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Laparoscopic Hemi-Hysterectomy-Retrospective Study of Case Series of over 9 Years

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Abstract

Background: Word hemi-hysterectomy and removal of rudimentary functional horn may be used interchangeably in published data. The same term may be used when a non-obstructive hemi-uterus is removed when there is an associated pathology. The article tries to standardise classification of Mullerian dysgenesis where this procedure is required according to ESHRE ESGE classification, preoperative diagnosis and discuss the operative details. **Objective:** The objective was to study the demographic profile, symptoms, association of endometriosis, variation in the anatomy, accuracy of preoperative diagnosis, to classify according to ESHRE ESGE classification and to standardize the laparoscopic surgical steps of hemi-hysterectomy. **Study Design:** This is a retrospective case series of cases of Mullerian dysgenesis with obstructive hemi-uterus or non-obstructive hemi-uterus with pathology treated by laparoscopic hemi-hysterectomy. (Canadian task force classification III). **Methods:** Data from hospital electronic records of all cases tagged with word laparoscopic hemi-hysterectomy were collected for 9 years from Jan 2009 to Dec 2018. **Results:** Total 19 patients of hemi-hysterectomy were analysed. Pre-operative diagnosis was made in 100% of patients. 100% patients with obstructive horn had dysmenorrhoea. ESHRE ESGE class U4aC3V0 was more frequently seen followed by U5aC4V4 and U3bC3V2 as obstructive and U4bC3V0, as non-obstructive. Associated endometriosis along with other pathology was seen in 74% of the patients. 3 patients with HWWS had ipsilateral renal agenesis. Laparoscopic hemi-hysterectomy was offered to all such patients. The operative steps & variants were studied. Post-operative outcome was uneventful in all. **Conclusion:** An experienced surgeon should deal with these problems of Mullerian dysgenesis discussed in this study. The other variants diagnosed also must be treated by an experienced surgeon only. Laparoscopic hemi-hysterectomy is almost the most standard surgical method to

treat pelvic pain in cases with rudimentary non-communicating horns or in cases of non-obstructive horns with other associated pathologies. Post-operative recovery is uneventful, and all patients reported pain free periods as well as they are free of chronic pain which they had before surgery.

Keywords

Hemi-Hysterectomy, Mullerian Dysgenesis, Rudimentary Non-Communicating Horns, ESHRE ESGE, Unicornuate Uterus

1. Introduction

Mullerian dysgenesis is found in .4 of general population [1] or in normal fertile population 3.2% [2], 7% of adolescent age group [3] and in 24.5% of infertile females [4]. In one study unicornuate uterus is about 2.5% - 13.2% of uterine malformations [5]. In any age group female presenting with cyclic menstrual midline suprapubic pain which gradually increases in severity and later becomes frequent throughout the month along with feeling of bloated abdomen; there should be a strong suspicion of obstructive Mullerian malformations (0.001%) with or without associated endometriosis [6].

ESHRE ESGE classification [7] of Mullerian dysgenesis classifies obstructive malformations which may require hemi-hysterectomy are U4aC3V0, U3bC3V2 (HWWS (Herlyn-Werner-Wunderlich syndrome) type 1.2) [8], U5aC4V4 and non-obstructive as U4bC3V0, categories.

This is a retrospective study of case series of obstructed hemi-uterus and hemi-uterus with associated pathology treated in last 9 years. An attempt is made to describe the variants of obstructive or otherwise Mullerian dysgenesis treated by hemi-hysterectomy, surgical steps and post-operative outcome. Literature does not have similar publication; there are isolated case reports and related management aspects which are discussed. The present case series will help clinicians to understand and classify such Mullerian dysgenesis according to ESHRE ESGE classification. This also would help to understand in which case, hemi-hysterectomy would be required.

It is necessary to diagnose and treat obstructive Mullerian dysgenesis in females as early as possible. If these obstructive Mullerian dysgenesis are not treated in time they have subsequent increased risk of endometriosis, pelvic adhesions, infertility and secondary pelvic infection [9].

2. Material and Methods

2.1. Study Design

This is a retrospective case series of cases of Mullerian dysgenesis with obstructive hemi-uterus or hemi-uterus with pathology treated by laparoscopic hemi-hysterectomy (Canadian task force classification III). The study was per-

formed at tertiary care referral centre for laparoscopic surgeries, Isha Hospital, Vadodara Gujarat India from year Jan 2009 to Dec 2018 for a period of 9 years.

2.2. Ethical Approval

Institutional ethical approval was taken. The data collection was for research.

2.3. Data Collection

Data from hospital electronic records of all cases tagged with word laparoscopic hemi-hysterectomy were collected. Patients who were referred as functional rudimentary non-communicating horn, but after ultrasound examination were diagnosed as Juvenile cystic adenomyoma were excluded. Total 19 no of cases of obstructive and non-obstructive Mullerian dysgenesis in which laparoscopic hemi-hysterectomy was carried out were studied from year 2009 to 2018 for a period of 9 years.

2.4. Objectives

1) To study the demographic profile, symptoms, association of endometriosis, variation in the anatomy, accuracy of preoperative diagnosis and to classify according to ESHRE ESGE [7] classification.

2) To standardize the laparoscopic surgical steps of hemi-hysterectomy.

3) To study post-operative outcome.

2.5. Method

From case records details of records of complaints of abdominal pelvic pain, relation to menstrual cycle, menstrual history, clinical examination, per speculum and per vaginal examination (married patients) was noted. Details of biochemical investigations required as per anaesthesia requirement were checked. Biochemical investigations were in normal limits for all. Diagnosis of Mullerian dysgenesis was made by trans abdominal or trans vaginal 3D ultrasound after clinical suspicion (**Figures 1(a)-(h)**). Imaging details of Trans abdominal or trans vaginal 3D Ultrasonography was noted. As per hospital policy MRI routinely is not performed in cases of Mullerian dysgenesis/agenesis for confirmation of diagnosis. MRI may be additionally performed in cases where cervical atresia was suspected and communication and connection of unicornuate uterus with vagina was not clear, the level of obstruction in vagina was in doubt, especially in cases of didelphys (HWWS) uterus. Additional findings as rudimentary horn pregnancy and co-existing pathology as fibroids or adnexal pathology reported were noted. Three patients of Juvenile cystic adenomyoma diagnosed who were referred as functional non-communicating horn were excluded from study. Pre-operative counselling explaining in detail the Mullerian dysgenesis, plan of surgery and information regarding future fertility was checked & was recorded in all case papers. In case of minor, parents participated in pre-operative counselling. Informed consent was taken for treatment. These details were checked.

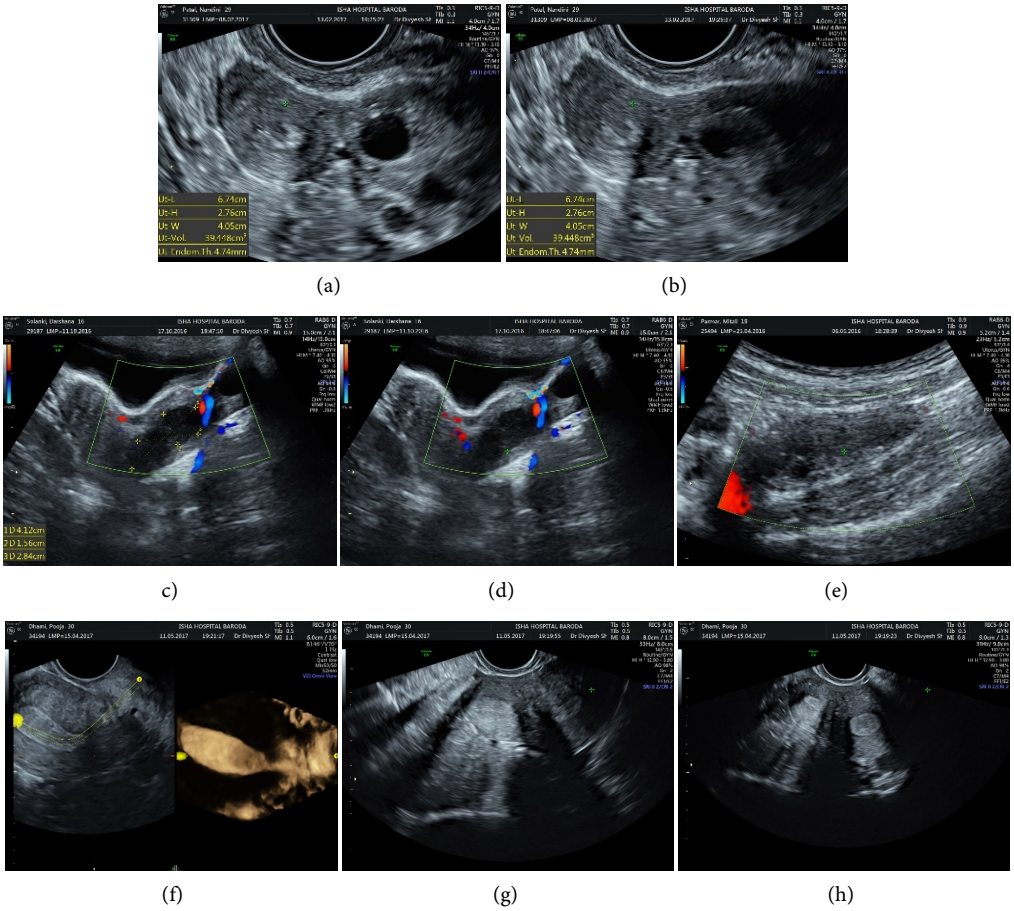


Figure 1. (a) (b) U4aC3Vo; (c) (d) Class U3bC3V2; (e) Ectopic ovary; (f)-(h) Class U4aC3V0, 3 D USG.

Operative records about the details of variant of Mullerian malformation mentioned, surgical steps of hemi-hysterectomy, additional peritoneal pathology identified and treated were noted. In every patient Mullerian dysgenesis was classified according to ESHRE ESGE [10] classification and this was noted. Prior to 2013 depending upon operative findings ESHRE ESGE classification was made.

Method of performing hemi-hysterectomy-

1) Laparoscopic hemi-hysterectomy was performed using standard 3 accessory port technique. Primary pneumoperitoneum was created in all. Primary trocar was inserted in midline about 3 cm above umbilicus in all. In case of patients < 13 years instead of 10 mm telescope 5 mm telescope was used.

2) To confirm communicating and non-communicating rudimentary functional horn vaginoscopy hysteroscopy was performed in all cases of HWWS using 1.9 mm telescope (**Figure 2**). This alleviated damage to the hymen in unmarried girls. This helps in diagnosing presence of oblique vaginal septum, whether opening was present in the septum and correctly identifying communicating functional horn in case of didelphis uterus [11] [12].

3) Few studies described transillumination while performing hysteroscopy in these cases also helped in finding out correct plane of dissection [12]. However,

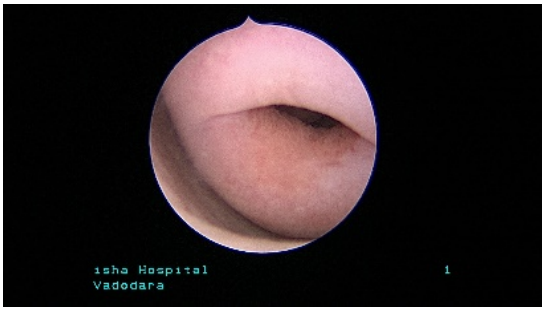


Figure 2. Vaginoscopy, hysteroscopy.

we had not used this step (trans illuminating) during surgery in our series. Hysteroscopy also helped in differentiating juvenile cystic adenomyoma, in this case uterine cavity was normal with both normal ostia seen.

4) On laparoscopic there can be confusion which horn is to be removed in this case to further confirm communicating and non-communicating rudimentary functional horn. This is because in some cases the obstructed horn appears large in size. Additional procedure of chromo pertubation was performed to check spillage of dye from the fimbrial end of connected horn (**Figure 3(a)**, **Figure 3(b)**). Obviously, the other horn had to be removed.

5) Surgery was performed by using ultrasound dissectors, vessel sealers, monopolar and bipolar hand instruments.

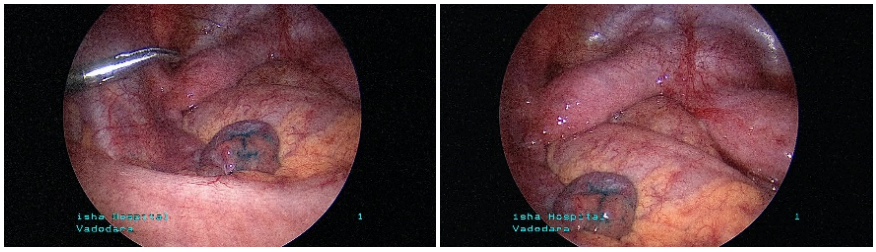
6) Horn to be removed was detached from lateral attachment (round ligament), total salpingectomy was performed. (**Figure 4**) During this step opening retroperitoneal area will help in identifying the blood vessel supplying the horn from lateral side (**Figure 5(a)**, **Figure 5(b)**). Anteriorly vesicouterine peritoneal fold was incised and bladder limits were identified, or bladder was dissected down as per requirement. Stiff disposable catheter was placed in bladder to identify bladder margins. Ovary attached to the horn was preserved in all cases.

7) Ureter on the side of surgery can be visually identified in its retroperitoneal course in all cases. Further retroperitoneal space was only opened to identify course of the ureter if there was a doubt regarding its course (**Figure 6**). One study describes ipsilateral ureter to be located higher than normal and recommend being careful when round ligament is cut [13]. We found ureters elevated along its course only in one patient.

8) Blood supply along its lateral border was identified and vessels were sealed and cut. Horn may be closely attached with the ovary from with it was separated.

9) At this step surgery is over for laterally located functional horns in ESHRE ESGE class C4aC3V0 and class U5bC4V4.

10) In cases where rudimentary functional horn was located near midline they can be found to be attached with remaining connected horn with thick or thin band or can be closely attached. By ultrasound dissector this horn was separated from medial attachment with remaining hemi-uterus here the vascular supply was identified on inferior aspect at the point of its attachment to the uterus or if connecting muscular bands were present, vessels are found below the band.



(a) (b)

Figure 3. Chromopertubation to identify communicating horn.

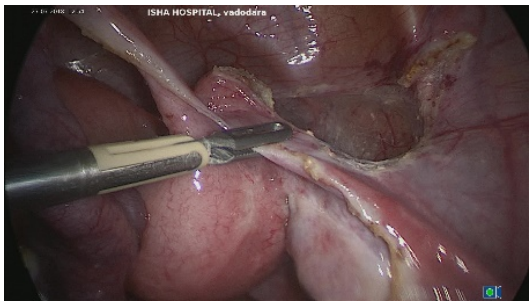
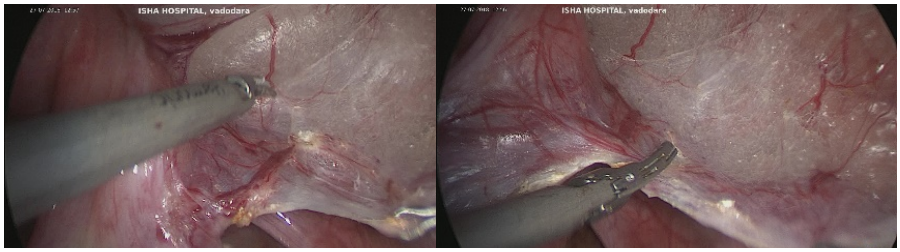


Figure 4. Salpingectomy.



(a) (b)

Figure 5. Lateral blood supply.

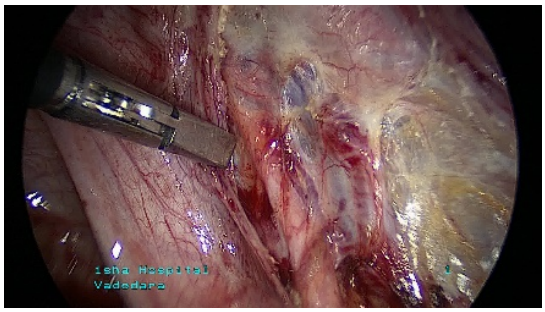
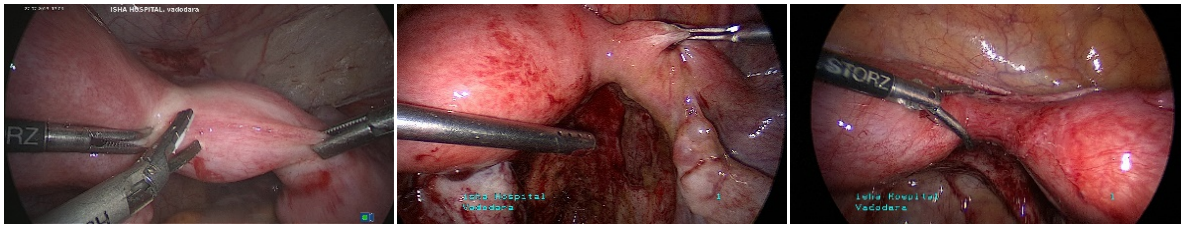


Figure 6. Ureteric dissection.

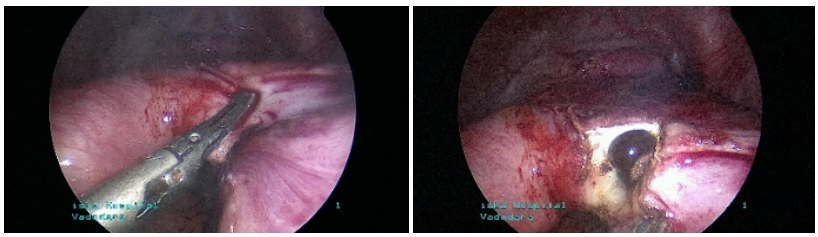
When band present it was cut little away from its attachment with normal hemi-uterus (**Figures 7(a)-(c)**). One may place a suture for haemostasis in this band instead of coagulation. (ESHRE ESGE class C4aC3V0). In Class U3bC3V2 there is no band between horns (**Figures 8(a)-(d)**).

11) In ESHRE ESGE Class C4bC3V0 when hemi-uterus has symptomatic pathology, hemi-hysterectomy was performed as per steps described above. After

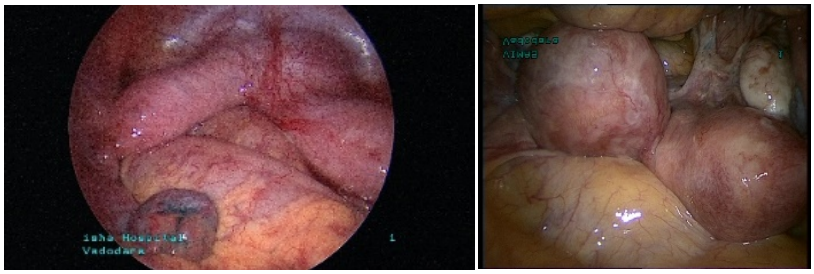


(a) (b) (c)

Figure 7. Thick band with fibroid, thick bands.



(a) (b)



(c) (d)

Figure 8. No band between horns (HWWS).

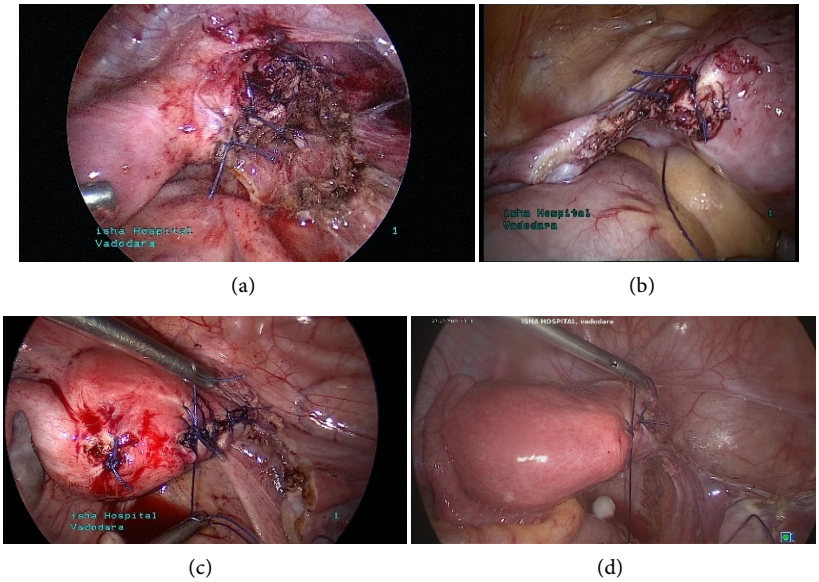
devascularization colpotomy was performed and uterus was retrieved from vagina in all. Vaginal vault was closed by standard Richardson's technique. Associated small non-functional horn also was removed in these patients.

12) Varying length of horns can be attached with each other in lower part. After separation multiple intermittent myometrial apposition sutures were taken (**Figures 9(a)-(d)**).

13) There can be a variant where there is no separation between horns, it may look like a normal uterus with protruding cornual area at the site of obstructed horn. In this case careful dissection is required beginning from fundus of the uterus (**Figure 10**).

14) In case of HWWS type 1.2 functional rudimentary non-communicating horn which had hematocervix (cervical atresia) and hematometra was separated from its cervical connection (In didelphys variety horns are connected at cervix) with another hemi-uterus. In these cases, there was only a potential vaginal space which may be difficult to identify located above oblique vaginal septum. Interrupted sutures were taken at this place of separation [14] [15] [16] (ESHRE ESGE class U3bC3V2) (**Figure 11(a)**, **Figure 11(b)**).

15) It was important to note in the group of patients discussed in this study



(a) (b)

(c) (d)

Figure 9. (a)-(c) Myometrial sutures; (d) Myometrial suture.

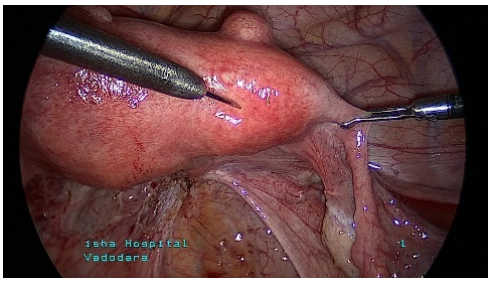
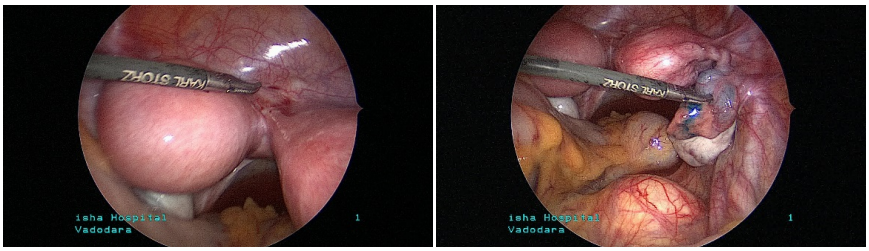


Figure 10. Class U4aC3V0, Horn attached from fundus.

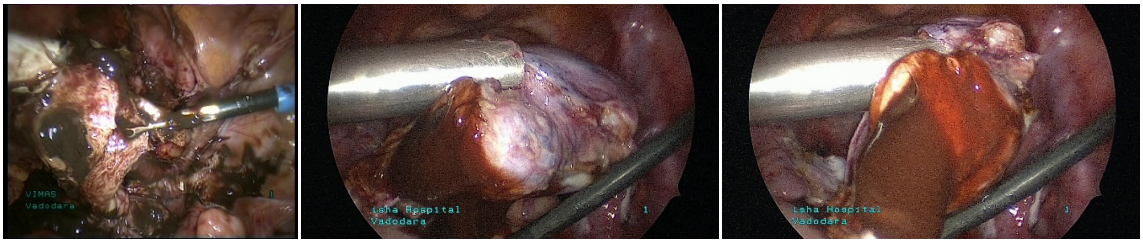


(a) (b)

Figure 11. Class U3bC3V2.

both uterosacral ligament attachments were seen at their usual attachment site only with the hemi-uterus which had normal cervix attached and was normally communicating with vagina. In adolescent girls with more laterally placed horn uterosacral ligaments may appear as relative thin structures. Obstructed rudimentary horn in any class did not have uterosacral ligament attachments.

16) In this study open power morcellation was offered to remove the hemi-hysterectomy specimen (obstructed horns) and small fibroid removed by myomectomy. There were no complications following morcellation (**Figures 12(a)-(c)**).



(a) (b) (c)

Figure 12. Morcellation.

17) Intraoperative blood loss was minimal in all operated patients. Associated pathology as fibroid, endometriosis was surgically treated as per requirement.

Outcome of surgery was studied by analysing post-operative OPD records of short term (day 8) and long term follow up to 1 year after discharge from the hospital.

2.6. Setting

Tertiary referral centre for laparoscopic surgery.

2.7. Data Analysis

Data extracted was entered in Microsoft excel sheets and analysed.

3. Results

Nearly half patients 8/19 (42.1%) patients were in childbearing age group. Two patients were minor 2/19 (10.5%). Remaining 5/19 (26.3%) patient were seen in adolescent age group and similar number in perimenopausal age.

Majority of patients had regular menstrual cycle and average BMI. Girls in adolescent age group had BMI < 18.

Preoperative diagnosis was made in 100% patients with help of 3 D USG [17] [18].

Three patients who had delayed periods with positive pregnancy test, on TVS diagnosed were to have non-communicating rudimentary horn pregnancy. These patients also gave history of dysmenorrhoea. One patient with MRKH type 2 [19] syndrome had primary amenorrhoea and pelvic pain with unilateral functional horn. Another patient with MRKH type 2 syndrome was menstruating through small fistulous tract resulted from prior surgery offered to her.

Dysmenorrhoea and pelvic pain were seen in 19/19 (100%) patients.

4/19 (21.05%) patients came for infertility evaluation at diagnosis. In 8/19 = 42.10% patients there was history of surgery performed (**Table 1**).

A referred young girl (MRKH type 2) who had undergone surgery for vaginoplasty and communication of functional horn with neovagina at the age of 16 yrs. Following this she was menstruating with persistent pelvic pain. She had presented 2 years after surgery with pus discharge from vagina with us. She had pus collection in uterus and same side fallopian tube with chronic PID. Hysteroscopy

Table 1. Demographic profile, history.

Age	**No/%**
<13 yr.	1/19 = 5.26%
13 - 20	5/19 = 26.32%
20 - 35	8/19 = 42.10%
35 - 45	5/19 = 26.32%
BMI	**No/%**
<18.5	6/19 = 35.29%
18.5 - <25	10/19 = 52.63%
25 - <30	3/19 = 15.79%
30 or >	-
Menstrual history	**No/%**
Regular	11/19 = 57.89%
Irregular	2/19 = 10.53%
Delayed periods (Rudimentary horn ectopic pregnancy)	3/19 = 15.79%
Primary amenorrhea	2/19 = 10.53%
Not attained menarchae	1/19 = 5.26%
Dysmenorrhoea	16/19 (84.20%)
Continuous chronic pain	8/19 = 42.10%
Parity	**No/%**
Nulliparous	4/19 = 21.05%
Multiparous	9/19 = 47.37%
Minor patients (12 yr., 16 yr.)	2/19 = 10.53%
Unmarried	4/19 = 21.05%
Infertility evaluation	**No/%**
Yes	4/19 = 21.05%
No	9/19 = 47.37%
Remaining 2 minor, 4 Unmarried	6/19 = 31.58%
Past surgeries	**No/%**
Laparotomy	1/19 = 5.26%
Appendicectomy	1/19 = 5.26%
CHD (congenital heart disease)	1/19 = 5.26%
Vaginoplasty with connecting one functional horn	1/19 = 5.26%
Laparoscopic adhesiolysis, drainage of pyometra, pyosalpinx (Same above patient operated again)	1/19 = 5.26%
Previous 2 CS	4/19 = 21.05%
Total patients with past surgeries	8/19 = 42.10%
Associated pathology other than endometriosis (Figures 13(a)-(f))	**No/%**

Continued

Severe pelvic adhesions	3/19 = 15.79%
Fibroids	5/19 = 26.32%
Endometrial Polyps	2/19 = 10.53%
Para-ovarian cyst	1/19 = 5.26%
Pelvic abscess	2/19 = 10.53%
Adenomyosis	1/19 = 5.26%
Total patients with associated pathology	14/19 = 73.68%

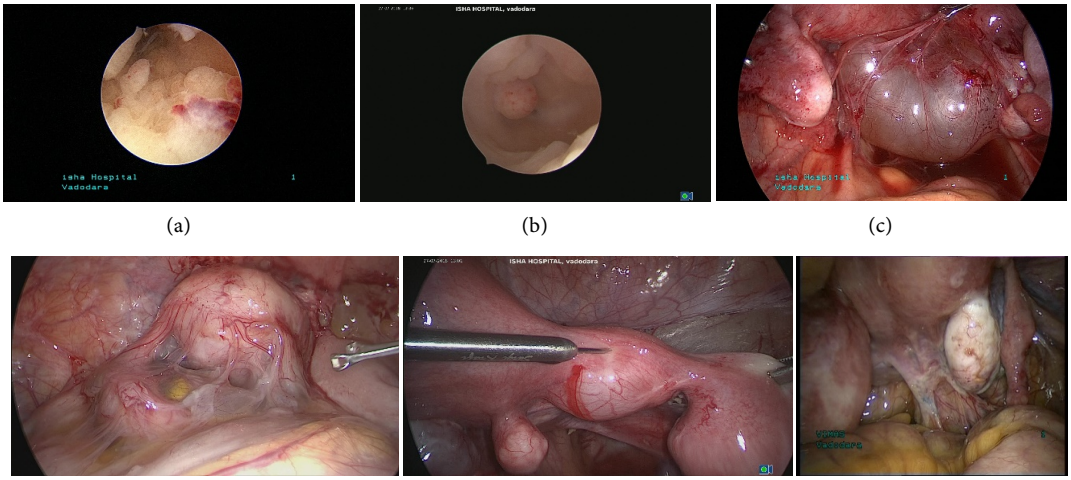
under USG guidance was carried out through fibrosed introital area with identifiable opening through which hysteroscope was guided into uterine cavity. Pus filled uterine cavity was washed. Laparoscopic adhesinolysis, salpingostomy and drainage of pus was performed simultaneously. At this stage it was not diagnosed other horn is also functional horn with endometrium. And so, within 6 months she presented again with severe abdominal and pelvic pain, now laparoscopic removal of bilateral hydrosalpingx and hemi-hysterectomy of non-communicating functional horn was performed. She had as rare instance of having bilateral functional non-communicating horns in a case of MRK H syndrome.

All 100% patients with functional rudimentary horn had presented with or had dysmenorrhoea and abdominal pain. 84.20% patients had severe dysmenorrhoea, because of long standing complaints additional 41% has chronic continuous suprapubic pelvic pain. One multiparous patient had presented with severe lower abdominal pain with signs and symptoms of sub-acute bowel obstruction had associated pelvic abscess. This was because of secondary infection of pelvic endometriosis. She had previous 2 caesarean delivery for abnormal presentation related to unicornuate uterus. This patient was treated by hemi-hysterectomy with removal of associated non-functional rudimentary horn. Opposite side rudimentary small non-functional horn was removed in these cases as a part of surgical procedure (Class U3bC3V0).

Pregnancy in rudimentary horn was diagnosed early in all 2 patients by 8 wks. There are reports of undiagnosed such pregnancy where patients present with rupture horn and intraperitoneal haemorrhage [20].

In 14/19 = 73.68% patients other associated pathologies was seen as fibroid 5/19 = 26.32%, adenomyosis 1/19 = 5.26%, severe pelvic adhesions 3/19 = 15.79%, endometrial polyp 2/19 = 10.53%, para ovarian cyst 1/19 = 5.26% and pelvic abscess in 2/19 = 10.53% [21] (**Table 1**).

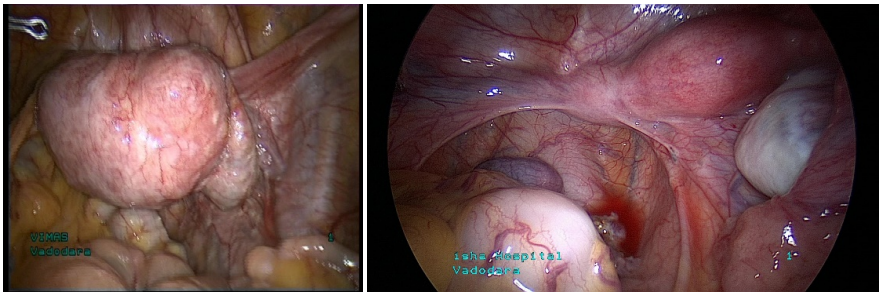
Association of endometriosis with mullerian dysgenesis is present in 14/19 = 73.68% of patients. In this study group majority had stage 1 disease (71.43%) and remaining had stage 2 disease (28.57%) according to AFS classification. When the untreated obstruction is long standing the association and severity of disease was found significant [9]. With late diagnosis and treatment offered endometriosis becomes more severe and was diagnosed as stage 3 - 4 disease [9] [22] (**Figures 13(a)-(f)**, **Figure 14(a)**, **Figure 14(b)**) (**Table 2**).



(a) (b) (c)

(d) (e) (f)

Figure 13. (a)-(c) Associated pathology endometrial polyps, para ovarian cyst; (d) (e) Associated pathology abscess, fibroid; (f) Endometriosis.



(a) (b)

Figure 14. Associated pathology adenomyosis, endometriosis.

Table 2. Associated endometriosis.

Endometriosis	No/%
Endometriosis present	14/19 = 73.68%
Endometriosis absent	5/19 = 26.32 %

Associated renal malformations were seen in 3/19 = 15.79% of patients in this group studied. Association of ipsilateral renal agenesis should be checked, especially in HWWS type of dysgenesis [23]. In our case series all were associated with HWWS type of dysgenesis (**Table 3**).

Most common type of Mullerian dysgenesis was ESHRE ESGE class U4aC3V0. (10/19 = 52.63%) This is commonest type of dysgenesis found unicornuate uterus with functional non-communicating horn (**Figure 19** & **Figure 20**).

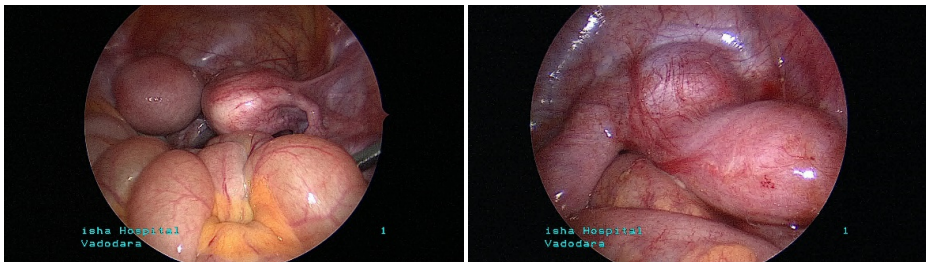
Remaining obstructive malformations belong to class U3bC3V2 reported as HWWS type 1.2 and U5aC4V4 as MRKH syndrome. In one of the published study classifying complex genital tract malformations have classified HWWS as U3a instead U3b [24].

Table 3. Associated renal malformations.

Renal malformations	No/%
Unilateral renal agenesis	3/19 = 15.79%
No renal malformations	16/19 = 84.21%

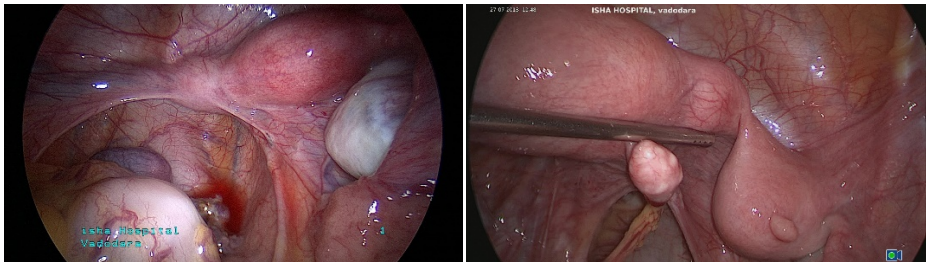
Table 4. ESHRE ESGE classification of obstructive malformations.

Class	No/%
U3bC3V2 (HWWS type 1.2) [8] (**Figure 15(a)**, **Figure 15(b)**)	3/19 = 15.79%
U4aC3V0 (Unicornuate uterus with functional horn) (**Figure 16(a)**, **Figure 16(b)**)	10/19 = 52.63%
U5aC4V4 (MRKH type 2) (**Figure 18**)	3/19 = 15.79%
U4bC3V0 (Unicornuate with nonfunctional horn) (**Figure 17(a)**, **Figure 17(b)**)	3/19 = 15.79%



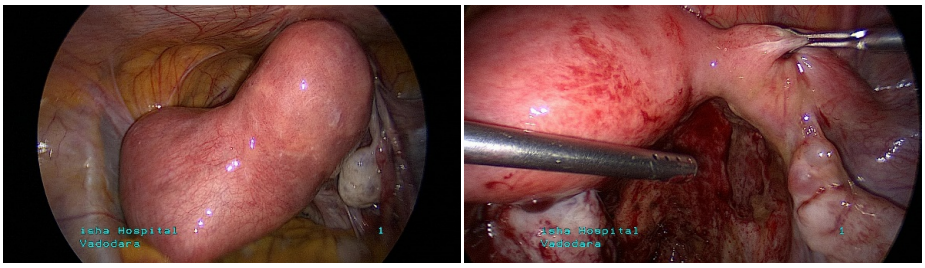
(a) (b)

Figure 15. Class U3bC3V2.



(a) (b)

Figure 16. Class U4aC3V0.



(a) (b)

Figure 17. Class U4bC3V0.

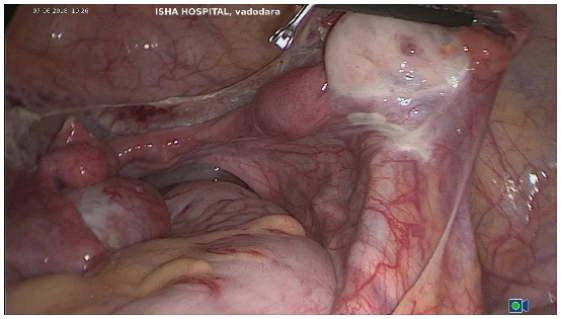


Figure 18. Class U5aC4V4.

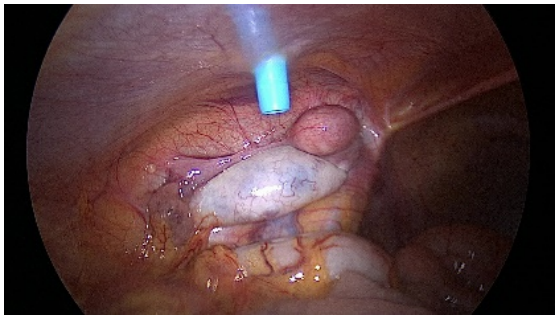


Figure 19. Class U4aC3V0 Ectopic ovary with lateral placed horn.

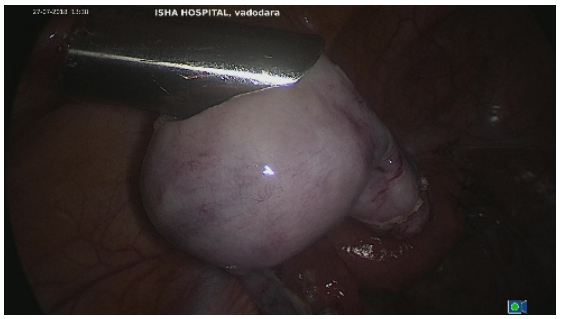


Figure 20. Rudimentary horn pregnancy.

In class U4bC3V0 hemi-hysterectomy surgery was indicated after child bearing was over as hemi uterus had developed pathologies as fibroids, adenomyosis or there was endometriosis with secondary pelvic infection for which patient were symptomatic [25].

The above 3 ESHRE ESGE class (U3bC3V2, U5aC4V4, U4bC3V0) there were 3/19 (15.79%) patients each (**Table 4**).

In class U4aC3V0 one patient 1/19 (5.26%) had small rudimentary functional horn with ectopic ovary. Ectopic ovaries are defined when they are located above division of common iliac vessels. They are found more frequently in cases of unicornuate uterus [26].

In class U4aC3V0 either thick or thin band was seen connecting horns. (13/19 = 68.42% vs 1/19 = 5.26%)

In class U3bC3V2, U5aC4V4 no band was seen between horns. (5/19 = 26.32%)

In 3 patients HWWS variant 1.2, U3bC3V2 were identified. (3/19 = 15.79%)

In class U4C3V0, U4bC3V0 blood supply was seen from both Medial & lateral side. While in class U5aC4V4, U4aC3V0 with lateral displaced horn (3 no) and U3bC3V2 blood supply was from lateral side only.

In 3/19 = 15.79% cases Cervical atresia was seen they were in class U3bC3V2. While Cervical agenesis was seen in class U4C3V0, U4bC3V0 and U5aC4V4, was identified in 16/19 = 84.21% patients.

Displacement of ureter more lateral without pathology and renal dysgenesis or agenesis was identified only in 1 patient. Ureteric course was normal in all others (Table 5).

In majority of cases on TAS or TVS examination a single cervix communicating with a unicornuate uterus and normal vagina, and on opposite side muscular adnexal mass with hypoechoeic or ecogenic content of different volume was seen (functional rudimentary horn was located around midline in majority). Rudimentary functional non-communicating horns placed high along lateral pelvic wall were also seen.

Rudimentary horn pregnancy in 3 patients also was pre-operative diagnosis. Pre-operative provisional diagnosis of obstructive Mullerian dysgenesis was possible in 100% patients (Figures 1(a)-(h)).

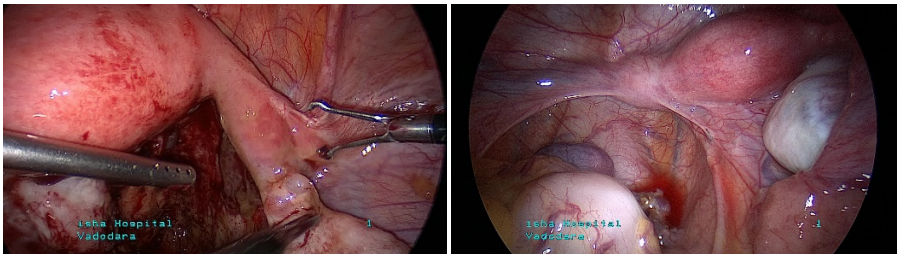
In majority of patients 15/19 = 78.95% horn sizes were unequal. In all Cases of HWWS variant (1.2), U3bC3V2 obstructed horn was larger than normal. While in class U4aC3V0 normal horn was larger than obstructed. This was not true in case of rudimentary horn pregnancy. Inequality in horn size was found in class U5aC4V4 also. This anatomical variation may not be of significance in management (Table 6).

Table 5. Anatomical variation of unicornuate malformations with ESHRE-ESGE class in study group.

	Variations with ESHRE ESGE class	No/%
1	Small rudimentary functional horn with ectopic ovary U4aC3V0	1/19 = 5.26%
2	**Band between the horns** (Figure 21(a), Figure 21(b))	
	Thin band at the level of internal OS, U4bC3V0	1/19 = 5.26%
	Thick band at the level of internal OS, U4aC3V0	13/19 = 68.42%
	No band between the horns, U3bC3V2, U5aC4V4	5/19 = 26.32%
3	HWWS variant (1.2), U3bC3V2	3/19 = 15.79%
4	**Blood supply to the horn in Hemi-hysterectomy specimen**	
	Lateral, U5aC4V4, U4aC3V0 with lateral displaced horn (3 no), U3bC3V2	8/19 = 42.10%
	Medial & lateral side both, U4aC3V0, U4bC3V0	11/19 = 57.89%
5	Cervical atresia Type 1, U3bC3V2	3/19 = 15.79%
	Cervical atresia Type 2, U4aC3V0, U4bC3V0 (non-functional horn), Cervical agenesis U5aC4V4	16/19 = 84.21%
6	**Ureter displaced**	
	yes	1/19 = 5.26%
	no	18/19 = 94.74%

Table 6. Horns' size.

Equal	Unequal
4/19 = 21.05%	15/19 = 78.95%



(a) (b)

Figure 21. Thick and thin band

Of all patients who required hemi-hysterectomy 16/ 19 = 84.21% had obstructive problem while only 3/19 = 15.79% had no obstruction [27] (**Table 7**). Hemi-hysterectomy was performed as per the described steps in methods.

A young patient operated of HWWS type 2.1 age 15 yrs., was diagnosed as hematocolpus and HWWS type 1.2 on trans abdominal USG. On vaginoscopy followed by hysteroscopy pus collection was seen draining through minute opening of 1 mm in upper part (right) of opposite lateral fornix. One cervical opening was seen at vaginal vault (left). Hysteroscope was introduced further introduced through this opening, pus was washed, another cervix was seen opening in this partially obliterated cavity. Hysteroscopy through both cervices one by one revealed unicornuate cavities. The opening in the oblique septum was widened to full extent. (HWWS variant 2.1). This patient was not included in this study.

In 2 cases of MRKH type 2 syndrome hemi-hysterectomy was indicated because of functioning non communicating horns [19] [28]. In other cases hemi-hysterectomy was performed because of associated fibroids [25].

In case of U4bC3V0 patients had previous caesarean deliveries because of abnormal presentation of foetus. In later life when they developed additional pathology as fibroids or adenomyosis and or secondary infection in associated endometriosis which make them symptomatic, hemi-hysterectomy was performed. Surgery also involved excision of associated pelvic endometriotic lesions. Associated non-functional small horn in this class of patients, although normal was removed as part of surgical protocol. Steps in removing these horns remains same. In present study about 53% of such patients had endometriosis [29]. Monopolar blend 2 current was used for excising pelvic endometriotic lesions using needle electrode. 17% patients in class U4bC3V0 had associated fibroids. Fibroids were removed by standard laparoscopic myomectomy procedure. 2 patients who had endometrial polyps were removed by hysteroscopic resection. In 94% patient's ureters were in normal position, only one had lateral shift from normal course (no pathology).

Table 7. Obstructive/Non-obstructive.

Removal of Rudimentary non-communicating functional horn U4aC3V0 (obstructive)	16/ 19 = 84.21%
Removal of Unicornuate uterus with pathology or associated pelvic disease U4bC3V0 (Non obstructive)	3/19 = 15.79%

There were no intraoperative or post-operative complications in this group of patients. Duration of hospitalization for all was one day.

Short term follows up at 1st week post-operative was uneventful. In long term follow-up period up to 1 year and beyond (2 years) patients were completely free of dysmenorrhoea & pelvic pain symptoms and were very satisfied as there was no pain. Married patients had reported successful pregnancies (4 patients) by the end of 2 years.

4. Discussion

In general no issues have been raised regarding ESHRE ESGE classification other than reporting septate uterus [30] [31]. This classification effectively identifies various unicornuate and didelphic uterus and so comparison of treatment methods may become easy in published literature.

Laparoscopy proves to be an effective surgical approach for the removal of the cavitated noncommunicating obstructive functional rudimentary horn as well as communicating unicornuate uterus with pathology. Literature has many case reports published as individual case management depending upon obstructive Mullerian dysgenesis identified [32] [33] [16]. Surgical techniques related to case specific are published. There are only few reported case reports or series of hemi-hysterectomy in the literature in this group of patients [13] [27]. Fedele in 2013 reported a 30 yrs. data of variants of HWWS variety studied in 87 patients [33].

Various failed or successful attempts to perform cervical canalization along with vaginoplasty have been reported in cases of MRKH type 2 syndrome [34].

A recently published new method which uses combined laparoscopic and vaginal cervicovaginal reconstruction using acellular porcine small Intestinal submucosa graft technique may give some hope in near future [35].

Our series appears to have largest number of such surgeries performed. The steps of Laparoscopic surgery in different ESHRE ESGE class are being discussed.

Laparoscopic surgery has its own advantage as compared to laparotomy in these cases. Best surgical treatment is achieved only by laparoscopic and hysteroscopic aid. Pre-operative diagnosis is achieved by 3 D ultrasonography and in some case of HWWS MRI may be required. We had established pre-operative diagnosis in 100% of patients [13].

Correct identification of functioning non communicating horn is required especially in cases of HWWS 1.2 variant. Hysteroscopy using 1.9 mm telescope helps without hymenal injury. Along with this some authors use transillumina-

tion of hysteroscopy to identify correct dissection planes [13]. We in our surgeries have not used such assistance, we feel it may not be required.

When we deal with cases obstructive Mullerian dysgenesis where hemi-hysterectomy may be required, the non-communicating rudimentary horn is expected to have either cervical agenesis or cervical atresia.

Cervical atresia in our series of patients was seen with HWWS variants Class U3bC3V2. Here in all patients it was type 1 atresia. In class U4aC3V0 and U4bC3V0 Cervical atresia was of class 2. While in cases of U5aC4V4, MRKH type 2 there was cervical agenesis. Xie Z in 2014 has described various types of cervical atresia and management of 32 such cases in the year 2014 [36].

Standard method of treatment in the above case series also was hemi-hysterectomy which was offered in our group of patients. (U4aC3V0, U4bC3V0 and U5aC4V4).

While performing Laparoscopic hemi-hysterectomy after cutting round ligament attachment. Ureteric course was identified by opening peritoneum and dissecting ureter along its pelvic course in the cases where it was required. In remaining the visual identification was done. Fallopian tube was removed in all. Devascularization was carried out by identifying lateral or medial or both side blood supply. Remain close to the horn while devascularization. Blood vessels were identified inferiorly traveling along lateral border from lateral side & medially along lower end to its point to attachment to the band or the uterus/cervix/obliterated vagina. Finally, the horn was detached by cutting the band (thick or thin) preferably close to horn to be removed or by correctly identifying the plane of dissection in case the horn was attached to communicating normal horn. Specimen can be removed by open or close power morcellation. We had performed open power morcellation. Surgeries were slightly complicated in case of patients who had history of previous surgeries, had pelvic endometriosis or pelvic infection [12] [32] [37] [38] [39]. Associated pelvic pathology as fibroids, endometriosis, para ovarian cysts etc. is treated surgically.

An experienced surgeon should deal with these problems of Mullerian dysgenesis. Post-operative recovery is uneventful, and all patients reported pain free periods as well as free of chronic pelvic pain which they felt. No patients were prescribed post-operative suppressive medical therapy for endometriosis.

In our series patient who had presented with infertility all were pregnant at the end of 2 years of follow up.

5. Conclusion

Early diagnosis of different variants of obstructive Mullerian dysgenesis is necessary. Preoperative definite evaluation of variant of a particular obstructive mullerian dysgenesis is necessary. Pre-operative counselling is necessary with regards to future fertility course in these group of patients. Patients have increasing dysmenorrhoea and if not treated in time the pain becomes continuous and intolerable. ESHRE ESGE classification helps in classifying different variants

clearly and this later helps in comparison in future studies. Laparoscopic hemi-hysterectomy is safe in experienced hands. Vaginoscopy and hysteroscopy is a necessary step before proceeding hemi-hysterectomy in HWWS 1.2 abnormalities. They are useful even when diagnosis is in doubt. An experienced surgeon with relevant insight into these malformations should treat these patients. Surgery further helps in treating associated pathologies causing infertility.

Limitations of the Study

After clinical suspicion we were able to achieve preoperative diagnosis of a variant of Mullerian dysgenesis in all. This included the associated pathologies. This does not match with some of the reports published. We may require more patients to add in this series to conclude in this regard.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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