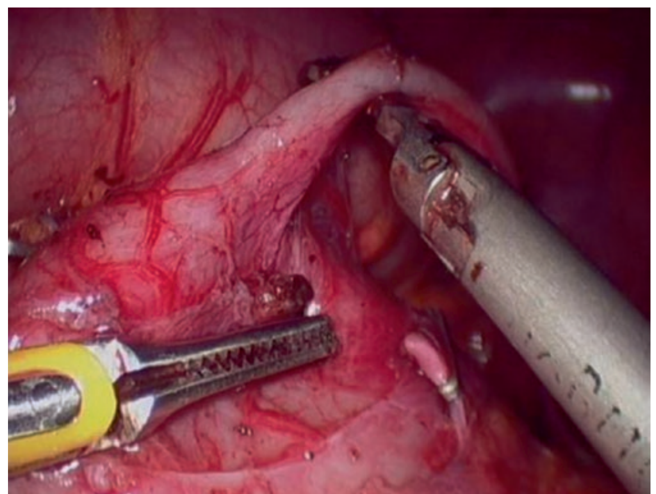

Fig. 5.102 Pelvi ureteric junction delineated all around

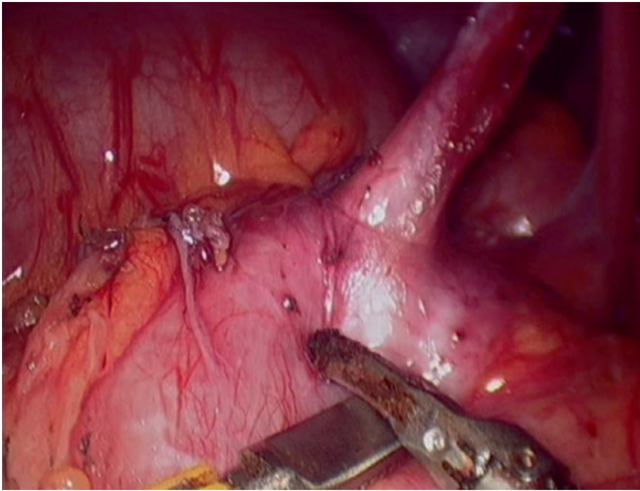

Fig. 5.103 Pelvi ureteric junction dissected

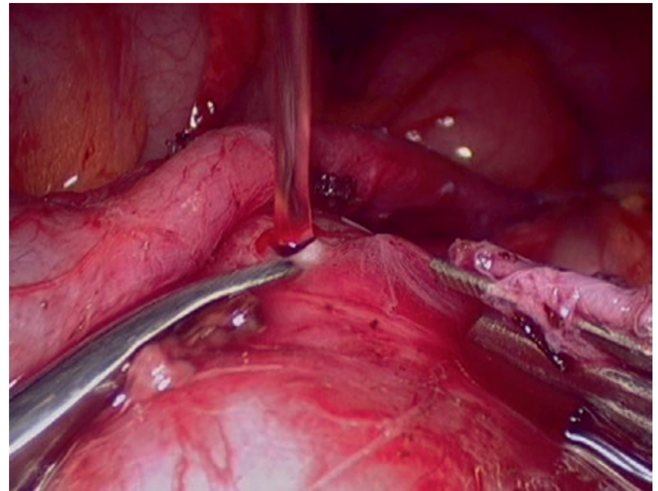

Fig. 5.104 Pyelotomy started

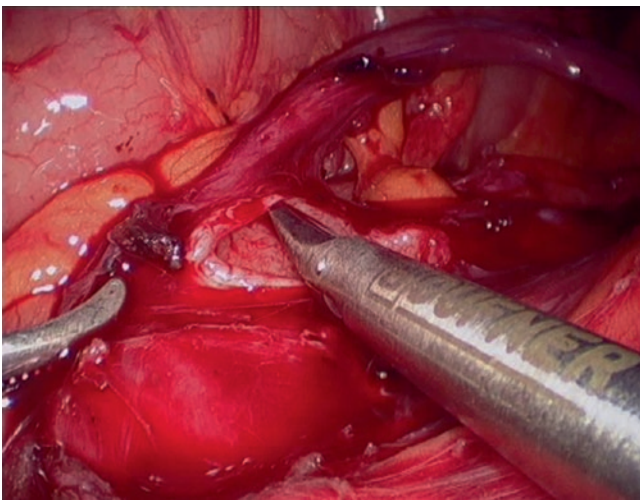

Fig. 5.105 Pyelotomy completed and ureteric spatulation started

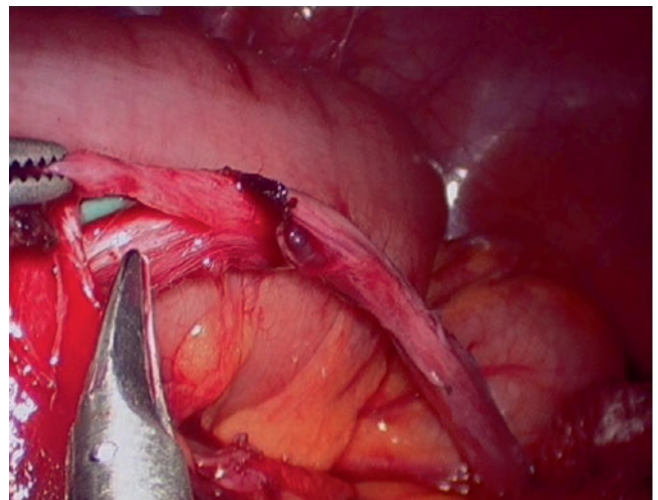

Fig. 5.106 Ureterotomy completed (UPJ not dismembered yet, for better orientation)

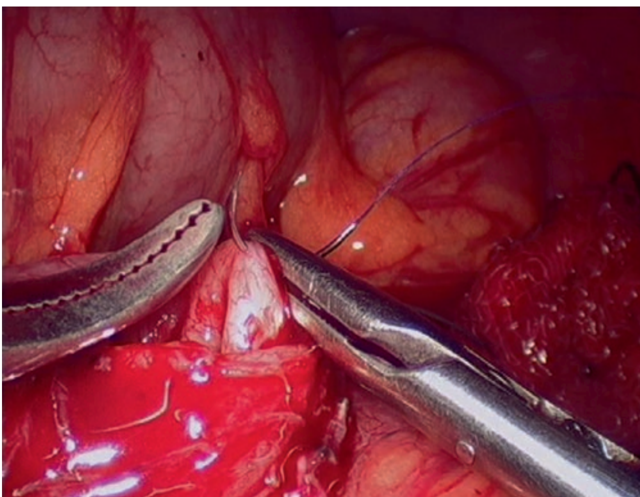

Fig. 5.107 Apical suture in the pelvis

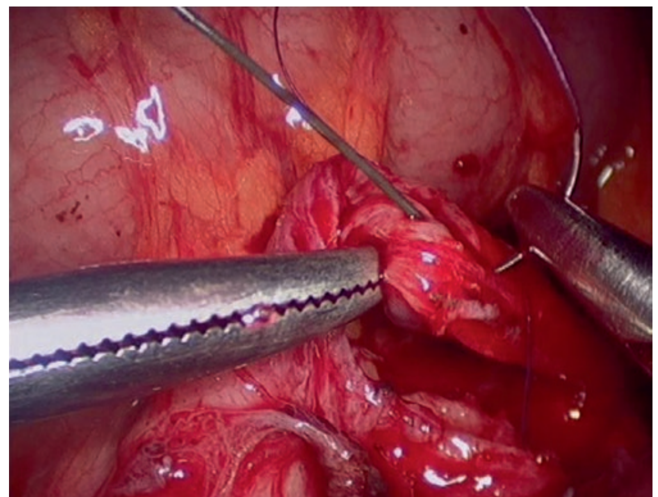

Fig. 5.108 Corresponding suture in the spatulated ureter

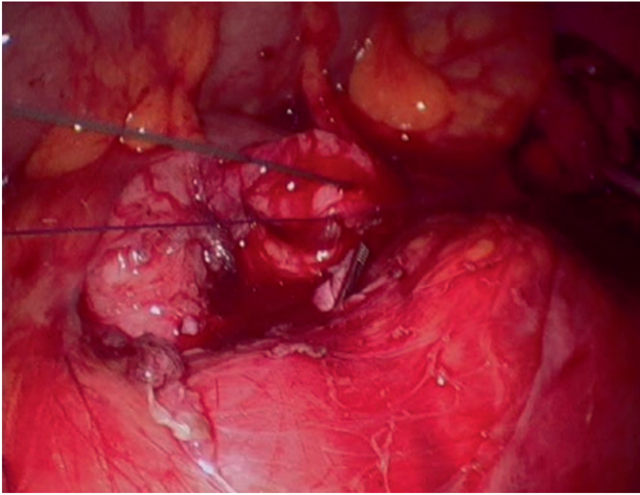

Fig. 5.109 Apical suture in place

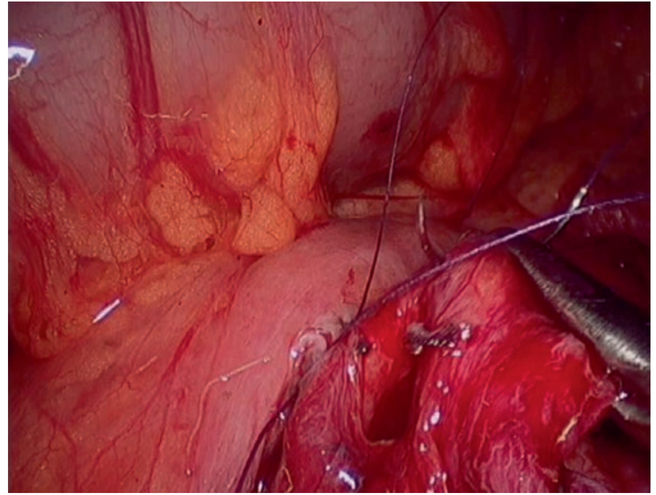

Fig. 5.110 Medial wall suturing started

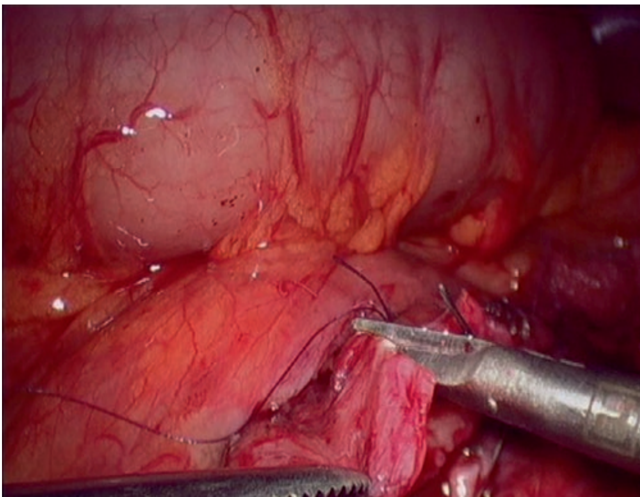

Fig. 5.111 Pelviureteric junction being divided

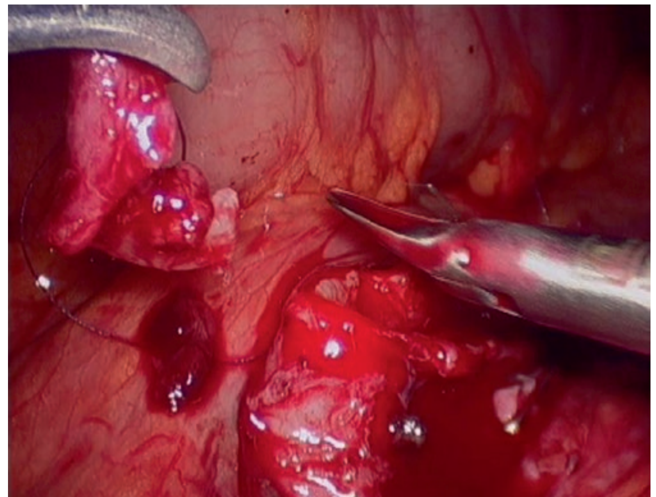

Fig. 5.112 Pelvic flap excised

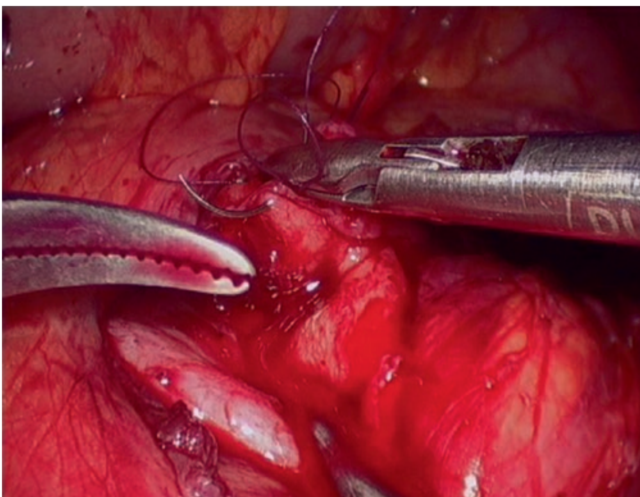

Fig. 5.113 Medial wall suturing in progress

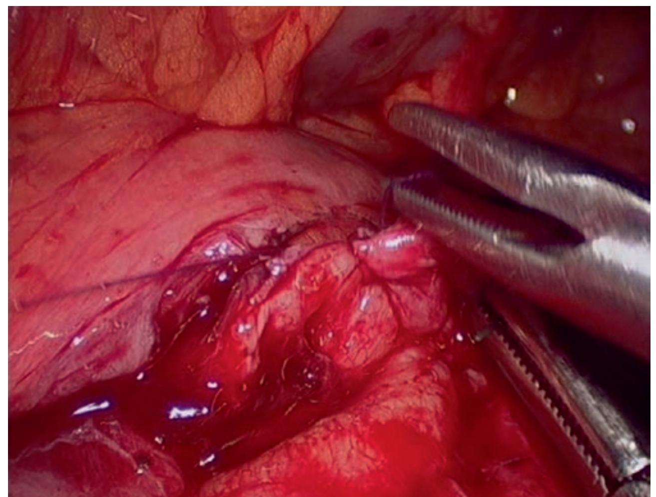

Fig. 5.114 Medial wall suturing in progress

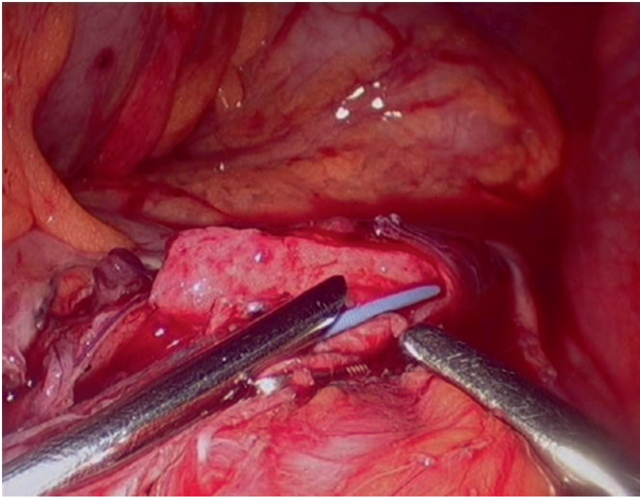

Fig. 5.115 Stent being inserted antegrade

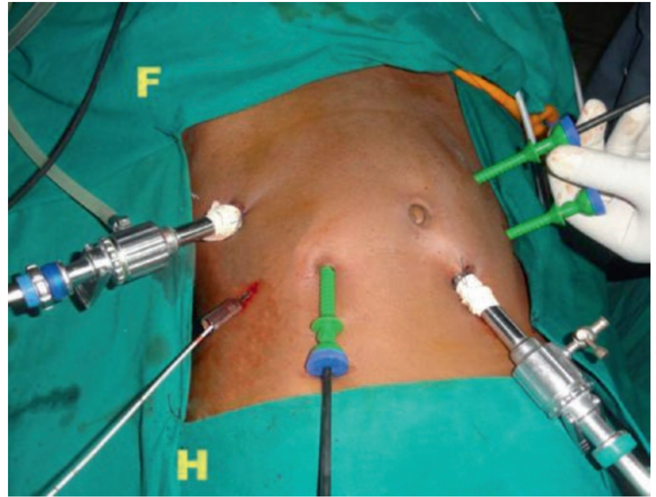

Fig. 5.116 Antegrade stenting

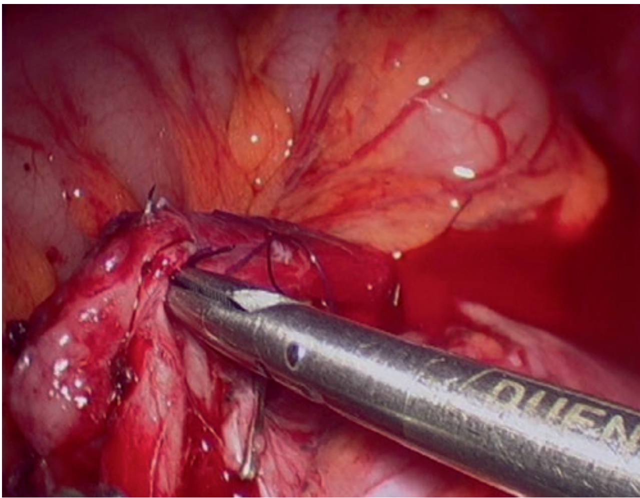

Fig. 5.117 Lateral wall suturing in progress

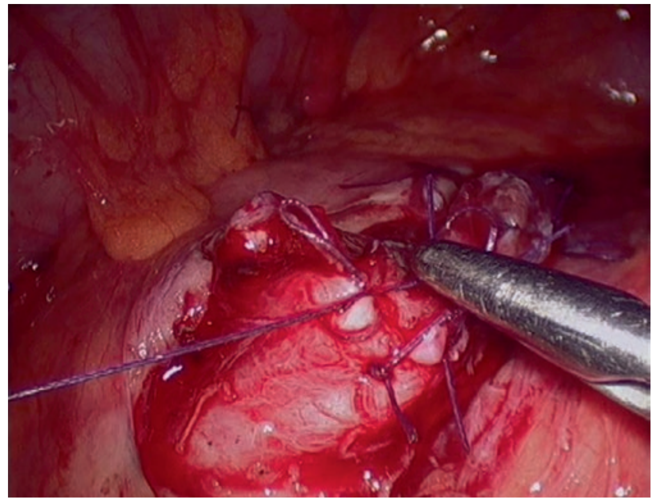

Fig. 5.118 Lateral wall suturing completed

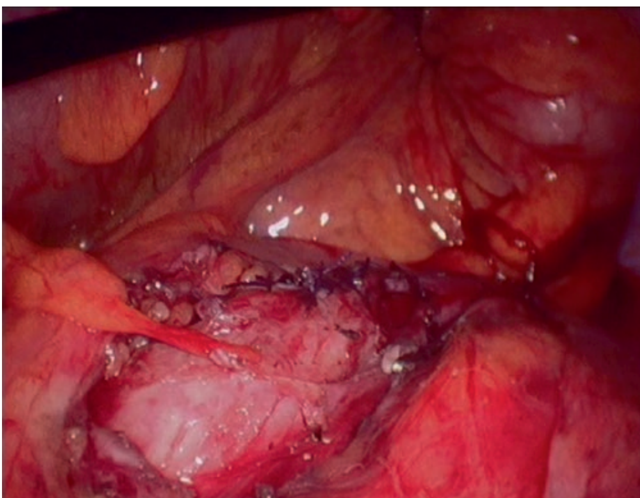

Fig. 5.119 Final view of completed pyeloplasty

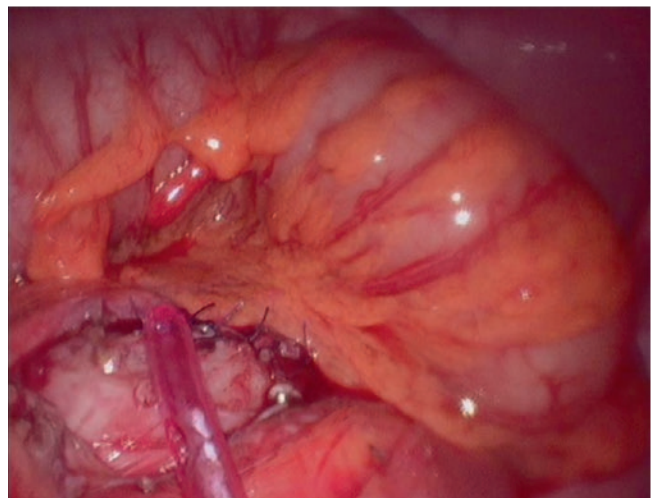

FIG. 5.120 Drain placed

5.10 Redo Lap. Pyeloplasty

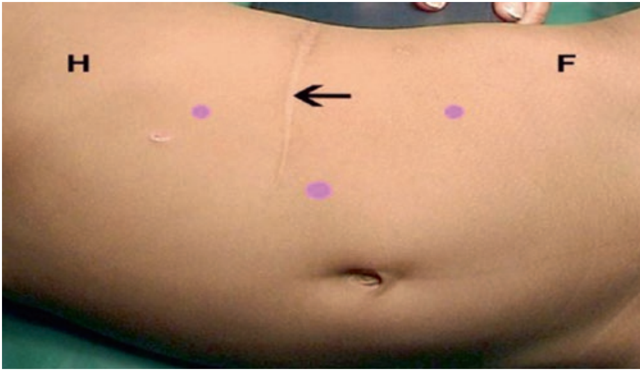

Fig. 5.121 Port position. (Scar of previous open pyeloplasty seen)

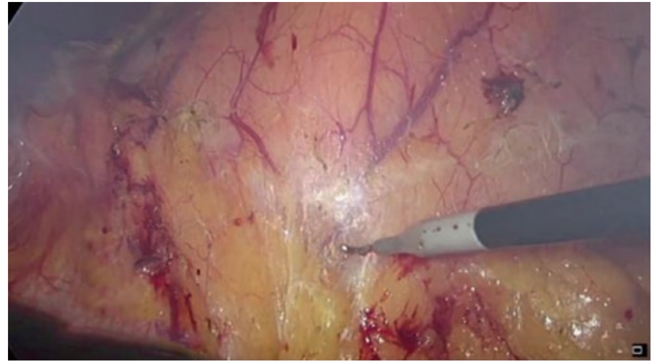

Fig. 5.122 Left colon being reflected medially and Gerota's fascia seen

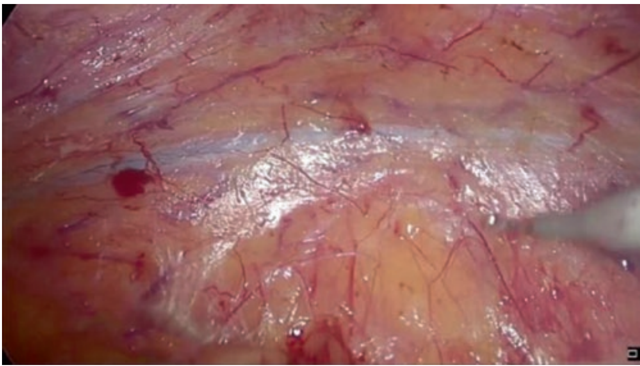

Fig. 5.123 Retroperitoneum exposed and gonadal vein is seen

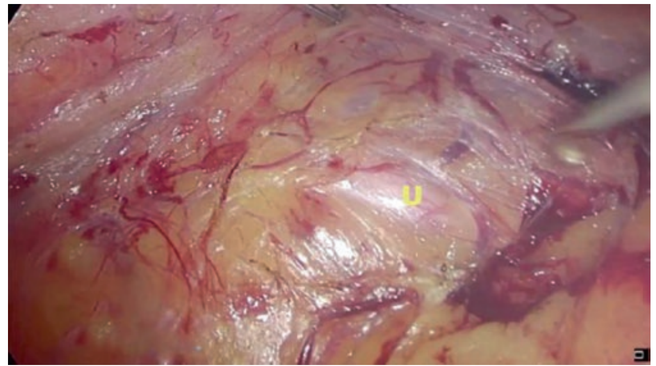

Fig. 5.124 Ureter identified with difficulty due to surrounding fibrosis and adhesions

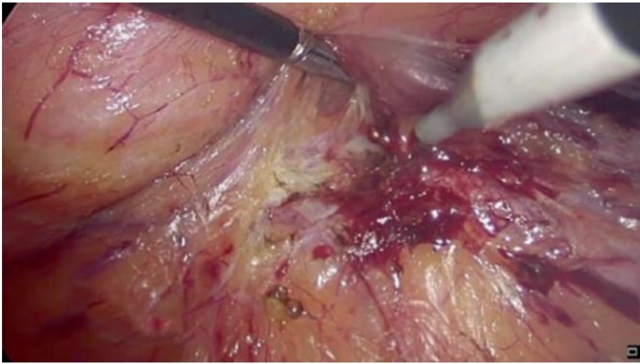

Fig. 5.125 Ureter dissected from tough pannus and fibrosis using hook diathermy (or ultrasonic shears)

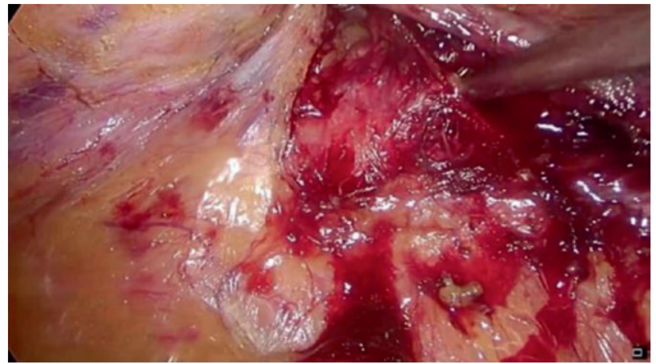

Fig. 5.126 Ureter being dissected proximally negotiating significant adhesions

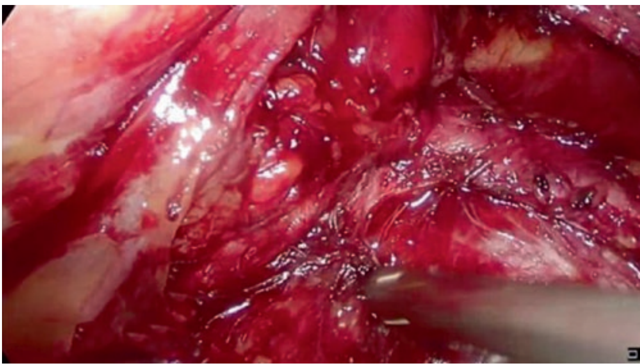

Fig. 5.127 Pelvis identified surrounded by adhesions

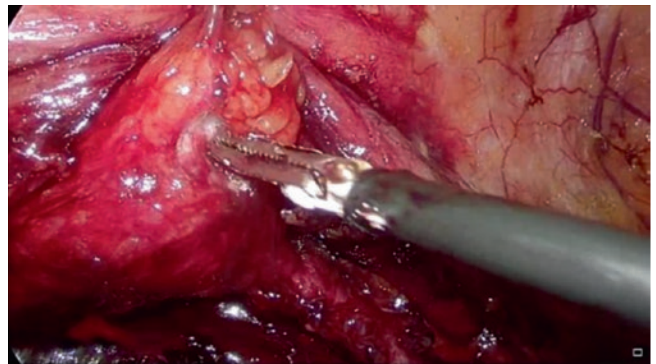

Fig. 5.128 Pelvis being dissected from surrounding pannus

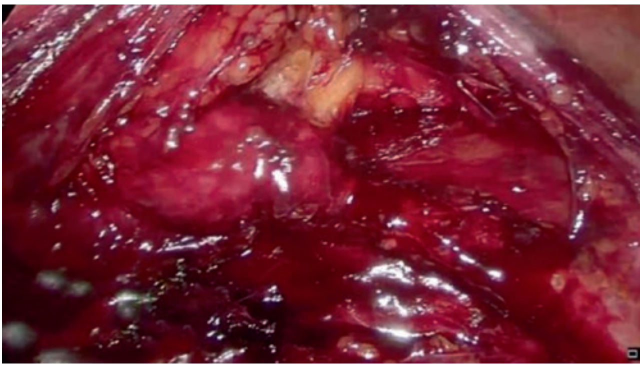

Fig. 5.129 Dissected pelvis, ureter and pelvi ureteric junction

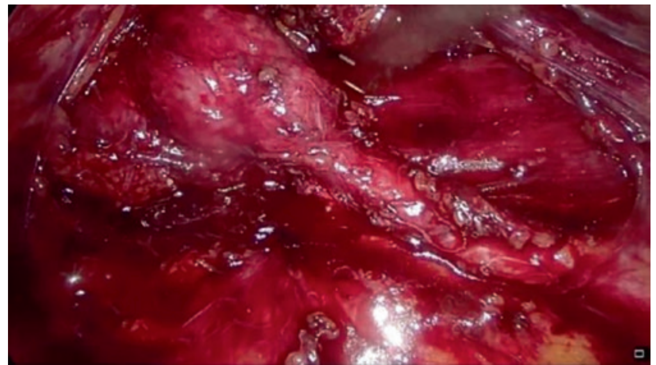

Fig. 5.130 Pelvi ureteric junction defined clearly

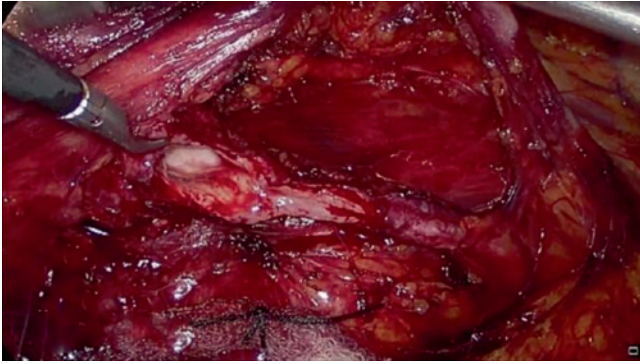

Fig. 5.131 Pyelotomy and ureterotomy done in 'Y' shape

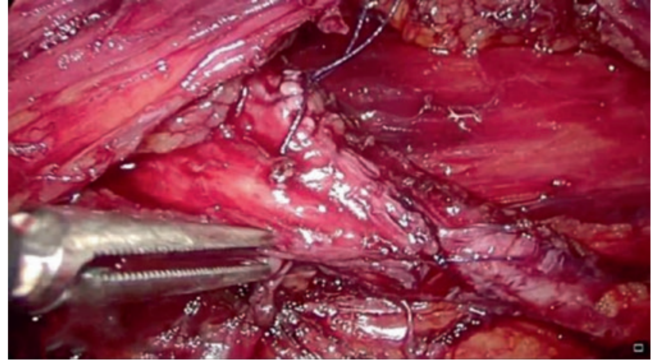

Fig. 5.132 Lateral margin suture completed

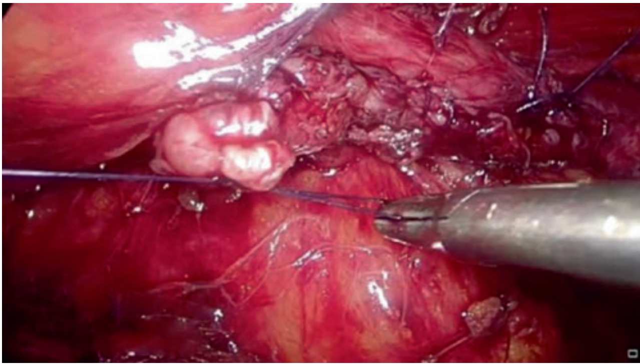

Fig. 5.133 Medial margin suture completed

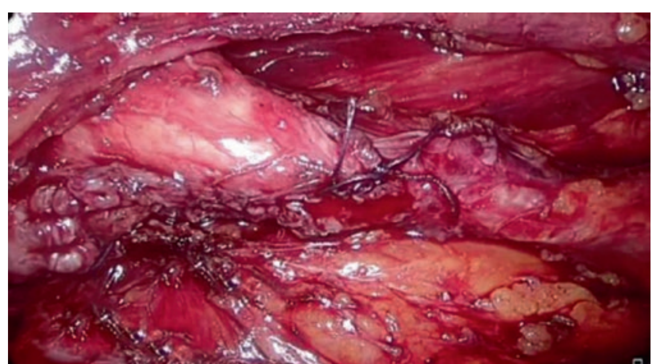

Fig. 5.134 Completed 'Y – V' plasty

5.11 Culp Flap Lap. Pyeloplasty

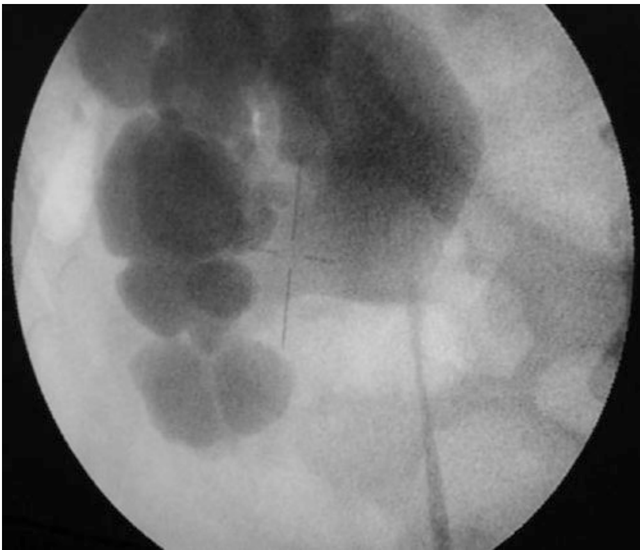

Fig. 5.135 IVU showing dilated pelvis and long segment of narrow ureter(Right)

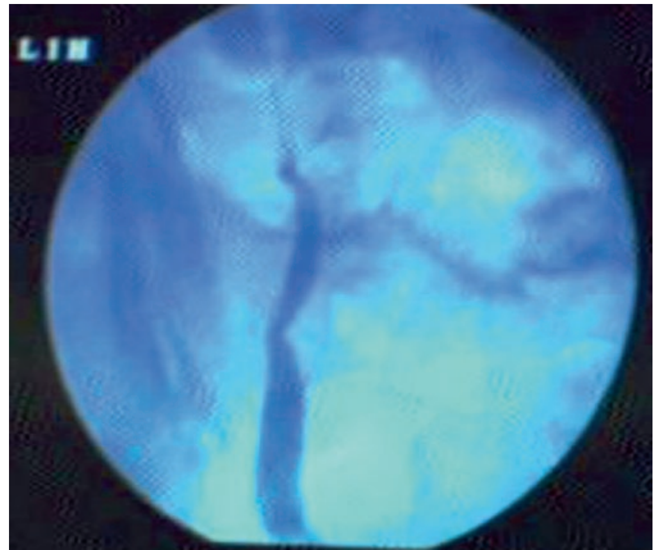

Fig. 5.136 Right RGP showing long segment narrowing of upper ureter

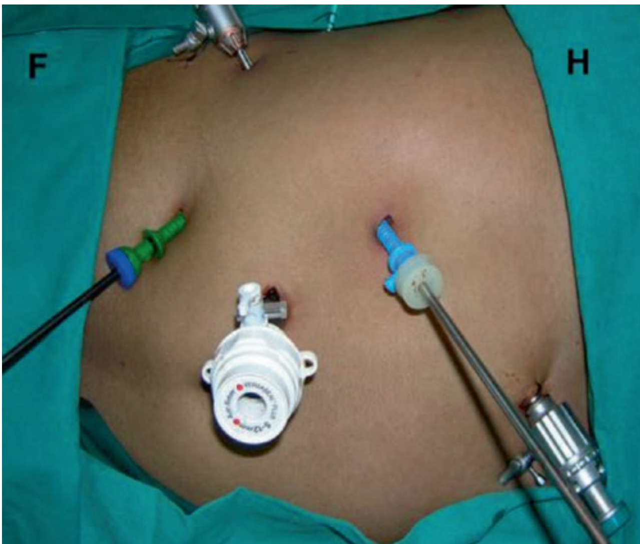

Fig. 5.137 Port position

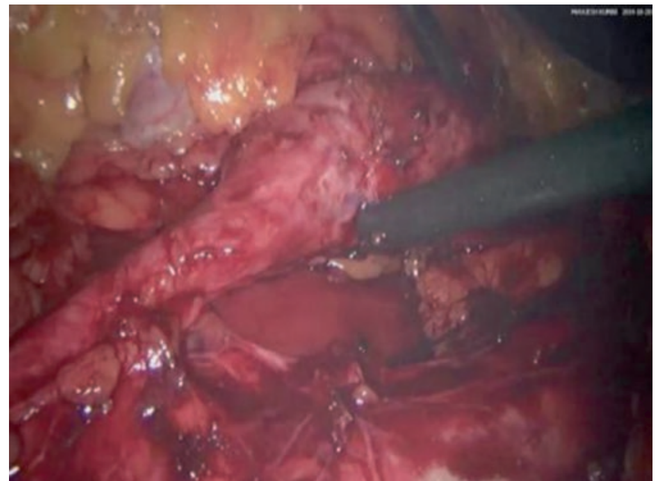

Fig. 5.138 Dilated pelvis and long narrow ureter seen

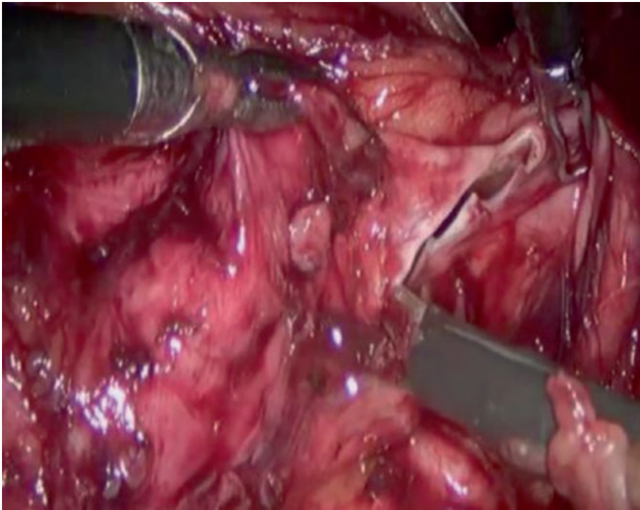

Fig. 5.139 Pyelotomy started along the medial aspect and extended inferiorly towards the ureter

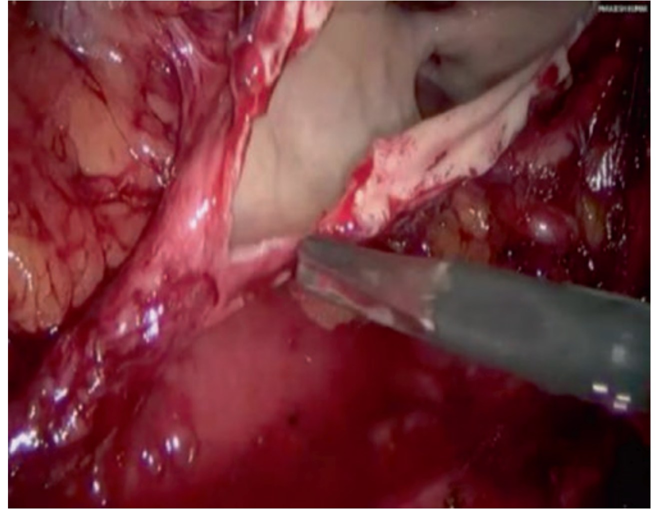

Fig. 5.140 Pyelotomy completed and ureterotomy to be started

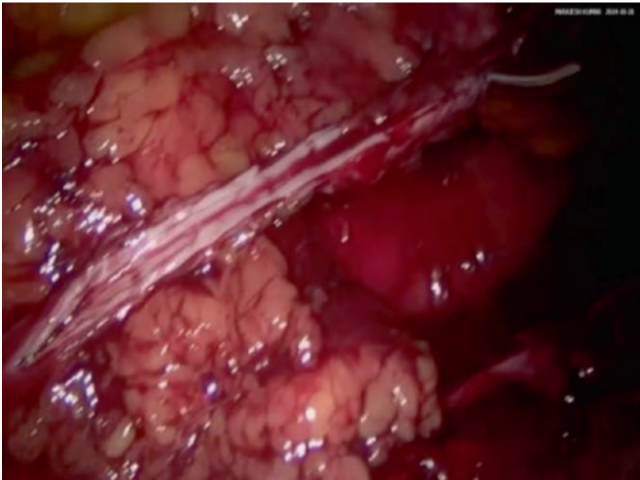

Fig. 5.141 Ureterotomy extended till normal ureter is seen

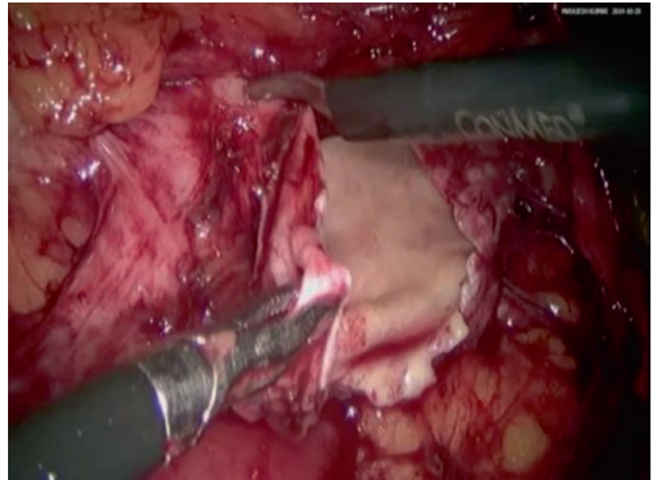

Fig. 5.142 Pelvic flap being created by extending the incision,then vertical pyelotomy on the lateral aspect(inverted U shape)

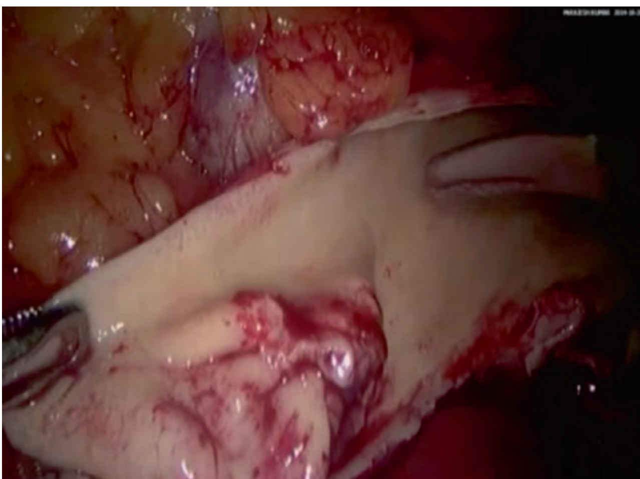

Fig. 5.143 Completed pelvic flap

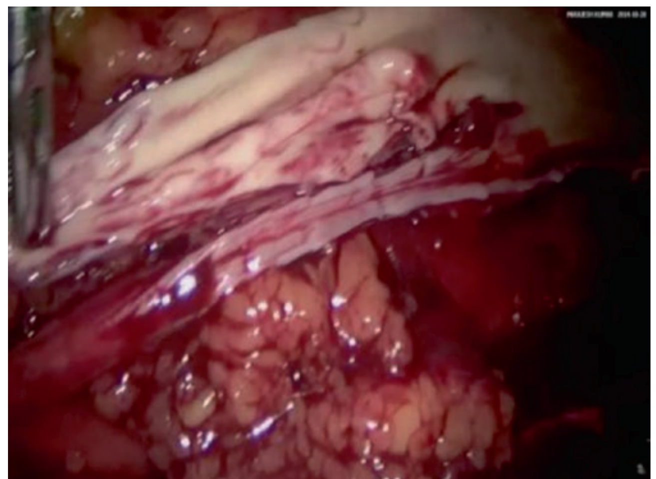

Fig. 5.144 Flap rotated down to confrm the adequacy of length

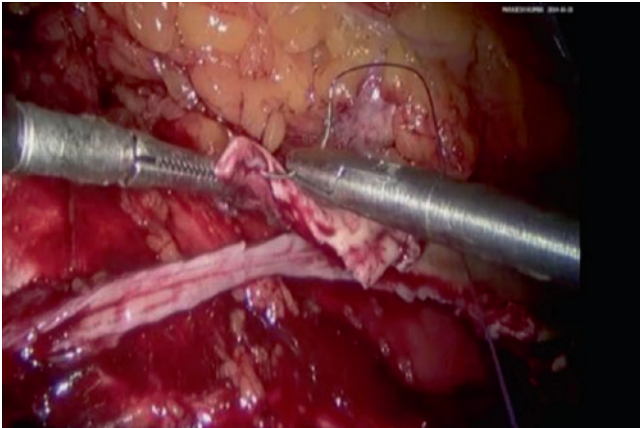

Fig. 5.145 Initial outside -in suture through apex of pelvic flap using 4-0 vicryl

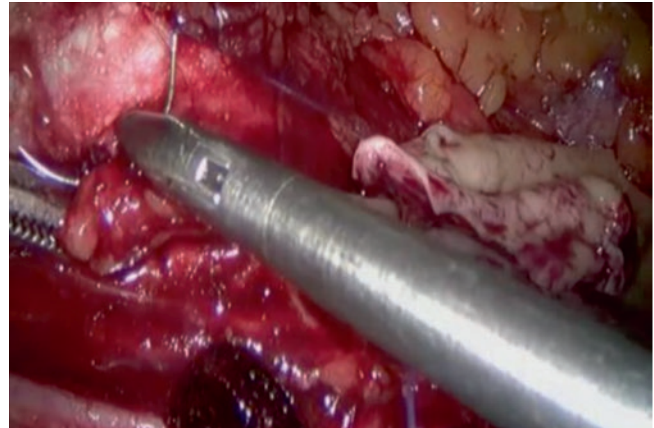

Fig. 5.146 Corresponding suture through the ureterotomy apex

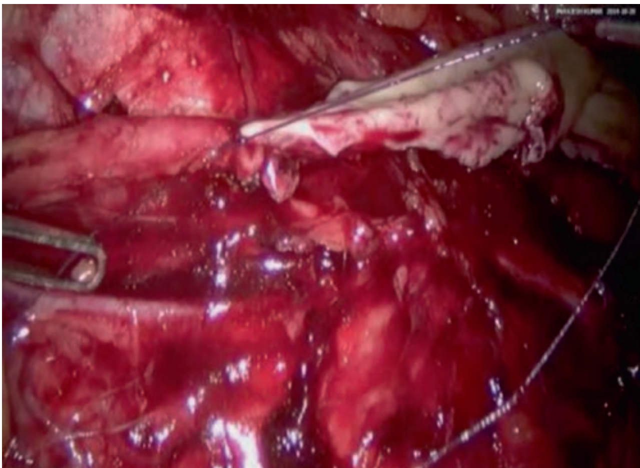

Fig. 5.147 Initial apical suture in place

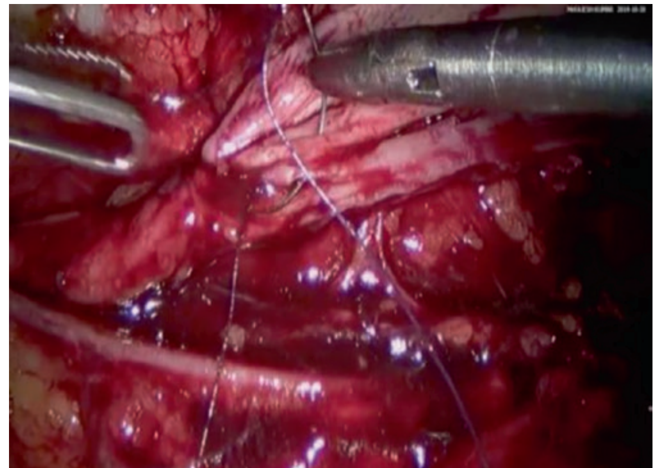

Fig. 5.148 Lateral ureterotomy edge sutured with the medial edge of pelvic flap to form the posterior layer

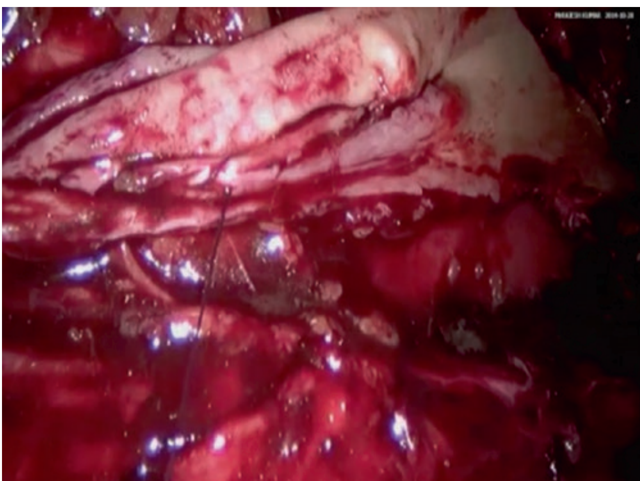

Fig. 5.149 Posterior layer suturing in progress

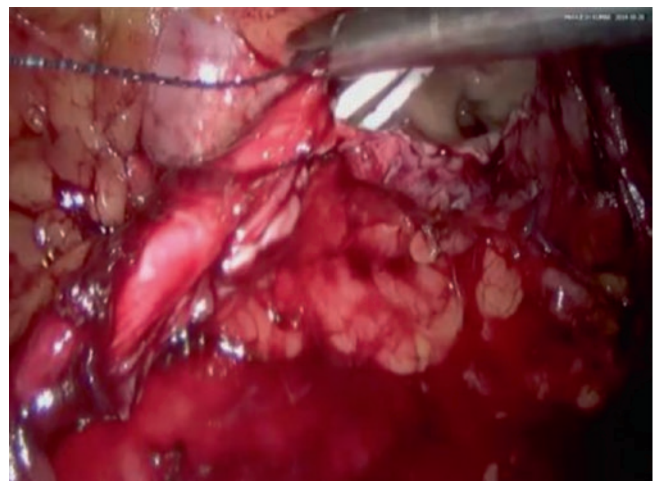

Fig. 5.150 Lateral edge of flap sutured with medial edge of ureterotomy – Anterior layer suturing in progress with 3-0 v-loc sutures

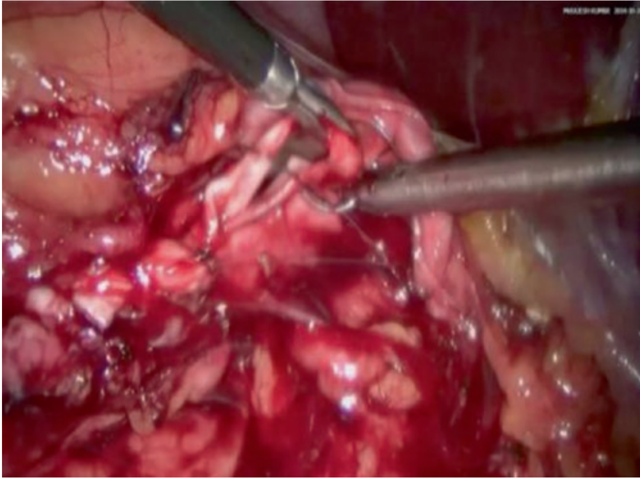

Fig. 5.151 Final part of suturing between the pyelotomy edges being done

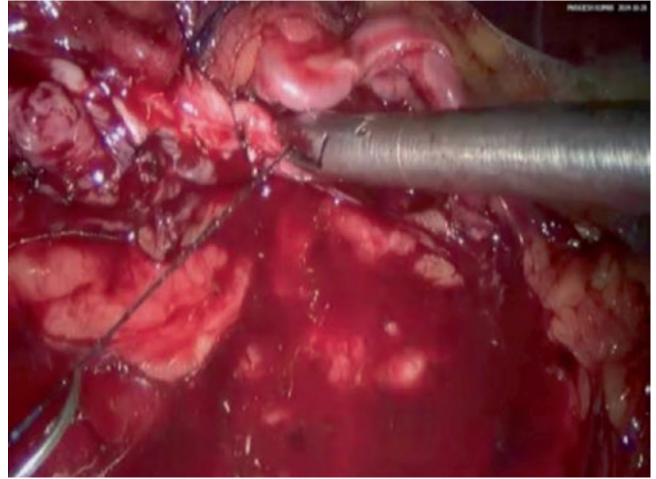

Fig. 5.152 Suturing almost complete

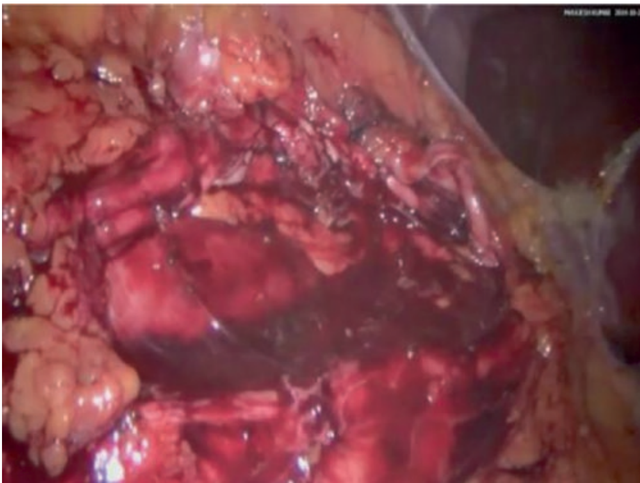

Fig. 5.153 Final view of completed flap pyeloplasty

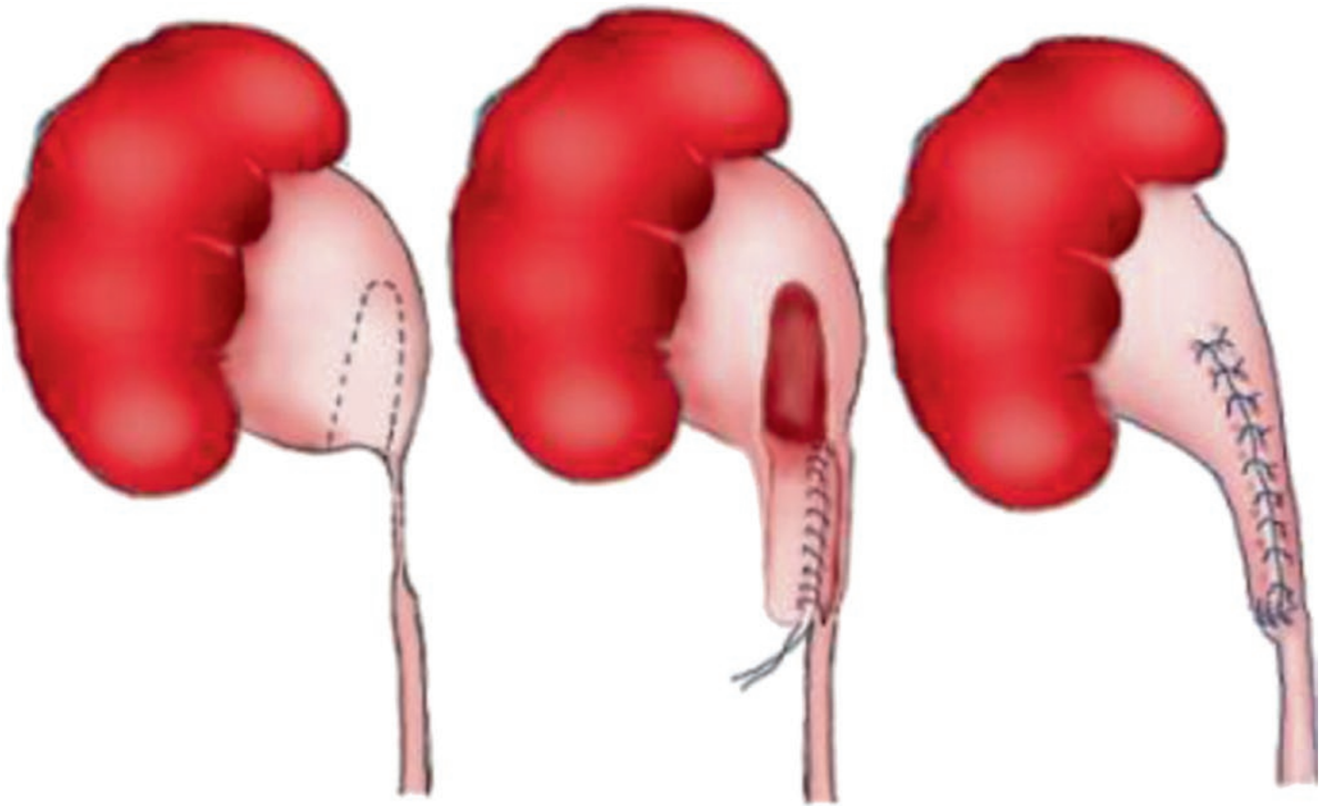

Fig. 5.154 Diagrammatic representation of Culp flap pyeloplasty

5.12 Reteroperitoneoscopic Dismembered Pyeloplasty

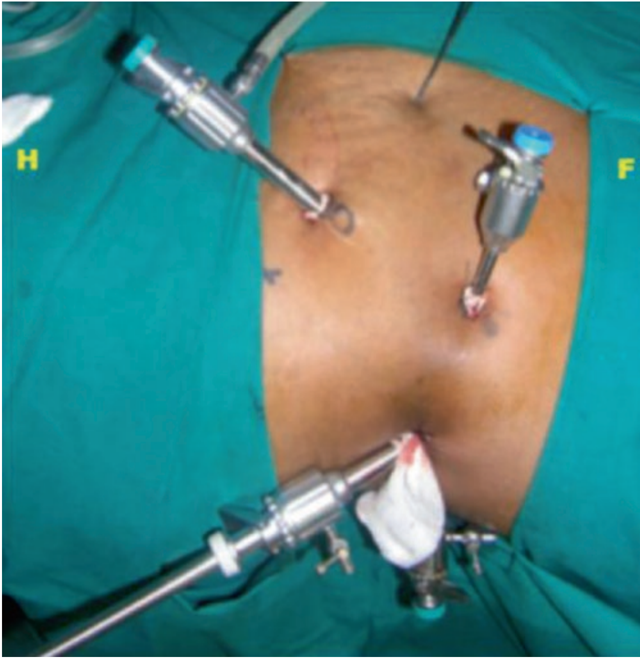

Fig. 5.155 Port placement (Right PUJ obstruction)

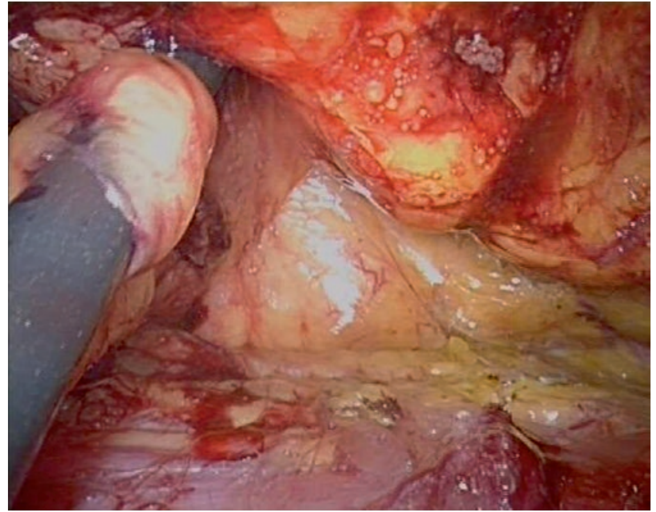

Fig. 5.156 Initial retroperitoneal dissection anterior to psoas

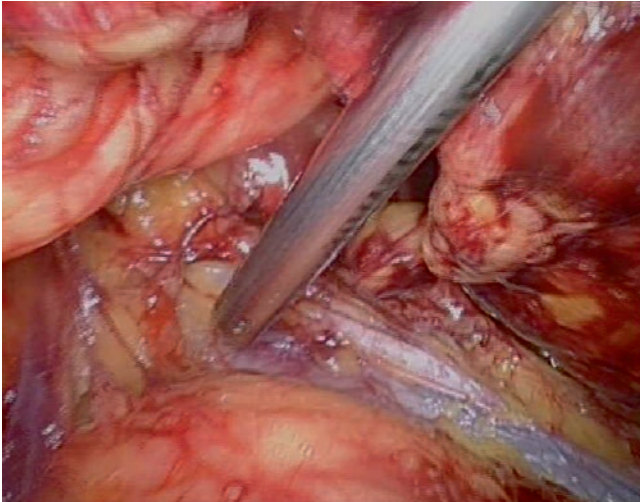

Fig. 5.157 Ureter and gonadal vein seen in the retroperitoneum

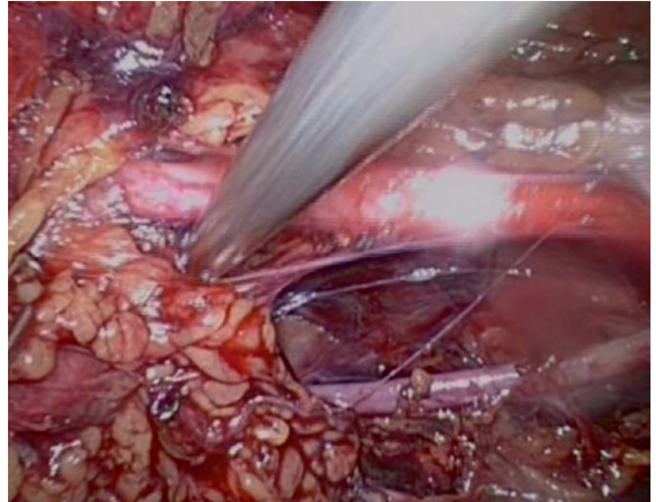

Fig. 5.158 Pelvis dissected and pevi ureteric junction delineated

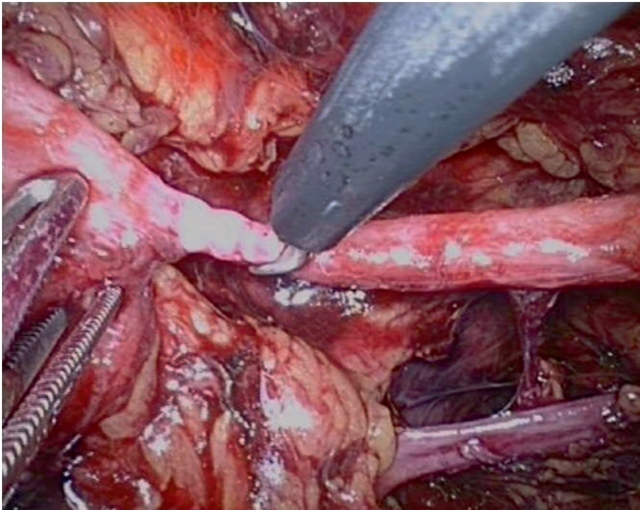

Fig. 5.159 Ureterotomy done distal to the PUJ

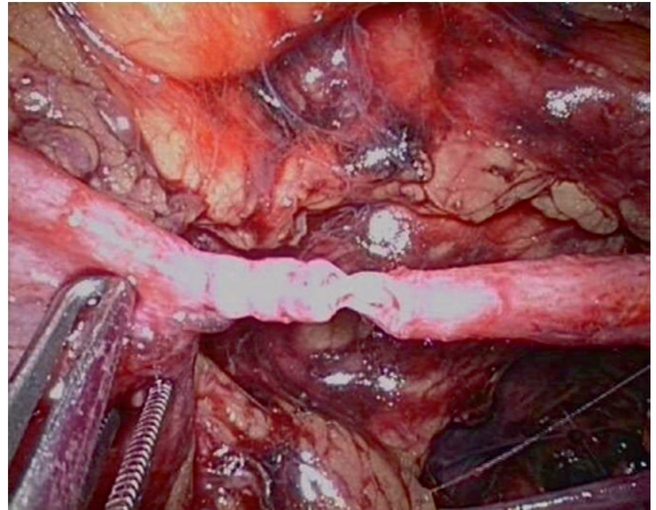

Fig. 5.160 Partial ureterotomy done – for better orientation

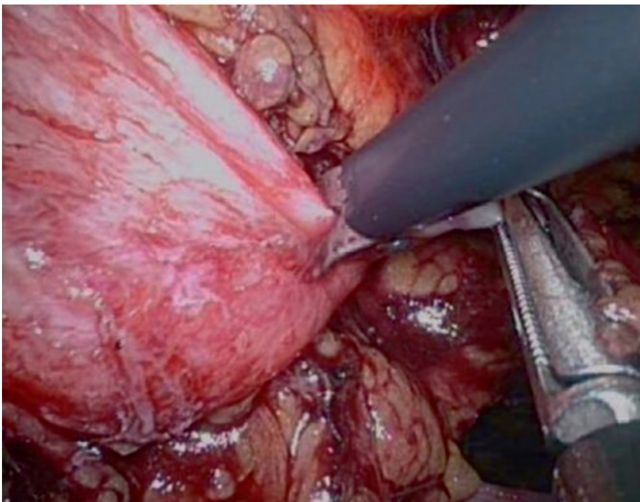

Fig. 5.161 Pyelotomy proximal to narrow PUJ

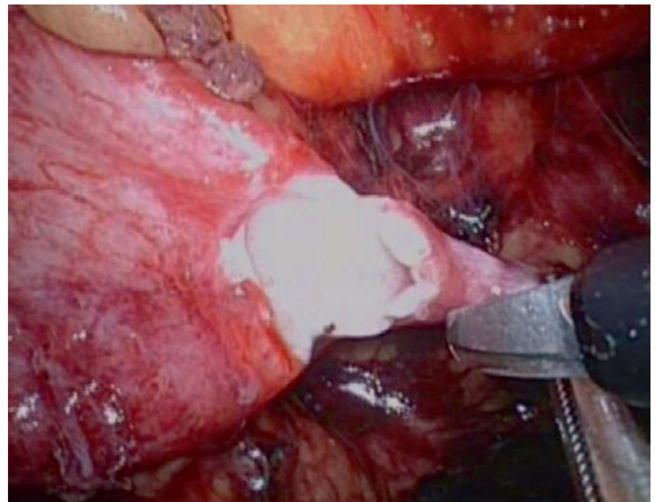

Fig. 5.162 Pyelotomy in progress

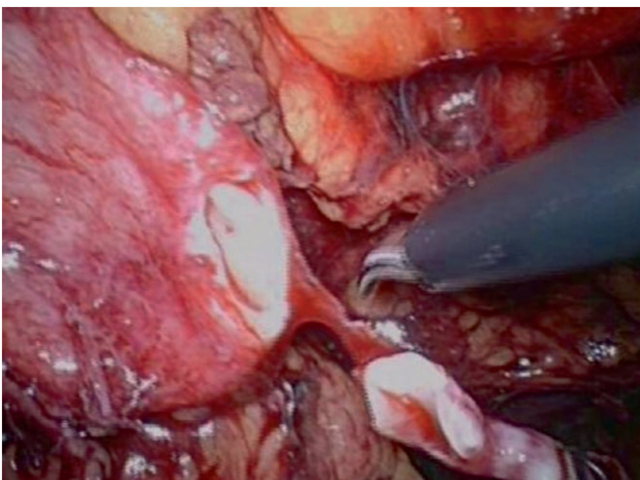

Fig. 5.163 PUJ dismembered from pelvis

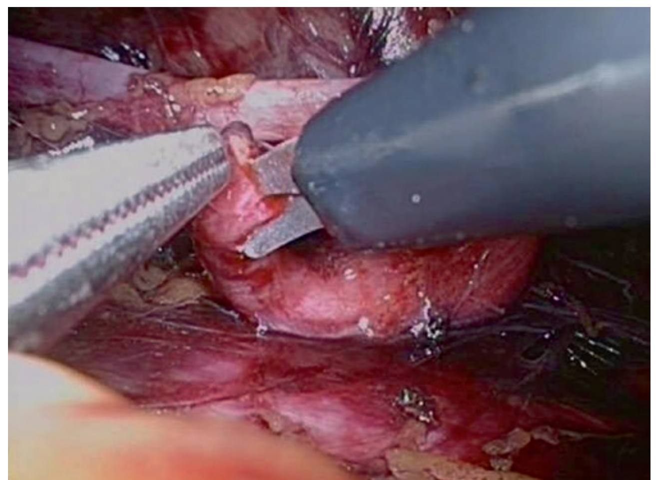

Fig. 5.164 Ureter spatulated after excision of PUJ

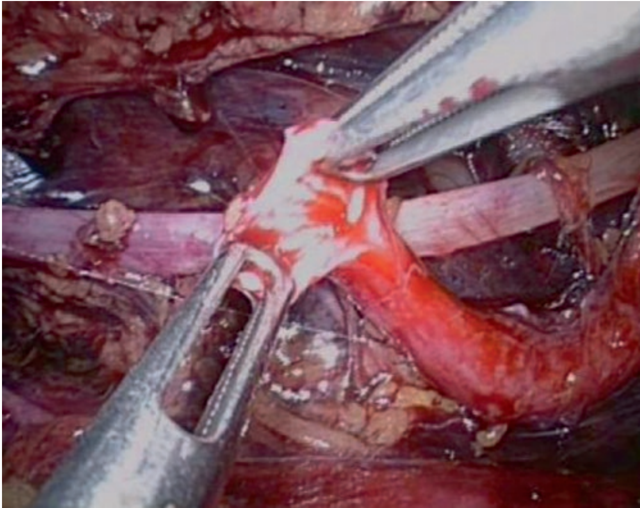

Fig. 5.165 Spatulated ureter

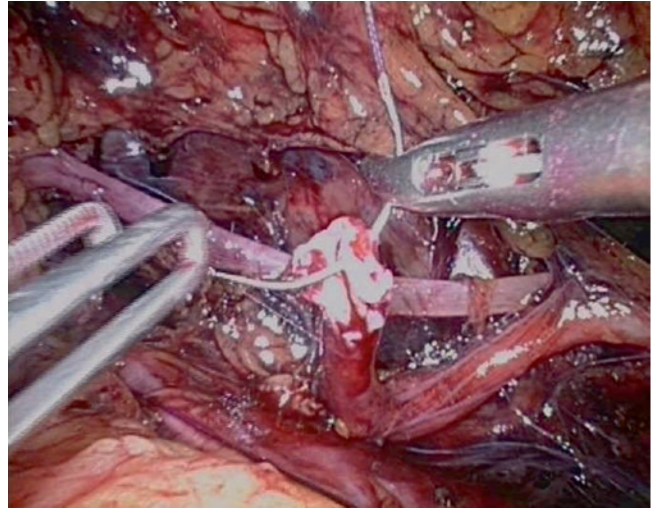

Fig. 5.166 Initial suture through the apex of spatulated ureter

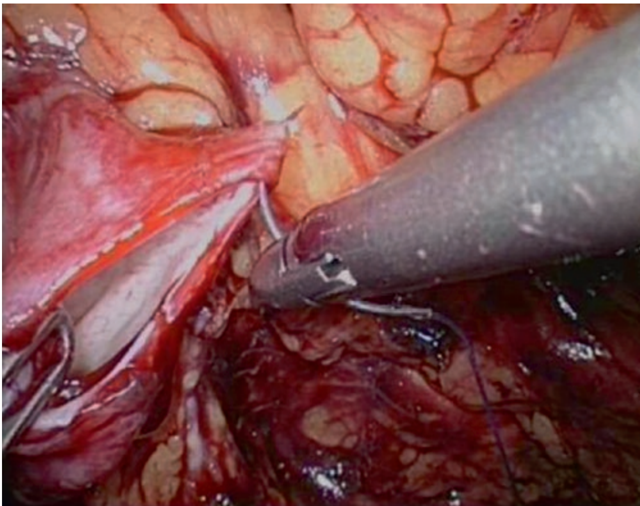

Fig. 5.167 Corresponding suture through the pelvis

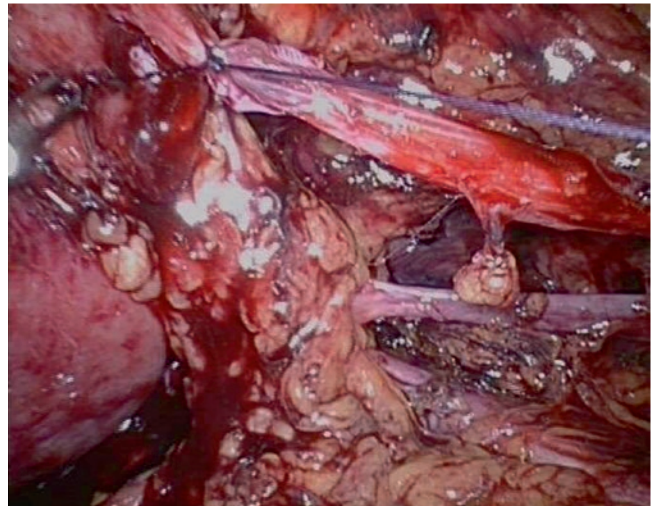

Fig. 5.168 Apical suture in place

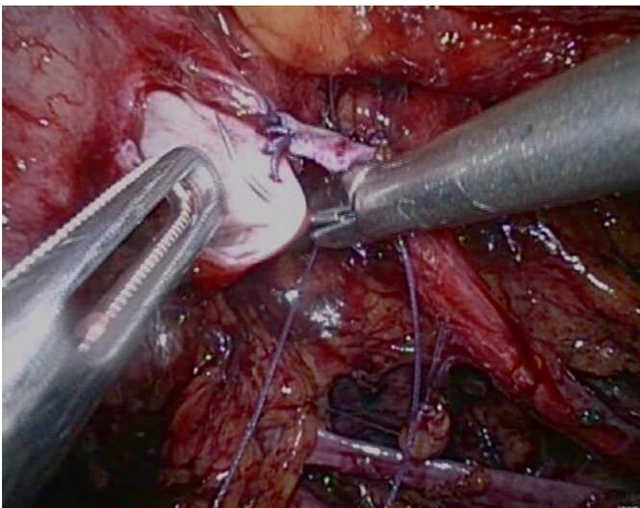

Fig. 5.169 Posterior layer suturing in progress

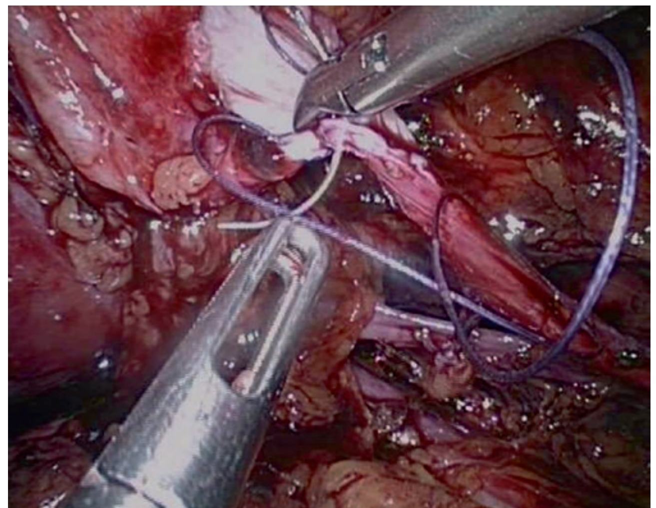

Fig. 5.170 Posterior layer suturing almost complete

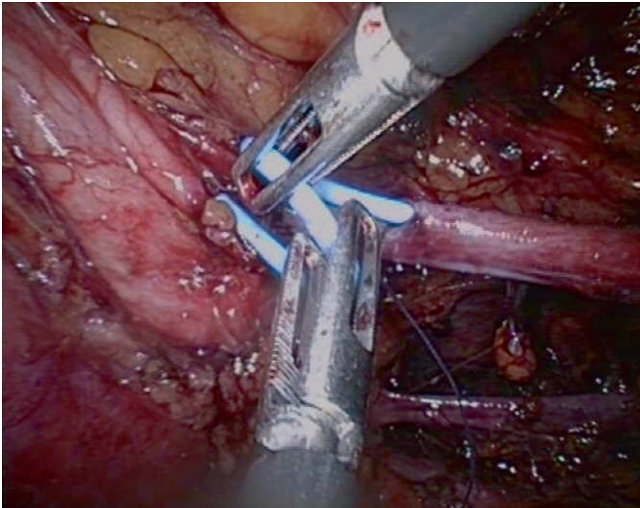

Fig. 5.171 Antegrade stenting after completion of posterior layer

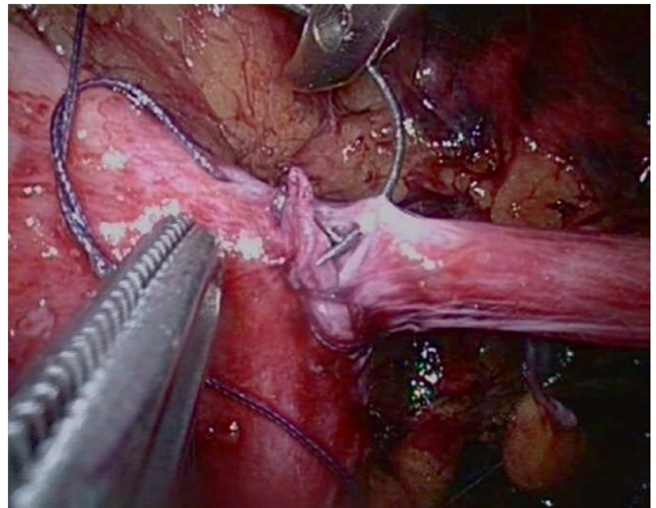

Fig. 5.172 Anterior layer suturing in progress

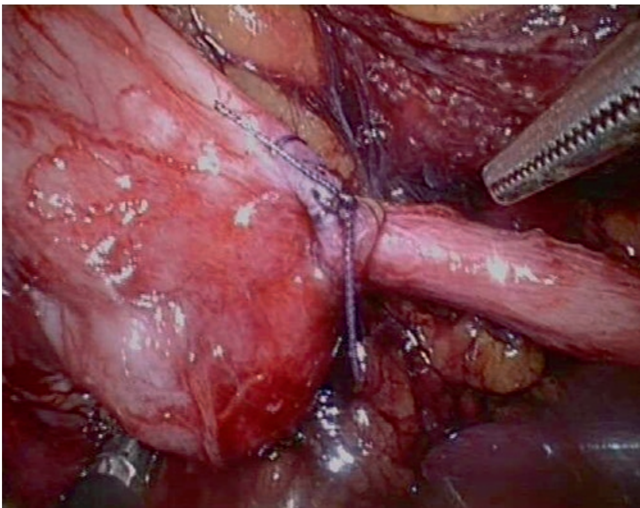

Fig. 5.173 Completed pyeloplasty

5.13 Reteroperitoneoscopic Non Dismembered Pyeloplasty

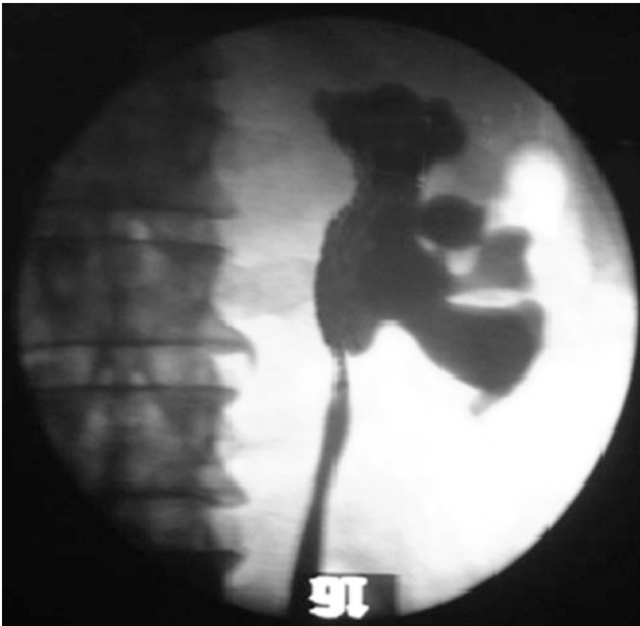

Fig. 5.174 Left RGP showing UPJ narrowing

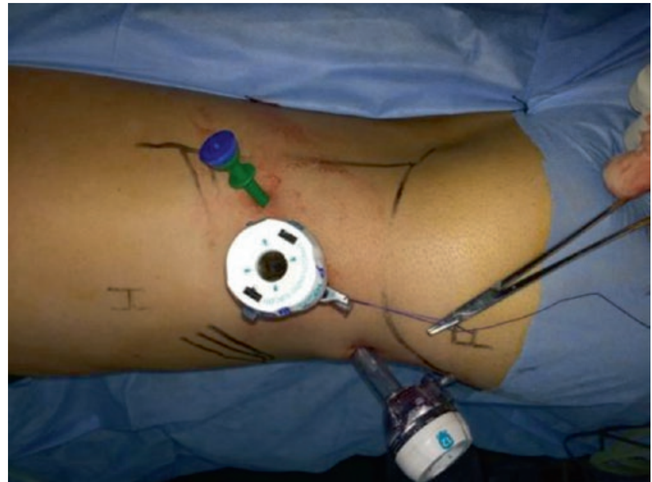

Fig. 5.175 Ports position

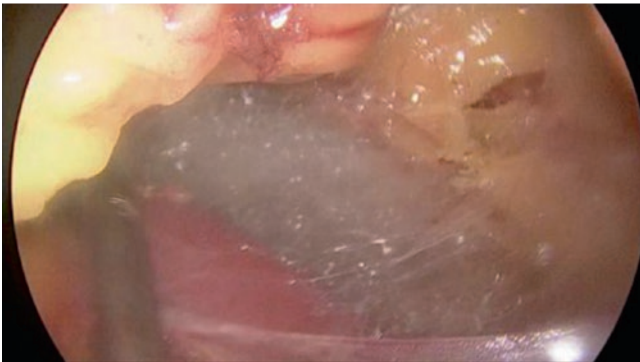

Fig. 5.176 Retroperitoneal dissection anterior to psoas

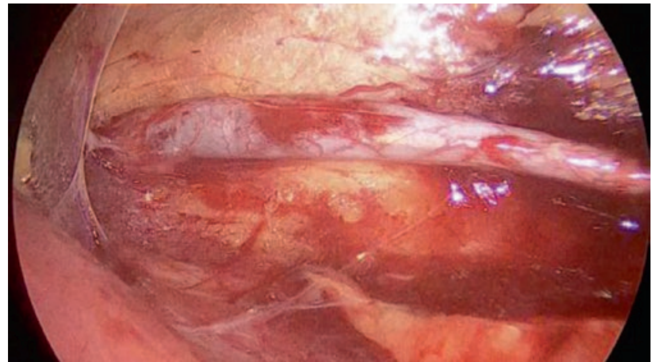

Fig. 5.177 Upper ureter being dissected

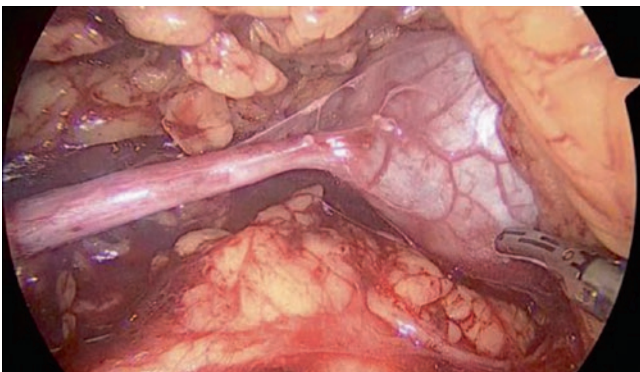

Fig. 5.178 Ureter being traced proximally till pelvis – Narrow PUJ seen

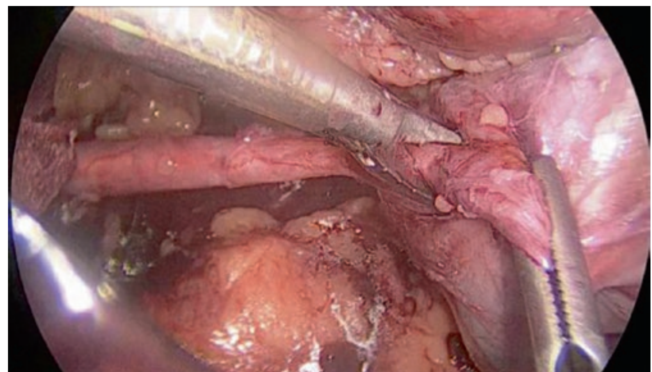

Fig. 5.179 Pelvic ‘Y’ flap creation started

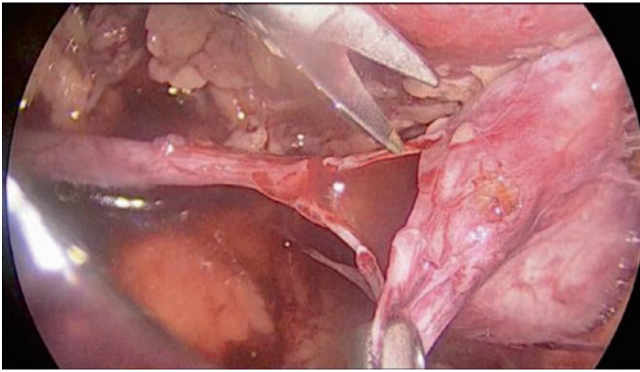

Fig. 5.180 Pelvic 'Y' flap creation in progress

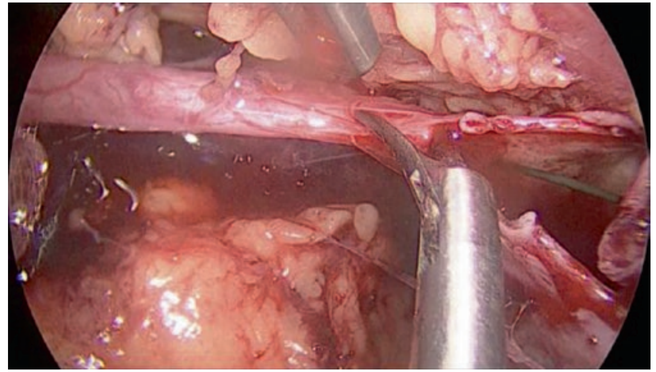

Fig. 5.181 Ureter spatulated laterally to create the vertical limb of 'Y' flap

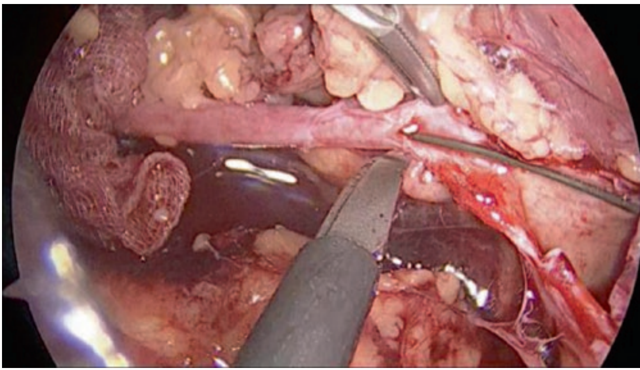

Fig. 5.182 Completed 'Y' flap

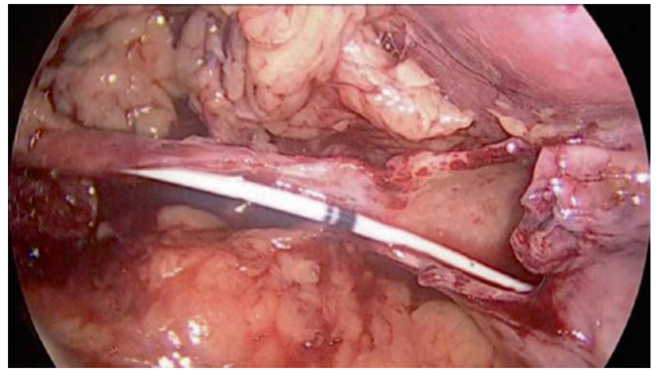

Fig. 5.183 Stent being inserted antegrade

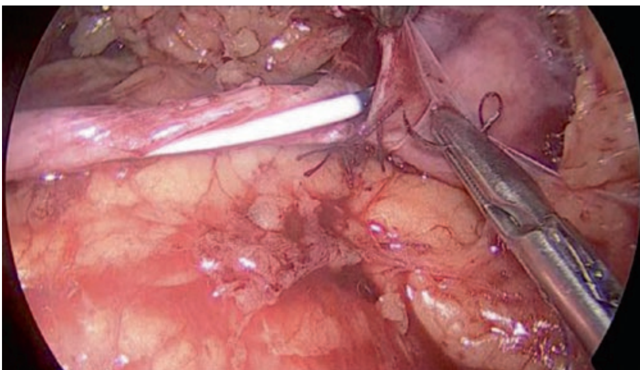

Fig. 5.184 Flap advanced downwards by placing interrupted 4-0 vicryl sutures, in the posterior layer

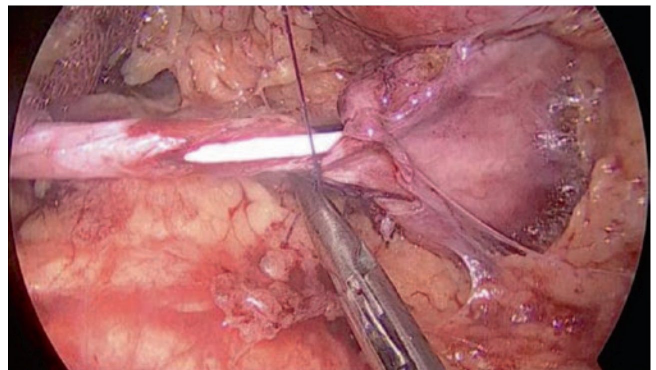

Fig. 5.185 Posterior layer suturing in progress

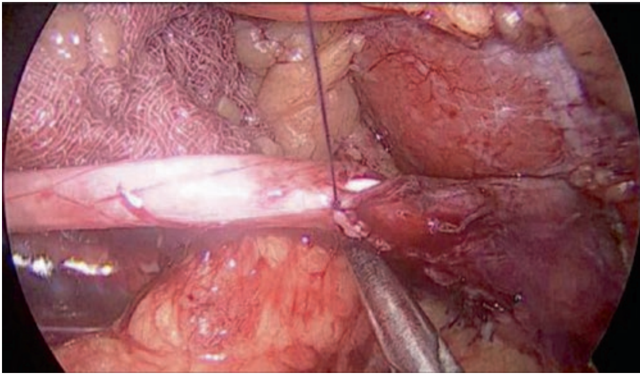

Fig. 5.186 Posterior layer suturing completed

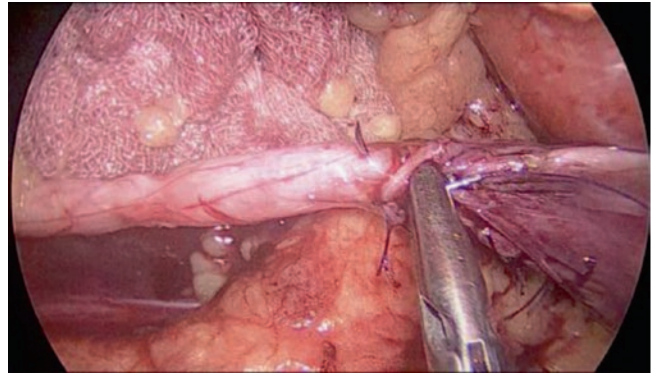

Fig. 5.187 Apex of flap sutured with the apex of ureteric spatulation

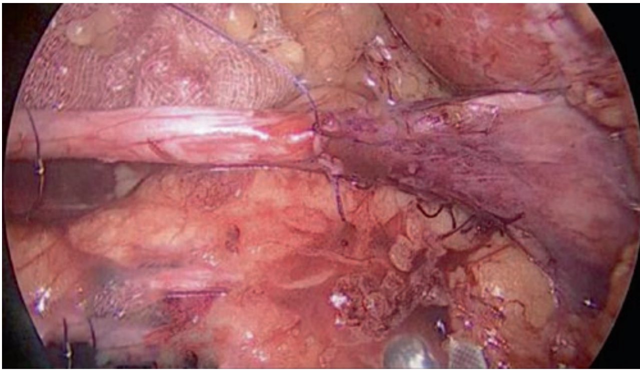

Fig. 5.188 Posterior layer and apical suture completed

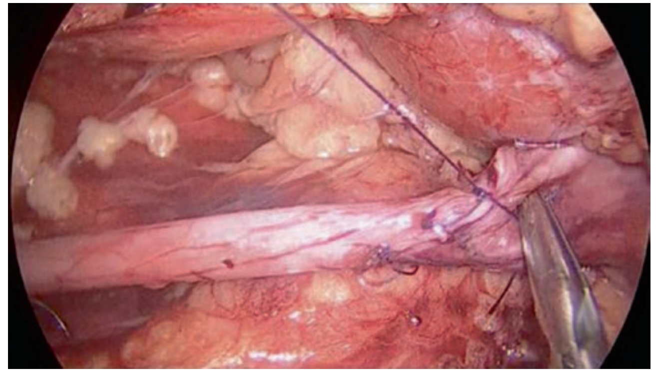

Fig. 5.189 Interrupted anterior layer suturing in progress

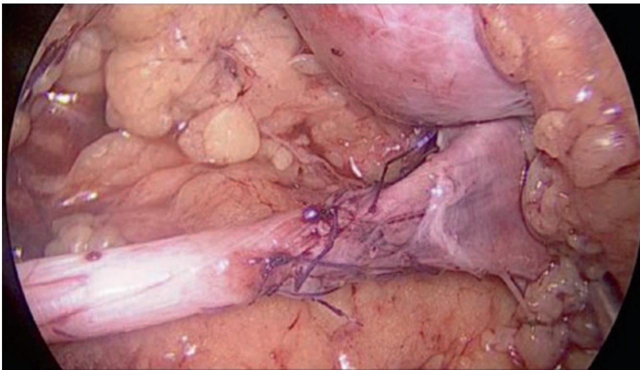

Fig. 5.190 Completed Y- V pyeloplasty

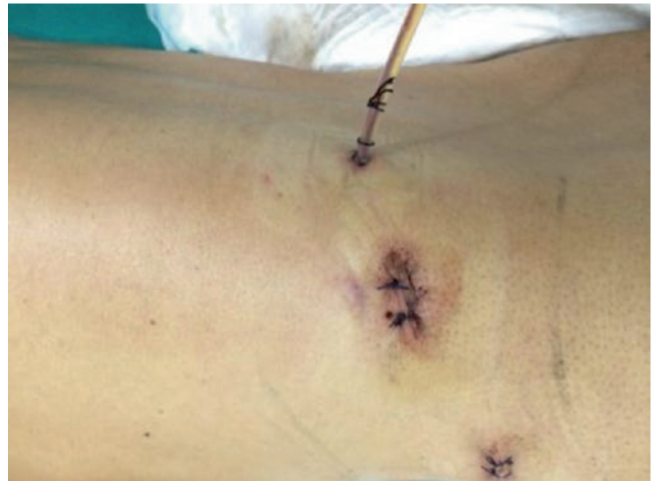

Fig. 5.191 Drain placed

5.14 Tips – Difficulty in Stent Insertion

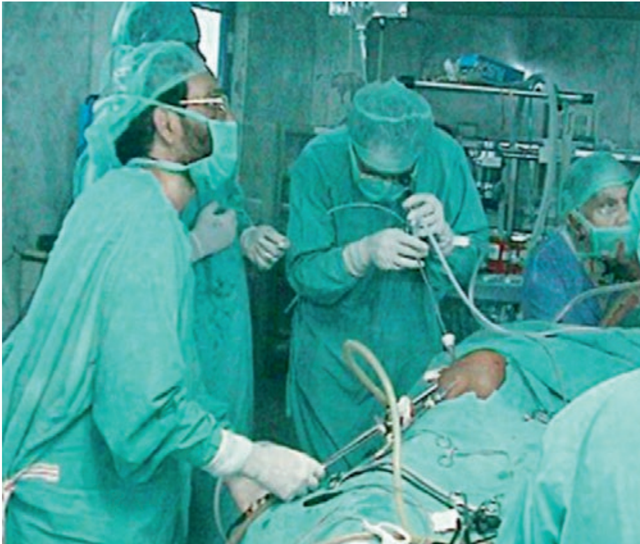

Fig. 5.192 Difficulty in stent insertion negotiated using intra operative ureteroscopy through subcostal port-external view

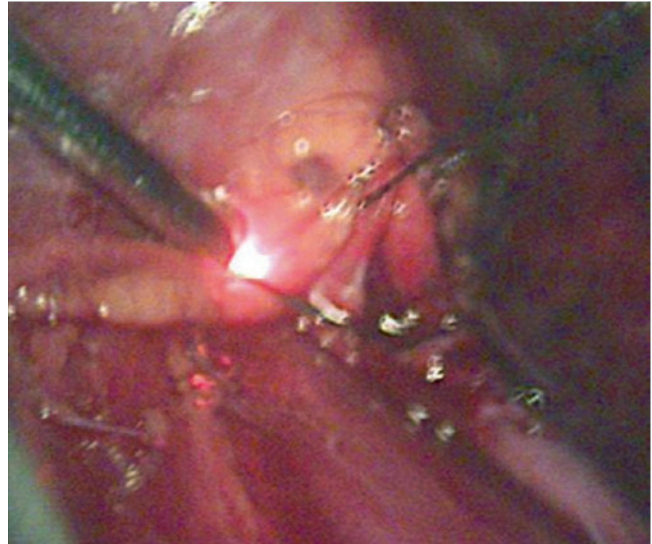

Fig. 5.193 Difficulty in stent insertion negotiated using intra operative ureteroscopy -endoview

5.15 PUJ Obstruction with Secondary Calculus

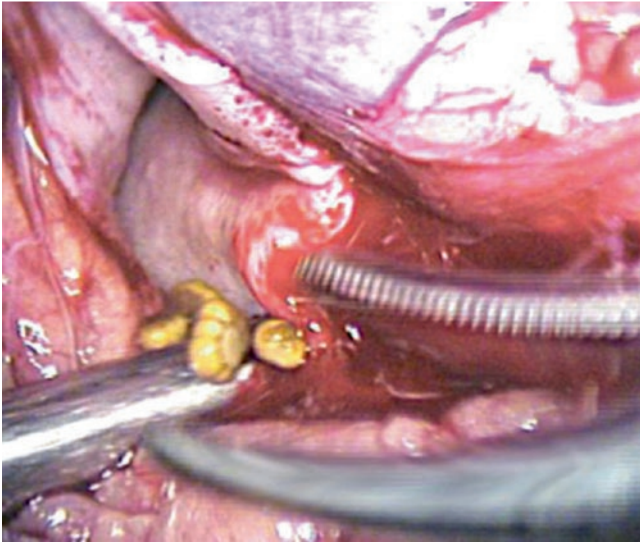

Fig. 5.194 Calculi being removed with forceps

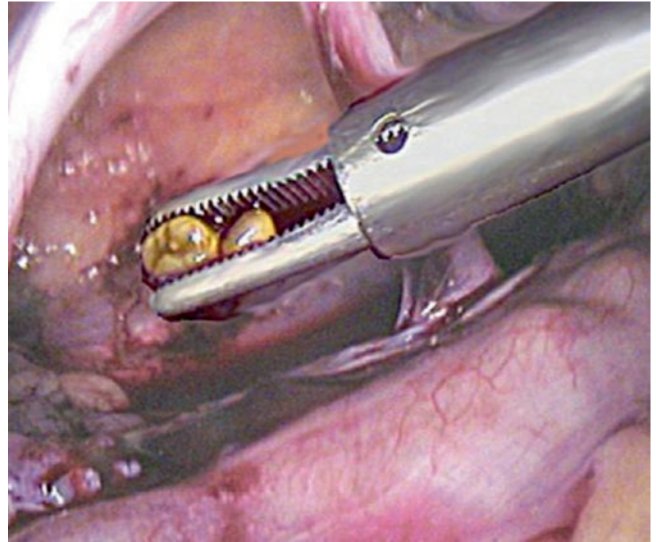

Fig. 5.195 Calculi being removed through 10 mm port

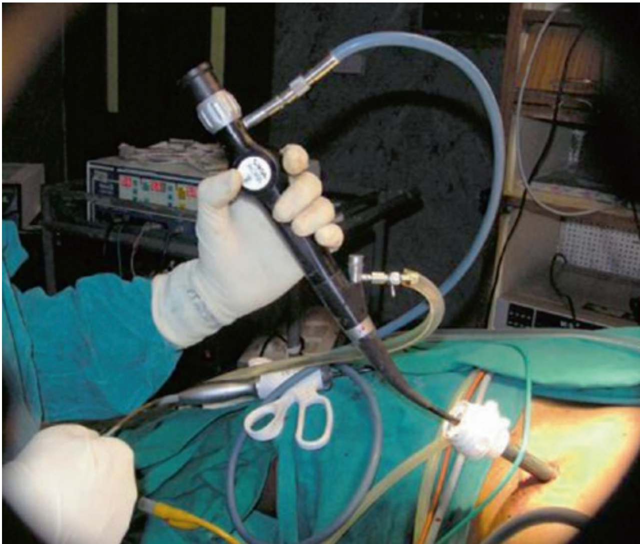

Fig. 5.196 Flexible ureteroscopy introduced through 5 mm port

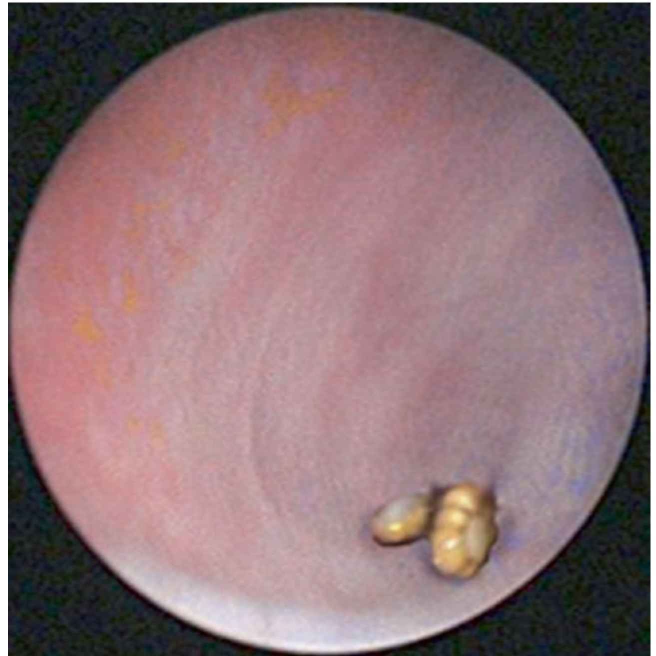

Fig. 5.197 Calculi removed using flexible ureteroscope and basket

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