

# Which kind of classification is more suitable for Herlyn–Werner–Wunderlich syndrome

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## Research article

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## Abstract

**Background:** To analyze the clinical characteristics of patients with Herlyn–Werner–Wunderlich syndrome (HWWs) in two classification methods.

**Methods:** 87 HWWs patients syndrome admitted to the Shengjing hospital of China Medical University between April 2003 to June 2020 were retrospectively reviewed.

**Results:** Type II of average age at time of diagnosis ( $25.11 \pm 8.96$ ) was significantly longer than the other two types ( $13.06 \pm 2.55$ ;  $13.06 \pm 2.55$ ). The menarche and the interval between menarche and time of diagnosis was significant difference between types I and II. The average age at time of diagnosis, the menarche and the interval between menarche and time of diagnosis was significant difference between classification I and II. Cystic mass in vaginal wall was a significant difference between type I and II. Endometriosis of type I and II was a more common than type III. Sex life was a significant difference between type I and II. Mediastinum of uterus of type II was a more common than type I and III. The time of diagnosis, menarche, interval between menarche and time of diagnosis, cystic mass in vaginal wall, abnormal vaginal discharge, sex life, changes of urination and defecation and mediastinum of uterus were significant difference between classification 1 and classification 2. The site of oblique septum vaginalis was significant difference in two classification methods. The absence of kidney in HWWs type was significant difference in two classification methods.

**Conclusion:** Type I HWWs should be suspected in cases involving adolescent girls presenting with cyclical pelvic pain, change of urination and defecation. Two classification can be easy to treat in clinical work.

## Background

Herlyn Werner Wunderlich syndrome (HWWs) includes duplication of uterus and vagina with semivaginal obstruction and ipsilateral renal hypoplasia[1]. In China, HWWs is defined as vaginal septal syndrome, including double uterus, double cervix, double vagina, vaginal septum and ipsilateral urinary system abnormalities, such as renal hypoplasia. Patients with single cervix and uterus mediastinum are relatively rare[2–3].

HWWs is categorized into three types: Type I is nonporous oblique vaginal septum, type II is perforated oblique vaginal septum, type III is nonporous oblique vaginal septum and cervical fistula. This classification was first reported by Bian [4]. HWWs can also be classified according to complete or incomplete blocking, Classification 1, patients with a completely obstructed hemivagina, and Classification 2, patients with an incompletely obstructed hemivagina. This classification was reported by Lan Zhu[5]. Classification 1 included type I, classification 2 included type II and type III. Because HWWs is an uncommon syndrome, it is easily misdiagnosed, and the treatment is often delayed. Now an analysis of HWWs clinical characteristics in a large sample of patients (more than 80 cases) has been reported only one[6]. Most of the studies are in the form of case reports, and there are different manifestations of diseases[7–11]. Early accurate diagnosis and resection of the oblique vaginal septum are the objective. Therefore, it is important to recognize the syndrome early. This study retrospectively analyzed 87 patients diagnosed and treated at Shengjing hospital of China Medical University from April 2003 to June 2020.

## Methods

Methods from April 2003 to June 2020, a total of 3551 cases of female reproductive system malformations in Shengjing Hospital of China Medical University were retrospectively analyzed. We classified the patients according to Bian and Zhu Lan's classification report[4–5].

We obtained the diagnosis through clinical manifestations, medical examination and ultrasonography mainly. The cystic mass in vaginal wall can be found through vaginal examination. The abnormal pus or blood could outflow from the hole of oblique vaginal septum by pressing the cystic mass in vaginal wall in type II, and could be aspirated by transvaginal paracentesis of the hematocolpus in types I and III. The abnormal pus or blood could outflow from the normal cervix in type III. HWWs can be also classified according to the complete or incomplete obstruction of the hemivagina as follows: Classification 1, patients with a completely obstructed hemivagina, and Classification 2, patients with an incompletely obstructed hemivagina. This classification was reported by Lan Zhu[5]. Ultrasonography could reveal the uterus didelphys, hematometrocolpos, and renal agenesis.

Statistical analyses were conducted using SPSS version 25.0 (IBM, Armonk, NY, USA). Data were compared between groups via  $\chi^2$  test, Fisher exact test, ANOVA test and nonparametric correlation analysis. The significance level for all analyses was set at  $p < 0.05$ .

## Results

HWWs accounted for 2.5% of congenital reproductive malformations. There were 50 cases of type I, 34 cases of type II and 3 cases of flat type III. Only one case is before menarche because it is difficult to urinate. Other cases were diagnosed after menarche. The average age at diagnosis, the average age at menarche and the interval between menarche and diagnosis time are shown in Table 1.1. There were significant differences in diagnosis time between type I and type II, type II and type III. There were significant differences in diagnosis time and menstrual cycle between menarche and type I and type II, but no significant differences between type II and type III.

Table 1.1  
Average age at time of diagnosis, average age at menarche and interval between menarche and time of diagnosis of HWWs by Bian

|   | Type I<br>(n = 50) | Type II<br>(n = 34) | Type III<br>(n = 3) |
|---|--------------------|---------------------|---------------------|
| Average age at time of diagnosis (years)                | 13.06 ± 2.55a*     | 25.11 ± 8.96b*      | 13.06 ± 2.55        |
| Average age at menarche (years)                         | 12.17 ± 2.28a*     | 13.82 ± 1.83        | 13.33 ± 1.53        |
| Interval between menarche and time of diagnosis (month) | 11.50 ± 11.89a*    | 135.50 ± 92.30      | 33.00 ± 44.40       |
| a vs. type II, b vs. type III                           |                    |                     |                     |
| * P < 0.05  |                    |                     |                     |

Classification 1 included type I, classification 2 included type II and type III, type 1 included 50 cases, and type 2 included 37 cases. Other cases were diagnosed after menarche. The average age at diagnosis, the average age at menarche and the interval between menarche and diagnosis are shown in Table 1.2. There were significant differences in diagnosis time, menarche, menarche interval and diagnosis time between classification 1 and classification 2.

Table 1.2  
Average age at time of diagnosis, average age at menarche and interval between menarche and time of diagnosis of HWWs by Lang

|   | Classification 1<br>(n = 50) | Classification 2<br>(n = 37) |
|---|------------------------------|------------------------------|
| Average age at time of diagnosis (years)                | 13.06 ± 2.55a*               | 24.37 ± 8.96                 |
| Average age at menarche (years)                         | 12.17 ± 2.28a*               | 13.78 ± 1.80                 |
| Interval between menarche and time of diagnosis (month) | 11.50 ± 11.89a*              | 127.19 ± 93.40               |
| a < 0.05 vs. classification 2                           |                              |                              |
| * P < 0.05  |                              |                              |

Dysmenorrhea and cystic mass in vaginal wall occurred common in all of the three types, but it was no difference. Cystic mass in vaginal wall was a significant difference between type I and II. Endometriosis of type I and II was a more common than type III. Sex life was a significant difference between and III. The common clinical manifestations of HWWs are shown in Table 2.1.

Table 2.1  
Common clinical manifestations of HWWs by Bian

|  | Type I<br>(n = 50) | Type II<br>(n = 34) | Type III<br>(n = 3) |
|--|--------------------|---------------------|---------------------|
| Dysmenorrhea(n (%))                          | 39(78.0)           | 26(76.5)            | 3(100.0)            |
| Cystic mass in vaginal wall (n (%))          | 49a(89.0) *        | 29(85.3)            | 3(100.0)            |
| Abnormal vaginal discharge (n (%))           | 4 (8.0)            | 8(23.5)             | 1(33.3)             |
| Endometriosis (n (%))                        | 6 b(12.0) *        | 7b (20.6) *         | 2(66.7)             |
| sex life (n (%))                             | 0a(0.0) *          | 19(55.9)            | 2(66.7)             |
| Changes of urination and defecation (n (%))  | 7(14.0)            | 2(5.9)              | 0(0.0)              |
| Mediastinum of uterus                        | 1a(2.0) *          | 9b(26.5) *          | 0(0.0)              |
| a < 0.05 vs. type II; b < 0.05 vs. type III; |                    |                     |                     |
| * P < 0.05                                   |                    |                     |                     |

Cystic mass in vaginal wall, abnormal vaginal discharge, sex life, changes of urination and defecation and mediastinum of uterus were significant difference between classification 1 and classification 2. The clinical manifestations of HWWs by Lang are shown in Table 2.2.

Table 2.2  
Common clinical manifestations of HWWs by Lang

|   | <b>Classification 1<br/>(n = 50)</b> | <b>Classification 2<br/>(n = 37)</b> |
|---|--------------------------------------|--------------------------------------|
| Dysmenorrhea(n (%))                         | 39 (78.0)                            | 29(78.4)                             |
| Cystic mass in vaginal wall (n (%))         | 49a(89.0)*                           | 32(86.5)                             |
| Abnormal vaginal discharge (n (%))          | 4a(8.0)*                             | 9(24.3)                              |
| Endometriosis (n (%))                       | 6 (12.0)                             | 9 (24.3)                             |
| sex life (n (%))                            | 0a(0.0) *                            | 21(56.8)                             |
| Changes of urination and defecation (n (%)) | 7a(14.0) *                           | 2(5.4)                               |
| Mediastinum of uterus                       | 1a(2.0) *                            | 9 (24.3)                             |
| <i>a</i> < 0.05 vs. classification 2        |                                      |                                      |
| * <i>P</i> < 0.05                           |                                      |                                      |

HWWs occurred on the right of oblique septum vaginalis 47 patients (57.3 %; type I 32, type II 14, and type III 1), and on the left in 26 patients (31.7%; type I 15, type II 9, and type III 2), among 5 patients did not describe the location of the oblique diaphragm, and only one cervical in 9 patients (10.0%; type I 3, type II 6; type III 0). The site of oblique septum vaginalis in HWWs type is significant difference. The results were shown in Table 3.1.

Table 3.1  
The site of Oblique septum vaginalis in HWWs by Bian\*

|   | <b>Type I<br/>(n = 50)</b> | <b>Type II<br/>(n = 29)</b> | <b>Type III<br/>(n = 3)</b> |
|---|----------------------------|-----------------------------|-----------------------------|
| The left of Oblique septum vaginalis (n (%))  | 15(30.0)                   | 9(31.0)                     | 2(66.7)                     |
| The right of Oblique septum vaginalis (n (%)) | 32(64.0)                   | 14(48.3)                    | 1(33.3)                     |
| Single cervical (n (%))                       | 3(6.0)                     | 6(20.7)                     | 0(0.0)                      |
| <i>P</i> = 0.011                              |                            |                             |                             |

HWWs occurred on the right of oblique septum vaginalis 47 cases(57.3%; classification 1 32, classification 2 15), and on the left in 26 cases(31.7%; classification 1 15, classification 2 11), among 5 patients did not describe the location of the oblique diaphragm, and only one cervical in 9 patients (10.0%; classification 1 3, classification 2 6). It was a significant difference. The results were shown in Table 3.2.

Table 3.2  
The site of Oblique septum vaginalis in HWWs by Lang\*

|   | <b>Classification 1<br/>(n = 50)</b> | <b>Classification 2<br/>(n = 32)</b> |
|---|--------------------------------------|--------------------------------------|
| The left of Oblique septum vaginalis (n (%))  | 15(30.0)                             | 11(37.5)                             |
| The right of Oblique septum vaginalis (n (%)) | 32(64.0)                             | 15(46.9)                             |
| Single cervical (n (%))                       | 3(6.0)                               | 6(18.8)                              |
| <i>P</i> = 0.025                              |                                      |                                      |

29 cases (33.3%; type I 16, type II 11 and type III 2) had left kidney deficiency, 51 cases (58.6%; type I 34, type II 16 and type III 1) had right kidney deficiency, and 7 cases (8%; type I 0, type II 7 and type III 0) had normal renal function. This is a significant difference. The results are shown in Table 4.1.

Table 4.1  
Urinary malformation of HWWs by Bian\*

|                         | Type I<br>(n = 50) | Type II<br>(n = 34) | Type III<br>(n = 3) |
|-------------------------|--------------------|---------------------|---------------------|
| Absence of left kidney  | 16(32.0)           | 11(32.5)            | 2(66.7)             |
| Absence of right kidney | 34(68.0)           | 16(47.1)            | 1(33.3)             |
| Normal                  | 0(0.0)             | 7(20.6)             | 0(0.0)              |
| <i>P = 0.008</i>        |                    |                     |                     |

HWWs occurred on absence of left kidney in 29 patients(33.3%; classification 1 16, classification 2 13), and absence of right kidney in 51 patients(58.6%; classification 1 34, classification 2 17), and both kidney normal in 7 patients(8%; classification 1 0, classification 2 7). It was a significant difference. The results were shown in Table 4.2.

Table 4.2  
Urinary malformation of HWWs by Lang\*

|                         | Classification 1<br>(n = 50) | Classification 2<br>(n = 37) |
|-------------------------|------------------------------|------------------------------|
| Absence of left kidney  | 16(32.0)                     | 13(35.1)                     |
| Absence of right kidney | 34(68.0)                     | 17(45.9)                     |
| Normal                  | 0(0.0)                       | 7(18.9)                      |
| <i>P = 0.004</i>        |                              |                              |

HWWs occurred in 28 cases of type A (40.6%; 19 cases of type I, 7 cases of type II, 2 cases of type III), 21 cases of type B (30.4%; 10 cases of type I, 11 cases of type II, 0 cases of type III), 15 cases of type O (21.7%; 6 cases of type I, 9 cases of type II, 0 cases of type III), 5 cases of type AB (7.2%; 3 cases of type I, 1 cases of type II, 1 cases of type III). It doesn't make any difference. The results are shown in Table 5.1.

Table 5.1  
Blood type of HWWs by Bian

| Blood type    | Type I<br>(n = 38) | Type II<br>(n = 28) | Type III<br>(n = 3) |
|---------------|--------------------|---------------------|---------------------|
| A             | 19(50.0)           | 7(25.0)             | 2(66.7)             |
| B             | 10(26.3)           | 11(39.3)            | 0(0.0)              |
| O             | 6(15.8)            | 9(32.1)             | 0(0.0)              |
| AB            | 3(7.9)             | 1(3.6)              | 1(33.3)             |
| <i>P=0.05</i> |                    |                     |                     |

HWWs occurred on the A blood type in 28 patients (40.6%; classification 1 19, classification 2 9), and on the B blood type in 21 patients (30.4%; classification 1 10, classification 2 11), and on the O blood type in 15 patients (21.7%; classification 1 6, classification 2 9), and on the AB blood type in 5 patients (7.2%; classification 1 3, classification 2 2). It was no difference. The results were shown in Table 5.2.

Table 5.2  
Blood type of HWWs by Lang

| Blood type    | Classification 1<br>(n = 38) | Classification 2<br>(n = 31) |
|---------------|------------------------------|------------------------------|
| A             | 19(50.0)                     | 9(29.0)                      |
| B             | 10(26.3)                     | 11(35.5)                     |
| O             | 6(15.8)                      | 9(29.0)                      |
| AB            | 3(7.9)                       | 2(6.3)                       |
| <i>P=0.05</i> |                              |                              |

We analysis the relationship between the different factors by Bian. HWWs type was related to time of diagnosis, menarche, interval between menarche and time of diagnosis, abnormal vaginal discharge, endometriosis, sex life, and mediastinum of uterus(all P < 0.05). Age at time of diagnosis was related to HWWs type, menarche, interval between menarche and time of diagnosis, cystic mass in vaginal wall, sex life, changes of urination and defecation and mediastinum of uterus(all P < 0.05). Menarche was related to HWWs type, time of diagnosis, interval between menarche and time of diagnosis, abnormal vaginal discharge, sex life and changes of urination and defecation(all P < 0.05). Interval between menarche and time of diagnosis was related to HWWs type, time of diagnosis, menarche, sex life, changes of urination and defecation and mediastinum of uterus(all P < 0.05). Cystic mass in vaginal wall was related to time of diagnosis, the site of oblique septum vaginalis and urinary malformation(all P < 0.05). Abnormal vaginal discharge was related to menarche and sex life(all P < 0.05). Endometriosis was related to HWWs type(all P < 0.05). Sex life was related to HWWs type, time of diagnosis, menarche, interval between menarche and time of diagnosis, abnormal vaginal discharge, mediastinum of uterus, the site of oblique septum vaginalis and urinary malformation(all P < 0.05). Changes of urination and defecation was related to time of diagnosis, menarche, interval between menarche and time of diagnosis and blood type(all P < 0.05). Mediastinum was related to HWWs type, time of diagnosis, interval between menarche and time of diagnosis, sex life and the site of oblique septum vaginalis(all P < 0.05). The site of oblique septum vaginalis was related to cystic mass in vaginal wall, sex life, mediastinum of uterus and urinary malformation (all P < 0.05). Urinary malformation was related to cystic mass in vaginal wall, sex life and the site of oblique septum vaginalis(all P < 0.05). Blood type was related to changes of urination and defecation(P < 0.05). The results were shown in Table 6.1.

Table 6.1  
The relationship between the factors by Bian

| P  | 1      | 2      | 3      | 4      | 5     | 6      | 7      | 8      | 9      | 10     | 11     | 12     | 13     | 14     |
|----|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1  |        | 0.000* | 0.002* | 0.000* | 0.738 | 0.094  | 0.032* | 0.039* | 0.000* | 0.286  | 0.008* | 0.138  | 0.502  | 0.856  |
| 2  | 0.000* |        | 0.000* | 0.000* | 0.683 | 0.020* | 0.106  | 0.377  | 0.000* | 0.012* | 0.000* | 0.111  | 0.274  | 0.884  |
| 3  | 0.002* | 0.000* |        | 0.000* | 0.401 | 0.195  | 0.015* | 0.600  | 0.000* | 0.001* | 0.205  | 0.263  | 0.537  | 0.766  |
| 4  | 0.000* | 0.000* | 0.000* |        | 0.727 | 0.079  | 0.115  | 0.362  | 0.000* | 0.042* | 0.000* | 0.087  | 0.224  | 0.903  |
| 5  | 0.738  | 0.683  | 0.401  | 0.727  |       | 0.085  | 0.547  | 0.241  | 0.107  | 0.977  | 0.512  | 0.071  | 0.728  | 0.293  |
| 6  | 0.094  | 0.020* | 0.195  | 0.079  | 0.085 |        | 0.293  | 0.970  | 0.008* | 0.394  | 0.084  | 0.000* | 0.012* | 0.067  |
| 7  | 0.032* | 0.106  | 0.015* | 0.115  | 0.547 | 0.293  |        | 0.850  | 0.032* | 0.188  | 0.638  | 0.463  | 0.721  | 0.359  |
| 8  | 0.039* | 0.377  | 0.600  | 0.362  | 0.241 | 0.970  | 0.850  |        | 0.714  | 0.152  | 0.809  | 0.434  | 0.568  | 0.065  |
| 9  | 0.000* | 0.000* | 0.000* | 0.000* | 0.107 | 0.008* | 0.032* | 0.714  |        | 0.085  | 0.000* | 0.002* | 0.029* | 0.141  |
| 10 | 0.186  | 0.012* | 0.001* | 0.042* | 0.977 | 0.394  | 0.188  | 0.152  | 0.085  |        | 0.259  | 0.751  | 0.180  | 0.011* |
| 11 | 0.008* | 0.000* | 0.205  | 0.000* | 0.512 | 0.084  | 0.638  | 0.809  | 0.000* | 0.259  |        | 0.001* | 0.767  | 0.526  |
| 12 | 0.138  | 0.111  | 0.263  | 0.087  | 0.071 | 0.000* | 0.463  | 0.434  | 0.002* | 0.751  | 0.001* |        | 0.000* | 0.728  |
| 13 | 0.502  | 0.274  | 0.537  | 0.224  | 0.728 | 0.012* | 0.721  | 0.568  | 0.029* | 0.180  | 0.767  | 0.000* |        | 0.146  |
| 14 | 0.856  | 0.884  | 0.766  | 0.903  | 0.293 | 0.067  | 0.359  | 0.065  | 0.141  | 0.011* | 0.526  | 0.728  | 0.146  |        |

1,HWWs type; 2,Time of diagnosis; 3,Menarche; 4,Interval between menarche and time of diagnosis; 5,Dysmenorrhea; 6,Cystic mass in vaginal wall; 7,Abnormal vaginal discharge; 8,Endometriosis; 9,Sex life; 10,Changes of urination and defecation; 11,Mediastinum of uterus; 12,The site of Oblique septum vaginalis; 13, Urinary malformation; 14,blood type

\*P<0.05

We analysis the relationship between the different factors by Lang. HWWs type was related to time of diagnosis, menarche, interval between menarche and time of diagnosis, cystic mass in vaginal wall, abnormal vaginal discharge, sex life, and mediastinum of uterus(all P < 0.05). Age at time of diagnosis was related to HWWs type, menarche, interval between menarche and time of diagnosis, abnormal vaginal discharge, sex life, changes of urination and defecation and mediastinum of uterus(all P < 0.05). Menarche was related to HWWs type, time of diagnosis, interval between menarche and time of diagnosis, abnormal vaginal discharge, sex life and changes of urination and defecation(all P < 0.05). Interval between menarche and time of diagnosis was related to HWWs type, time of diagnosis, menarche, abnormal vaginal discharge, sex life, changes of urination and defecation and mediastinum of uterus(all P < 0.05). Cystic mass in vaginal wall was related to HWWs type, sex life, the site of oblique septum vaginalis and urinary malformation(all P < 0.05). Abnormal vaginal discharge was related to HWWs type, time of diagnosis, menarche, interval between menarche and time of diagnosis and sex life(all P < 0.05). Sex life was related to HWWs type, time of diagnosis, menarche, interval between menarche and time of diagnosis, cystic mass in vaginal wall, abnormal vaginal discharge, mediastinum of uterus, the site of oblique septum vaginalis(all P < 0.05). Changes of urination and defecation was related to time of diagnosis, menarche, interval between menarche and time of diagnosis and blood type(all P < 0.05). Mediastinum was related to HWWs type, time of diagnosis, interval between menarche and time of diagnosis, sex life and the site of oblique septum vaginalis(all P < 0.05). The site of oblique septum vaginalis was related to

cystic mass in vaginal wall, sex life, mediastinum of uterus and urinary malformation (all  $P < 0.05$ ). Urinary malformation was related to cystic mass in vaginal wall and the site of oblique septum vaginalis (all  $P < 0.05$ ). Blood type was related to changes of urination and defecation ( $P < 0.05$ ). The results were shown in Table 6.2.

Table 6.2  
The relationship between the factors by Lang

| P  | 1      | 2      | 3      | 4      | 5     | 6      | 7      | 8     | 9      | 10     | 11     | 12     | 13     | 14     |
|----|--------|--------|--------|--------|-------|--------|--------|-------|--------|--------|--------|--------|--------|--------|
| 1  |        | 0.000* | 0.000* | 0.000* | 0.967 | 0.036* | 0.035* | 0.136 | 0.000* | 0.197  | 0.001* | 0.120  | 0.379  | 0.664  |
| 2  | 0.000* |        | 0.000* | 0.000* | 0.963 | 0.111  | 0.007* | 0.116 | 0.000* | 0.003* | 0.000* | 0.335  | 0.990  | 0.454  |
| 3  | 0.000* | 0.000* |        | 0.000* | 0.877 | 0.422  | 0.001* | 0.515 | 0.000* | 0.022* | 0.073  | 0.260  | 0.458  | 0.179  |
| 4  | 0.000* | 0.000* | 0.000* |        | 0.563 | 0.140  | 0.044* | 0.106 | 0.000* | 0.006* | 0.000* | 0.401  | 0.649  | 0.768  |
| 5  | 0.967  | 0.963  | 0.877  | 0.563  |       | 0.085  | 0.547  | 0.241 | 0.107  | 0.977  | 0.512  | 0.088  | 0.753  | 0.289  |
| 6  | 0.036* | 0.111  | 0.422  | 0.140  | 0.085 |        | 0.293  | 0.970 | 0.008* | 0.394  | 0.084  | 0.013* | 0.029* | 0.073  |
| 7  | 0.035* | 0.007* | 0.001* | 0.044* | 0.547 | 0.293  |        | 0.850 | 0.032* | 0.188  | 0.638  | 0.601  | 0.818  | 0.376  |
| 8  | 0.136  | 0.116  | 0.515  | 0.106  | 0.241 | 0.970  | 0.850  |       | 0.714  | 0.152  | 0.809  | 0.376  | 0.655  | 0.051  |
| 9  | 0.000* | 0.000* | 0.000* | 0.000* | 0.107 | 0.008* | 0.032* | 0.714 |        | 0.085  | 0.000* | 0.001* | 0.056  | 0.237  |
| 10 | 0.197  | 0.003* | 0.022* | 0.006* | 0.977 | 0.394  | 0.188  | 0.152 | 0.085  |        | 0.259  | 0.485  | 0.161  | 0.008* |
| 11 | 0.001* | 0.000* | 0.073  | 0.000* | 0.512 | 0.084  | 0.638  | 0.809 | 0.000* | 0.259  |        | 0.030* | 0.964  | 0.749  |
| 12 | 0.120  | 0.335  | 0.260  | 0.401  | 0.088 | 0.013* | 0.601  | 0.376 | 0.011* | 0.485  | 0.030* |        | 0.000* | 0.875  |
| 13 | 0.379  | 0.990  | 0.458  | 0.649  | 0.753 | 0.029* | 0.818  | 0.655 | 0.056  | 0.161  | 0.964  | 0.000* |        | 0.192  |
| 14 | 0.664  | 0.454  | 0.179  | 0.768  | 0.289 | 0.073  | 0.376  | 0.051 | 0.237  | 0.008* | 0.749  | 0.875  | 0.192  |        |

1,HWWS type; 2,Time of diagnosis; 3,Menarche; 4,Interval between menarche and time of diagnosis; 5,Dysmenorrhea; 6,Cystic mass in vaginal wall; 7,Abnormal vaginal discharge; 8,Endometriosis; 9,Sex life; 10,Changes of urination and defecation; 11,Mediastinum of uterus; 12,The site of Oblique septum vaginalis; 13, Urinary malformation; 14,blood type

\* $P \leq 0.05$

## Discussion

Among the obstructive malformations of the female genital tract, HWWs is a common type [12]. There are three types of HWWs in the world. In recent years, some scholars divided them into two types according to the presence or absence of obstruction. HWWs can be also classified according to the complete or incomplete obstruction of the hemivagina as follows: Classification 1, patients with a completely obstructed hemivagina, and Classification 2, patients with an incompletely obstructed hemivagina. Classification 1 included type I, classification 2 included type II and III. We research the impact of the two classification methods on the clinical analysis. We study that it was 9(11%) patients single cervix in type I and II. In the present study, it was 7(8%) patients no urinary malformation in type II, but the affected kidney had no research function or polycystic kidney.

The age of diagnosis and the interval between menarche and diagnosis of type II were longer than those of type I and type III. as type II had vaginal oblique septal perforation, blood could flow out through meridians. Type III has vaginal septal atresia and cervical fistula, blood can not flow out smoothly. The age at diagnosis and the interval between menarche and diagnosis of classification 1 were longer than those of classification 2.

Dysmenorrhea and cystic mass in vaginal wall were the most common clinical symptom. Dysmenorrhea was common in all type of HWWs, but cystic mass in vaginal wall was more common in type I. Abnormal vaginal discharge was more common in type II, but it is no difference. Endometriosis was common in type III, but it is no difference. Sex life was common in type II, because the age patients of type I was young. Changes of urination and defecation was more in type I. Type I and II was often associated with mediastinum of uterus. Cystic mass in vaginal wall and changes of urination and defecation were common in classification 1, abnormal vaginal discharge, sex life and mediastinum of uterus were common in classification 2. It may be associated with blood flow, bacterial retrograde infection.

The right of oblique septum vaginalis in HWWs was more common than left in two typing methods. 9 patients had a single cervix, so it was impossible to determine the position of the oblique diaphragm.

Most of the ipsilateral diaphragmas were associated with ipsilateral urinary malformations. Absence of right was more common than left in two typing methods. 7 patients had two kidney, but they had ipsilateral renal abnormalities.

Blood type was not associated with HWWs types. A type was common in type I and III, B type was common in type II. A type was common in classification 1, B type was common in classification 2, but it is no difference.

HWWs type was related to time of diagnosis, menarche, interval between menarche and time of diagnosis, abnormal vaginal discharge, endometriosis, sex life, and mediastinum of uterus. The difference was that HWWs classification was associated with endometriosis, but not with vaginal wall mass. Age at time of diagnosis in three categories was related to menarche, interval between menarche and time of diagnosis, cystic mass in vaginal wall, sex life and changes of urination and defecation. The difference was that time of diagnosis was associated with abnormal vaginal discharge and mediastinum of uterus, but not with cystic mass in vaginal wall in two categories. Interval between menarche and time of diagnosis was related to sex life, changes of urination and defecation and mediastinum of uterus in three categories. The difference was that interval between menarche and time of diagnosis was associated with abnormal vaginal discharge, but not with mediastinum of uterus.

Most patients had clinical symptom after time of diagnosis, so HWWs was easy to miss diagnosis. What's interesting is that blood type was related to changes of urination and defecation. Scholars can expand the sample size to study the relationship between blood type and constipation.

For the patients with postoperative vaginal septal stenosis, re-resection of the vaginal septum is still a better choice. With the development of surgical technology, more and more hysteroscopy and laparoscopy are used in the treatment of HWWs. Hysteroscopy and laparoscopy combined application can better diagnosis and treatment.

Most of the patients were lost in follow-up. 6 patients had birth history, 2 with spontaneous delivery, 4 with full-term cesarean section and 1 with abortion.

## Conclusion

Type I should be suspected in cases involving adolescent girls presenting with cyclical pelvic pain, change of urination and defecation. It is difficult to distinguish type III in international classification, but it is easier to analyze in two classification. The second classification was related to cystic mass in vaginal wall, but the first classification is not. However, it does not affect the diagnosis and treatment of the disease.

Therefore, we can be easy to treat in clinical work.

## Abbreviations

HWWs Herlyn–Werner–Wunderlich syndrome

## Declarations

### Ethics approval and consent to participate

This study was received ethical approval from the ethics review committee of the Shengjing hospital(2020PS716K). The consent from study participants was written.

### Consent for publication

All authors are consent for publish.

### Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available as the project is on-going and additional analyses are planned. However, excerpts from the dataset can be made available from the corresponding author upon reasonable request.

### Competing Interests

None of the authors has any conflict of interest to declare.

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### Authors Contributions

All authors fulfill the criteria for authorship. L.W. participated in data collection and designed the study. W.H. participated in data collection and analyses and revised the article.



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