variable as 'any cystic lesion in the pelvis detected by ultrasonography'. This lesion may correspond to TOA, but cystic structures other than TOA such as hydrosalpinx or ovarian cysts should be included. Interestingly, cases with any cystic lesion in the pelvis detected by ultrasonography were associated with poor clinical course, whereas other conditions or diseases such as endometriosis, fibroid and adenomyosis, identified by ultrasonography were not associated with clinical course. It is well known that TOA requires long hospitalization and/or surgical intervention,[2] but the findings of the current study indicate that gynecologists can predict poor clinical course only by identifying cystic lesions by using ultrasonography, before confirming their characterization.

High CRP level on admission was identified as an independent factor associated with poor clinical course, whereas other clinical and laboratory factors such as body temperature and WBC counts did not predict clinical course. It has been well described that serial CRP measurements are useful to assess the clinical success of the conservative treatment of PID, such as response to antimicrobial therapy.[10,11] The aim of this novel study was to identify predictors of poor clinical course from factors that are ascertainable on admission. We discovered that high CRP levels on admission are significantly associated with poor clinical course. We further conducted ROC analysis, which indicated that the cut-off was 4.4 mg/dL, although the sensitivity and the specificity were not satisfactorily high (sensitivity, 76.2%; specificity, 58.4%).

This study is the first of its kind to demonstrate that history of intrauterine operation before the onset of PID is an independent factor associated with poor clinical course. In general, PID is caused by the ascending spread of microorganisms from the vagina to the uterus, fallopian tubes and adnexa. Therefore, transvaginal intrauterine operations such as the collection of endometrial cytology or embryo transfer may potentially induce PID. Here, we evaluated the impact of intrauterine operations on the severity of hospitalized PID, and discovered that PID triggered by intrauterine operations is likely to result in a poor clinical course regardless of concomitant risk factors. Indeed, 13 out of 18 PID cases that developed shortly after intrauterine operations developed poor clinical courses. Five of the 13 patients had undergone collections of endometrial cytology and four had received embryo transfers. One patient underwent IUD removal just before the onset. IUD use has been shown to be strongly associated with an increased risk of surgery for PID as a result of failed conservative treatment.[4] On the other hand, no study has assessed the influence of infertility treatment-related intrauterine operations such as embryo transfer or intrauterine insemination on the severity of PID, although several case reports suggest that embryo transfer provoked severe PID.[12,13] The possible etiology of the association between intrauterine operation and severe PID is poorly understood, but it can be speculated that mechanical stimulation on the endometrium could provoke inflammatory reactions and enhance the spread of microorganisms. It is also possible that those who carried IUD in the uterus or infertile patients had asymptomatic PID, and symptoms were manifested by the intrauterine operations. Special attention should be paid to PID that develops after intrauterine operations, especially for patients in the course of infertility treatment, as they are potentially conceiving within treatment cycles.

This study has the following limitations. First, this is a retrospective study and diagnostic and therapeutic strategies may vary among cases, although each clinician follows the same guideline. Second, several important factors, such as the number of sexual partners, were not included due to a lack of information in medical records. It is also possible that small sample size may have limited the power to detect significances for some risk factors. A prospective study with a large number of cases should be performed to address these issues.

In summary, this study identified variables that can be obtained at the time of admission and can predict poor clinical course of patients hospitalized with PID. These findings can assist gynecologists to identify patients at risk and to optimize the choice of management in advance.

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Individualized management of umbilical endometriosis: A report of seven cases

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Abstract

Aim: The aim of this study was to review diagnostic/therapeutic strategies of umbilical endometriosis managed in our department and evaluate the effectiveness of these strategies.

Methods: Medical records for patients with diagnosis of endometriosis managed from 1999 through 2011 in the University of Tokyo Hospital were retrospectively reviewed. Cases with diagnosis of umbilical endometriosis were identified. Clinical information of age, gravida, parity, histories of surgery and oral contraceptive (OC), management for the disease prior to the first visit, symptoms, patients' desire for pregnancy, diagnostic/therapeutic methods and prognosis were reviewed and summarized.

Results: During the period, 2530 patients with diagnosis of endometriosis were identified. Seven patients had diagnosis of umbilical endometriosis, giving an incidence of 0.29% of all endometriosis cases and 5.6% of extragenital endometriosis cases. A definitive diagnosis was made by histological examination following a biopsy (two cases) or a resection (three cases). A clinical diagnosis was made by empirical treatment with OC (one case) or dienogest (one case). With regard to therapy, three patients chose expectant management and did not require therapeutic intervention. Three patients began OC and symptoms were well controlled in all patients. One patient who wished to conceive chose a wide resection followed by umbilical reconstruction. She became pregnant afterwards and recurrence was not reported.

Conclusion: There are various options of diagnostic/therapeutic strategies, such as empirical treatments and OC that can provide individualized management of umbilical endometriosis, congruent with the severity of patient symptoms, age and desire for pregnancy.

Key words: empirical treatment, endometriosis, extragenital, oral contraceptive, umbilicus.

Introduction

Endometriosis occurs commonly in pelvic genital organs, especially in the ovary. Endometriosis that develops outside the genital tract, such as lung, urinary tract, colon, inguinal canal, surgical scar or umbilicus, is termed extragenital or extrapelvic endometriosis.[1]

Umbilical endometriosis is rare. The incidence is as high as 0.5–4% in overall extragenital endometriosis.[2] In order to diagnose this condition, computed tomography, magnetic resonance imaging (MRI), ultrasonography and serum carbohydrate antigen 125 levels are commonly used, but the results of these screening procedures are not conclusive; the definitive diagnosis requires histological examination following biopsy or resection.[3] In order to treat umbilical endometriosis, wide resection is generally recommended[3–5] and few cases are managed conservatively.

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We have tried a variety of diagnostic/therapeutic strategies for umbilical endometriosis in an attempt to provide individualized management according to the severity of the symptoms, the patient's age and desire for current/future pregnancy. In this study, we retrospectively reviewed medical records for patients with umbilical endometriosis in order to evaluate the effectiveness of these strategies.

Methods

Medical records for patients with diagnosis of endometriosis managed from 1999 through 2011 in the University of Tokyo Hospital were retrospectively reviewed. Cases with diagnosis of umbilical endometriosis were identified. Clinical information of age, gravida, parity, managements for the disease prior the first visit, symptoms at the first visit and their changes with menstrual cycles, current patient desire for pregnancy, and methods of diagnosis and management were reviewed and summarized. For case 7, immunohistochemical study was performed for the resected specimen using antibodies for CD10 (catalogue no. 790–4506; Ventana Medical Systems, Tucson, AZ, USA), estrogen receptor (no. 790–4324; Ventana Medical Systems) and progesterone receptor (no. 790–2223; Ventana Medical Systems).

Results

Between 1999 and 2011, a total of 2530 women received management for endometriosis at the University of Tokyo Hospital. Of these women, 124 patients had diagnosis of extragenital endometriosis, including intestine, urinary tracts, respiratory tracts, groin, sciatic nerve and umbilicus. Seven patients had diagnosis of umbilical endometriosis, giving an incidence of 0.29% of all endometriosis cases and 5.6% of extragenital endometriosis cases. The mean age of patients at the first visit was 35.7 years (range, 26–45). No case had a history of surgery at umbilicus, indicating that endometriosis for all cases occurred spontaneously. Here, we demonstrate our experience of seven cases (Table 1).

Case 1

A 44-year-old woman (para 3) presented with a 2-month history of umbilical palpable nodule. On examination, a 0.5-cm nodule was observed at the umbilicus. A biopsy indicated endometriosis. Pelvic ultrasound showed no evidence of endometriosis in

Table 1 Clinical features of seven patients with umbilical endometriosis

Patient	Age at the first visit (years)	G/P	History of surgery	History of OC	Management prior to the first visit	Symptoms		Pelvic findings	Desire for pregnancy at the time	Diagnosis (methods)	Managements	Follow-up period (years)
1	44	G3P3	No	No	None	P, M	Cy	Normal	No	D (histology)	E	7
2	33	G0P0	No	No	None	P, M	Cy	Bil EMoma	No	D (histology)	E	6
3	37	G0P0	No	No	None	P, B	Cy	Bil EMoma	No	C (empirical treatment)	D → E	7
4	34	G0P0	No	No	LR	P, M, B	Cy	Normal	No	D (histology)	OC	4
5	26	G0P0	No	No	LR	P, M	NCy	Normal	No	D (histology)	OC	3
6	45	G1P1	Ov cystectomy	Yes	None	P, M, B	Cy	Left EMoma	No	C (MRI, empirical treatment)	OC → MP	3
7	31	G0P0	Appendectomy	Yes	None	P, M, B	Cy	Bil EMoma	Yes	C (MRI) → D (histology)	RR w/UR	4

B, bleeding; Bil, bilateral; C, clinical; Cy, Cyclical; D, definitive; D, dienogest; E, expectant management; EMoma, ovarian endometriomas; G/P, gravida/parity; LR, local resection; M, mass; MP, menopause; MRI, multiple resonance imaging; NCy, non-cyclical; OC, oral contraceptive; Ov, ovarian P, pain; RR w/UR, radical resection with umbilical reconstruction.

the pelvis. Given the diagnosis, the patient did not wish to undergo therapy because she was not bothered by the nodule. No therapeutic intervention has been required up to 7 years thereafter.

Case 2

A 33-year-old woman (para 0) presented with an 8-month history of umbilical hard nodule with cyclical pain. On examination, a 1-cm nodule was noted at the umbilicus. A biopsy indicated endometriosis. Pelvic ultrasound showed small bilateral ovarian endometriomas and adenomyosis. Given the diagnosis, the patient chose expectant management because her symptoms were not serious; therapy was not requested and no recurrence has been reported up to 6 years thereafter.

Case 3

A 37-year-old woman (para 0) presented with a several-month history of cyclical umbilical pain and bleeding. On examination, the lesion was not grossly evident. Pelvic ultrasound revealed small bilateral ovarian endometriomas and adenomyosis. 'Empirical treatment' using dienogest (Dinagest; Mochida, Tokyo, Japan) was initiated; her symptoms gradually subsided over a 2-month period of treatment. Given the clinical diagnosis of endometriosis, the patient discontinued the medication because her symptoms were slight. The patient has continued to be managed expectantly up to 7 years since then.

Case 4

A 34-year-old woman (para 0) was referred to us for management of umbilical endometriosis. Two months earlier, the patient had undergone local resection of an umbilical nodule at a dermatology clinic; further histological examinations revealed endometriosis. On presentation, a 0.5-cm hard nodule was palpable at the umbilicus. The patient reported that her umbilical pain continued following the local resection. Pelvic ultrasound showed no evidence of endometriosis in the pelvis. We proposed two options, a radical excision of the tumor or oral contraceptive (OC). The patient chose OC and a 21/7-day cyclic OC containing ethinylestradiol (0.035 mg) and norethisterone (1.0 mg) (Lunabell; Fuji Pharma, Tokyo Japan/Nippon Shinyaku, Kyoto Japan) was initiated. The patient's symptoms were relieved by this therapy and the patient has continued to take OC for 4 years up until now.

Case 5

A 26-year-old woman (para 0) presented to our hospital seeking further opinion for her residual umbilical endometriosis. Six months earlier, the patient underwent a local resection of the umbilical nodule at a cosmetic clinic; histology revealed endometriosis. Despite the resection, the patient continued to experience umbilical pain and bleeding. On examination, a 1-cm hard nodule was palpable at the umbilicus. Pelvic ultrasound showed no evidence of endometriosis in the pelvis. As the patient wished conservative management rather than undergoing another surgical intervention, we recommended OC. One month after commencing OC (Lunabell), her pain and bleeding disappeared. Management using a 21/7-day cyclic OC has continued for this patient for 3 years until now.

Case 6

A 45-year-old woman (para 1) presented with a 5-year history of umbilicus nodule with cyclical bleeding. At the age of 21 years, the patient underwent laparotomy for a removal of the left ovarian endometrioma, although the abdominal incision did not reach to the umbilicus. The patient had been taking OC until the age of 42 years. The patient reported that the nodule had begun to grow following discontinuation of OC. On examination, a 1.5-cm, hard, tender mass was observed. MRI revealed a mass of 1.5 cm, with low signal on T_2-weighted images, resembled a hemorrhagic nodule (Fig. 1) and small right ovarian endometrioma. With a presumptive diagnosis of endometriosis, we recommended OC (Lunabell) as an 'empirical treatment'. One month after, the patient's symptoms improved. Management with cyclic OC continued until the age of 48 years, when menopause occurred.

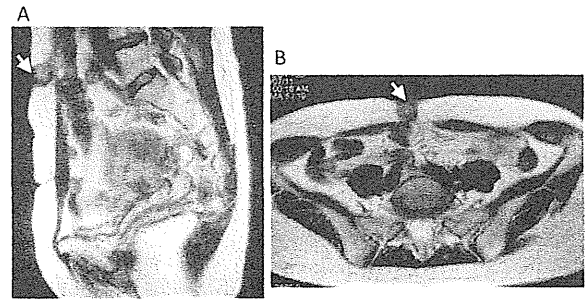

Figure 1 Multiple resonance imaging findings of umbilical endometriosis in case 6. (a) Sagittal and (b) transverse T_2-weighted images. Note: 1.5 cm mass with low signal on T_2-weighted images, resembling a hemorrhagic mass, was evident on the umbilicus (arrow).

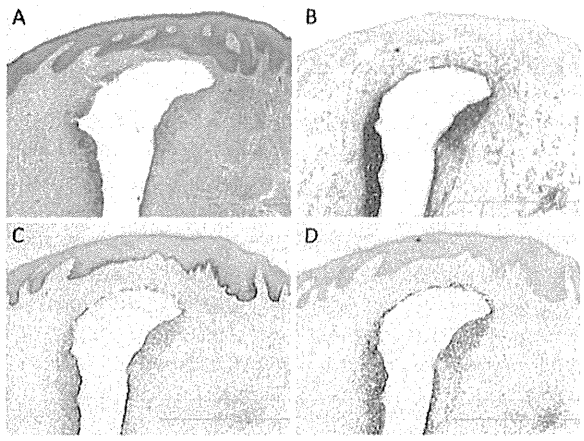

Figure 2 Histological findings of umbilical endometriosis in case 7. (a) Hematoxylin–eosin staining, (b) CD10, (c) estrogen receptor (ER), (d) progesterone receptor (PR) (original magnification ×40). Note: endometrial glands are lined with CD10-positive stroma in the dermis. The lesion is both ER and PR positive. Cells in the stratum basale of epidermis are also ER positive.

Case 7

A 31-year-old woman (para 0) presented with a 2-month history of cyclical umbilical bleeding. The patient had been using OC since the age of 26 years, and until 1 year before the consultation. On examination, a bluish 1-cm nodule at the umbilicus was noted and bloody discharge spilled from a small opening at the surface. MRI indicated a hemorrhagic mass and bilateral ovarian endometriomas. Because the patient wished to conceive at the time, a decision was made to surgically remove the mass rather than undergo hormonal treatment. A total excision of the umbilicus, followed by an umbilical reconstruction, was performed. Ovarian endometriomas were also removed laparoscopically. Histological results indicated endometriosis with positive staining of CD10, estrogen receptor and progesterone receptor (Fig. 2). Afterwards, the patient became pregnant by *in vitro* fertilization and gave birth, and no recurrence has been reported 4 years post-surgery.

Discussion

When managing endometriosis, regardless of its site, we must keep in mind that this disease has a wide spectrum of severity and clinical consequences. Given this principal, we have provided individualized management for umbilical endometriosis with a variety of diagnostic/therapeutic strategies primarily decided by the informed wishes and needs of the individual patients. Biopsy for diagnosis,[3] and wide resection for treatment, are generally[3–5] recommended for management of umbilical endometriosis and few cases are managed conservatively. In this study, however, we found that two out of seven cases were diagnosed without biopsy, and six out of seven cases were treated without surgical interventions, and thus avoided invasive interventions.

With regard to diagnostic strategies, it is crucial to perform a histological examination to reach a definitive diagnosis.[3,6] However, histological diagnosis is sometimes challenging, due to the lack of glandular epithelial structures or stromal cells,[6] especially when attempting to minimize the invasiveness of the biopsy, for instance, using fine-needle aspiration.[7] Consequently, some clinicians skip the biopsy and conduct a therapeutic excision when they suspect umbilical endometriosis and later confirm the histology with a resected specimen, the way we also applied for case 7. Alternatively, for patients having only mild symptoms, we trialed 'empirical treatment' to make the clinical diagnosis (cases 3 and 6). Both the European Society of Human Reproduction and Embryology and the American College of Obstetricians and Gynecologists recommend the empirical use of medical therapy before confirming a definitive diagnosis of pelvic endometriosis, to minimize the use of invasive procedure, in this case, laparoscopy.[8,9] We have applied this strategy to diagnose umbilical endometriosis. Indeed, 'empirical treatment' with OC or progestin not only relieved the patient's symptoms, but also resulted in a clinical diagnosis and successfully avoided invasive procedures to obtain specimens for histological diagnosis.

It was surprising that three out of seven women with umbilical endometriosis declined any therapeutic procedure and preferred expectant management once the diagnosis was established (cases 1, 2 and 3). We have learned that a tumor at the umbilicus with an unknown diagnosis causes patients to experience anxiety and fear, even though the mass does not cause physical discomfort. For these patients, an establishment of diagnosis that rules out malignancy meets their needs.

It was also surprising that OC was effective in controlling the symptoms associated with umbilical endometriosis. The efficacy of medical therapy (OC, progestin, gonadotropin-releasing hormone analogs,

danazol) has been reported in pelvic endometriosis,[8–11] and in extragenital endometriosis such as rectovaginal,[12] thoracic[13] and bladder endometriosis,[14] whereas medical treatment is reported to be insufficient for umbilical endometriosis.[4,6,7] However, we found that symptoms were well controlled in all three patients who took OC (cases 4, 5 and 6). In addition, two cases of umbilical endometriosis in our series (cases 6 and 7) progressed or developed shortly after quitting OC, as reported previously,[4,15] demonstrating that OC can suppress umbilical endometriosis. Therefore, we suggest that OC should be considered as a therapeutic option for umbilical endometriosis for patients who do not wish to become pregnant at that time.

Two patients who were referred to us after having undergone a local resection at other clinics both developed recurrent or residual tumors (cases 4 and 5). These observations strongly supported the need for wide and radical resections to prevent the recurrence of umbilical endometriosis,[4,5] although a very recent article reports that an excision biopsy with 2-mm margin avoids recurrence up to 6 months.[16] Therefore, we performed a wide resection; a total excision of the umbilicus followed by umbilical reconstruction (case 7) and obtained a preferable outcome. Patients who have experienced local resections previously, however, are reluctant to undergo reoperation. We recommended OC for these patients; fortunately, their symptoms were relieved, suggesting once again that OC is a satisfactory alternative treatment, especially for those who do not wish to undergo invasive procedures.

It is still unknown how long these patients need hormonal therapies. Given that two cases of umbilical endometriosis in our series (cases 6 and 7) progressed or developed shortly after quitting OC, as reported previously,[4,15] it is possible that the umbilical endometriosis may recur once the hormonal therapy is discontinued. Therefore, for those who do not wish to undergo invasive procedures, we plan to continue the therapy until the patient wishes to become pregnant or reaches menopausal status.

In summary, we have shown that umbilical endometriosis can be managed with a variety of diagnostic/therapeutic strategies. Although we still support wide resection as the ultimate radical cure, there are also alternative and less invasive strategies that can successfully manage umbilical endometriosis. These various strategies help us provide individualized management of umbilical endometriosis, congruent with the severity of patient symptoms, age and desire for pregnancy.

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Disclosure

None declared.

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Original Articles

The lung to thorax transverse area ratio has a linear correlation with the observed to expected lung area to head circumference ratio in fetuses with congenital diaphragmatic hernias

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ABSTRACT

Background/Purpose: The purpose of this study was to clarify the relationship between the lung to thorax transverse area ratio (L/T ratio) and the observed to expected lung area to head circumference ratio (O/E LHR), based on the results of a nationwide Japanese survey conducted in 2011, and to evaluate the compatibility of these prognostic predictors of fetal CDH.

Methods: Two hundred and forty-two prenatally diagnosed isolated CDH patients born between 2006 and 2010 were included in the present analysis. A regression analysis was conducted to investigate the relationship between the L/T ratio and the O/E LHR based on 191 simultaneous measurements of these parameters in 120 patients.

Results: The linear regression equation between the L/T ratio and the O/E LHR was: L/T ratio = 0.0233 + (0.00222 × O/E LHR), ($R = 0.847$, $p < 0.0001$). According to this equation, 25% of the O/E LHR, the cut-off value used in the fetal intervention for CDH, was equivalent to an L/T ratio of 0.08, a commonly accepted cut-off value for identifying the most severe cases of fetal CDH.

Conclusions: As there is a positive correlation between the L/T ratio and the O/E LHR, these two parameters proved to be used interchangeably according to the linear regression equation.

The mortality and morbidity of infants with congenital diaphragmatic hernia (CDH) mainly depend on the severity of pulmonary hypoplasia. Therefore, an accurate prenatal assessment of pulmonary hypoplasia is necessary to establish an optimal treatment strategy for individuals before birth. Although many prenatal prognostic parameters have previously been proposed by various investigators [1–4], measurement of the residual lung size seems to be one of the most reasonable and realistic methods [5–8].

The lung area to head circumference ratio (LHR) was the most commonly used predictor for CDH in the past [5,9,10]. The observed to expected (O/E) LHR has become a standard parameter used for determining the indications for fetal intervention to treat severe cases of CDH [11]. Of note, the O/E LHR was used in the Tracheal Occlusion To Accelerate Lung growth (TOTAL) trial of left CDH patients with severe pulmonary hypoplasia [12,13]. On the other hand, the lung to thorax transverse area ratio (L/T ratio), which was proposed before the publication of the LHR [5,6,9], has been widely used in Japan for the assessment of pulmonary hypoplasia in fetal CDH patients [6,14–16]. The LHR is no longer considered to be independently predictive of survival [17,18], as it was shown to increase according to the gestational age [11,19–21]. In contrast, the O/E LHR is not influenced by gestational age [22] as is the case with the L/T ratio [6,14,19], because it is standardized by the normal mean value of the LHR corresponding to the specific gestational age [11]. Both of the indicators are similarly based on the measurement of the contralateral lung area by using tracing methods [6,21,23] at the transverse section containing the four-chamber view of the heart.

The relationship between the L/T ratio and the O/E LHR has not been studied, despite their similarities. The purpose of this study was to clarify the relationship between the L/T ratio and the O/E LHR and to evaluate the compatibility of these parameters as prognostic predictors of fetal CDH based on the results of a nationwide Japanese survey.

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1. Materials and methods

1.1. Study population

This retrospective cohort study was performed as part of a nationwide Japanese survey of neonatal CDH conducted in 2011. This study was conducted after being approved by the ethics committee of Osaka University Hospital (approval number 11017) and the independent ethics committees of five other participating institutions: Hyogo College of Medicine, National Center for Child Health and Development, Kyushu University, Nagoya University Hospital and Osaka Medical Center and Research Institute for Maternal and Child Health. The data obtained from 72 institutions that consented to participate in a questionnaire survey targeted to the departments of pediatric surgery and/or tertiary perinatal care centers of 159 educational hospitals were retrospectively evaluated. Data were collected as case report forms requesting further details about the patients by the data center located in Osaka University Graduate School of Medicine. The entered data were crosschecked twice by the data center and then were fixed after data cleansing. A total of 614 neonates with CDH were born between 2006 and 2010; the overall profiles of the patients are described elsewhere [24]. Among those subjects, the present study was conducted using the data of the 364 isolated CDH cases that were prenatally diagnosed.

Isolated CDH was defined as being present in CDH infants who did not have other serious congenital anomalies, such as major cardiac anomalies or unfavorable chromosomal abnormalities. Three cases of bilateral diaphragmatic hernia were excluded from the study. The contralateral lung area accompanied by the thorax area and/or the head circumference was measured at least one time in 242 out of the 364 cases. The initial and final measurements were reported in the case report form if those parameters were measured more than two times. A total of 242 study subjects (400 measurements), which accounted for 39.4% of all 614 CDH patients treated at 45 institutes, were ultimately included in the present analysis. Among those subjects, the thorax area measurement was reported 339 times for 210 patients and the head circumference measurement was reported 251 times for 154 patients. The contralateral lung area, the thorax area and the head circumference were simultaneously measured 191 times in 120 patients.

1.2. Collected data

The primary outcome measure was the survival to discharge, which was defined as surviving at the time of discharge from the hospital. The secondary outcome measure was the "intact discharge", which is a new concept for prognostic evaluation, defined as being discharged from the hospital without any major morbidity that requires home treatment, including ventilatory support, oxygen administration, tracheostomy, tube feeding, parenteral nutrition or vasodilator administration [4]. The patient demographics, including the gestational age, birth weight, Apgar score at 1 minute, presence of liver and stomach herniation, mode of delivery, gender and side of hernia, were reviewed. Whether a surgery could be performed, the size of the diaphragmatic defect, the surgical procedure performed, the use of high-frequency oscillatory ventilation (HFOV), nitric oxide inhalation (iNO), prostaglandin E_1 or extracorporeal membrane oxygenation (ECMO) were also reviewed. As the indication criteria for surgery were not defined prospectively, the operability of each case was determined according to the clinical decisions of each institution. The highest preductal PaO_2, best oxygenation index and the right to left shunting at the ductus which were determined within 24 h after birth, were reviewed. The contralateral lung area (in square millimeters) and the thorax area (in square millimeters) were measured by manual tracing of the limit of the lung and thorax at the transverse section containing the four-chamber view of the heart in ultrasonography. The head circumference (in millimeters) was measured in the standard biparietal view of ultrasonography. The L/T ratio was defined as the area of the contralateral lung divided by the area of the thorax [19]. The observed LHR, which was the ratio of the contralateral lung to the head circumference, was divided by the appropriate normal mean for gestational age and multiplied by 100 to derive the O/E LHR and expressed as a percentage [21]. The expected LHRs were determined by the published formulas, which are freely available to all by the official calculator in the Tracheal Occlusion To Accelerate Lung Growth (TOTAL) trial website (access http://www.totaltrial.eu/) [12].

1.3. Analysis of the relationship between the L/T ratio and the O/E LHR

A simple regression analysis was conducted to investigate the relationship between the L/T ratio and the O/E LHR based on the simultaneous measurements in 120 cases. Although the initial and final simultaneous measurements were available in 71 cases, only a single simultaneous measurement was available in 49 cases. We decided to use all simultaneous measurements in order to obtain more accurate relationships between the two parameters. The linear regression equation between the L/T ratio and the O/E LHR was derived from the regression analysis. The L/T ratio values which corresponded to the cut-off values of the O/E LHR used in the TOTAL trial entry criteria were calculated according to the linear regression equation.

1.4. Patient outcome according to the prenatal prediction of the disease severity

In the 226 cases of left isolated CDH whose liver herniation was evaluated, the survival to discharge rate was reviewed according to the classification of the disease severity used in the TOTAL trial, which was defined by the combination of the O/E LHR and the presence of liver herniation, as proposed by Deprest et al. [25]. In the cases whose O/E LHR was not measured, the O/E LHR was estimated from the L/T ratio using the linear regression equation. The patient demographics, prenatal and postnatal profiles, including parameters indicating the respiratory status, circulatory status, surgical findings and outcome, were compared among the prenatal risk-stratified classifications defined by the combination of the L/T ratio and the presence of liver herniation, as proposed by Usui et al. [16]. In the cases whose L/T ratio was not measured, the L/T ratio was estimated from the O/E LHR using the linear regression equation. The values of the O/E LHR and L/T ratio were represented by the initial values of two measurements in principle, and the final values were substituted for the patients whose initial value was not available in the case report form.

1.5. Statistical analysis

The statistical analyses were performed using the JMP software program (version 9.02; SAS Institute, Inc, Cary, NC, USA). The frequencies and percentages were used to describe categorical data. The means and standard deviation were used to describe continuous variables. The median and interquartile ranges were used to describe Apgar scores. The chi-square test and Fisher's exact test were used to analyze categorical data. The one-way analysis of variance with Tukey's post-hoc honestly significant difference test was used to compare continuous variables. The Kruskal–Wallis test was used for the comparison of the Apgar scores. The log-rank test and Kaplan–Meier method were used to compare the survival times. Values of $P < 0.05$ were considered to indicate statistical significance.

2. Results

An outline of the patient demographics is shown in Table 1. Of the 242 neonates with prenatally diagnosed isolated CDH, 177 (73.1%)

Table 1
The patient demographics.

Number of patients	242
Gestational age (days)[a]	264.3 ± 8.6
Birth weight (g)[a]	2746 ± 386
Apgar score at 1 min[b]	4 (2–6)
Liver-up[c]	68/239 (28.5%)
Contralateral stomach herniation[d]	35/236 (14.8%)
Caesarean section delivery	177 (73.1%)
Gender (male)	138 (57.0%)
Side of hernia (left)	229 (94.6%)
Surgery performed for diaphragmatic hernia	224 (92.6%)
Time of surgery after birth (h)[b]	56, (30–95)
Patch closure	81/224 (36.2%)
Use of HFOV	212/233 (91.0%)
Use of iNO	166/241 (68.9%)
Use of ECMO	19 (7.9%)
Survival to discharge	200 (82.6%)
Intact discharge	177 (73.1%)

HFOV: high-frequency oscillatory ventilation, iNO: inhaled nitric oxide, ECMO: extracorporeal membrane oxygenation.
[a] Mean ± standard deviation.
[b] Median (interquartile range).
[c] Liver-up, liver occupying more than one-third of the thoracic space.
[d] Contralateral stomach herniation, more than half of the stomach was herniating into the contralateral thoracic cavity.

were delivered by Caesarean section and 224 (92.6%) underwent surgical repair for diaphragmatic hernia at a median age of 56 h after birth. Surgery could not be performed in 18 cases (7.4%) based on the clinical decisions of each institution. It was therefore assumed that these cases were extremely unstable and were considered to be in too serious of a condition to undergo a surgical repair. Two hundred patients (82.6%) survived until discharge, 177 (73.1%) of whom were discharged from the hospital without any major morbidity that required home treatment (Table 1).

2.1. Relationship between the L/T ratio and the O/E LHR

Eighteen of the 120 infants whose L/T ratio and O/E LHR were simultaneously determined died, resulting in an 85.0% survival rate. We found a strong positive correlation between the L/T ratio and the O/E LHR. The linear regression equation between the L/T ratio and the O/E LHR was: L/T ratio = 0.0233 + (0.00222 × O/E LHR), where the regression coefficient was 0.00222, correlation coefficient was 0.847 and coefficient of determination was 0.717 ($p < 0.0001$) (Fig. 1). According to this equation, 15%, 25%, 35% and 45% of the O/E LHRs, the cut-off values used in the TOTAL trial of left CDH patients, were found to be equivalent to 0.06, 0.08, 0.10 and 0.12 L/T ratios, respectively.

2.2. Patient outcome according to the prenatal prediction of the disease severity

In the 226 cases of left isolated CDH, the survival to discharge rate was reviewed according to the four-step stratification proposed by Deprest et al. [25]. The survival rate exhibited a trend toward a decrease as the severity of the disease increased. However, the effect of the liver herniation seemed to be stronger in our series compared to those in the series described by Deprest et al. (Fig. 2). In the prenatal risk-stratified classification [16], there were no significant differences in the patient demographics except for the side of hernia. There were unsurprisingly significant differences in the rate of liver-up and the L/T ratio based on how the each group was defined (Table 2). The highest preductal PaO_2 decreased, and the best oxygenation index increased, as the severity of the disease increased. The right to left shunting at ductus evaluated within 24 h after birth, which suggests the severity of pulmonary hypertension, differed significantly among the three groups, which resulted in the differences in the numbers of patients who used iNO, prostaglandin E_1 and ECMO. Although surgical repair

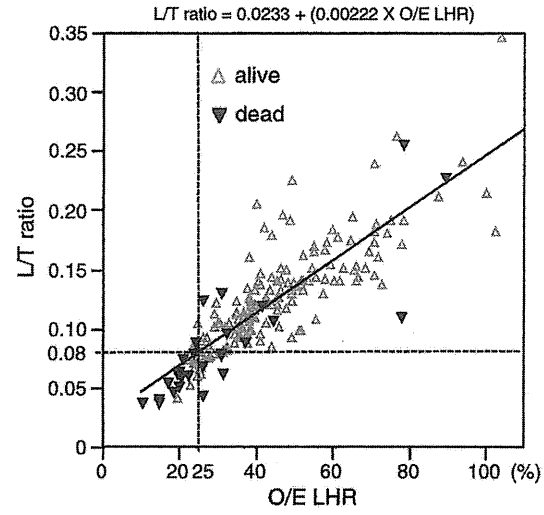

Fig. 1. The relationship between the O/E LHR and the L/T ratio. There was a linear positive correlation between the L/T ratio and the O/E LHR. The linear regression line was: L/T ratio = 0.0223 + (0.00222 × O/E LHR), where the regression coefficient was 0.00222, the correlation coefficient was 0.847 and the coefficient of determination was 0.717 ($p < 0.0001$). The open triangles represent the survivors and the closed triangles represent the non-survivors. The 25% O/E LHR was equivalent to an L/T ratio of 0.08 according to this equation, as indicated by broken lines.

could not be performed in only two (1.3%) cases in group A, surgery was not possible in six out of 16 (35.3%) cases in group C due to their unstable conditions. There were also significant differences in the proportions of patients with diaphragmatic defects exceeding 75%, as rated by the surgical record, as well as the need for patch repair. There were significant differences in the morbidity and mortality among the three groups. The rate of survival to discharge was 93% and the intact discharge rate was 87% in group A, whereas the corresponding rates were 72% and 58% in group B and 35% and 18% in group C, respectively (Table 3). There were also statistically significant differences in the survival curves among the three groups (Fig. 3).

3. Discussion

Since the mortality and morbidity of neonates with CDH primarily depend on the severity of pulmonary hypoplasia, an accurate prenatal assessment of pulmonary hypoplasia is necessary for making a decision about the optimal treatment. Although many prenatal prognostic parameters have been reported previously [1–4], the assessment of the residual lung size seems to be one of the most reasonable and

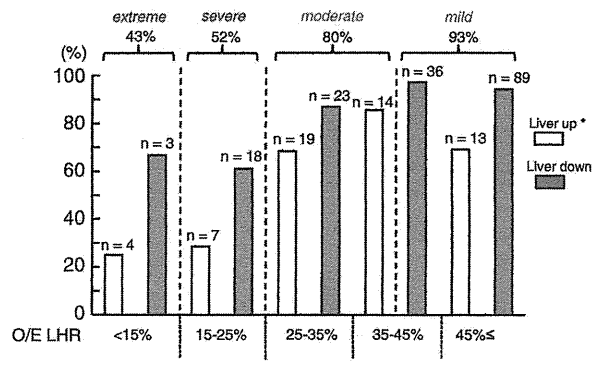

Fig. 2. The survival rates depending on the O/E LHR measurements and presence of liver herniation. *Liver-up, liver occupying more than one-third of the thoracic space.

Table 2
The patient demographics and prenatal findings according to the prenatal risk-stratified classification [16].

Definition of the group [16]	Group A	Group B	Group C	P
	L/T ratio ≥ 0.08 with liver-down	L/T ratio ≥ 0.08 with liver-up[a] or L/T ratio < 0.08 with liver-down	L/T ratio < 0.08 with liver-up[a]	
Number of patients	151	71	17	
Gender (male)	89 (58.9%)	36 (50.7%)	12 (70.6%)	0.265
Side of hernia (left)	149 (98.7%)	64 (90.1%)	13 (76.5%)	< 0.001
Gestational age at birth (days)	265 ± 7.7	263 ± 10.6	264 ± 6.9	0.313
Birth weight (kg)	2.76 ± 0.37	2.68 ± 0.45	2.87 ± 0.26	0.141
Caesarian section delivery	109 (72.2%)	53 (74.7%)	12 (70.6%)	0.908
Liver-up[a]	0 (0.0%)	51 (71.8%)	17 (100%)	< 0.001
Contralateral stomach herniation	5/148 (3.4%)	20/71 (28.2%)	10/17 (58.8%)	< 0.001
L/T ratio	0.148 ± 0.053*	0.106 ± 0.039**	0. 059 ± 0.020***	< 0.001

[a] Liver-up, liver occupying more than one-third of the thoracic space; Contralateral stomach herniation, more than half of the stomach was herniating into the contralateral thoracic cavity; L/T ratio, contralateral lung to thorax transverse area ratio.
* $P < .05$ A vs B.
** $P < .05$ B vs C.
*** $P < .05$ C vs A.

realistic methods. It has previously been reported that the LHR, which was first described in 1996 [5], was increased according to the gestational age in normal fetuses [21] and also in the fetuses with CDH [11,19]. The reason for this increase in the LHR with the gestational age is due to the difference in the rate of the increase of the lung area and head circumference. Peralta et al. reported that there was a four-fold increase in the LHR between 12 and 32 weeks of gestation in normal fetuses because of these differences [21]. Approaches to standardize the LHR by using the normal mean value of the LHR have been proposed to provide a constant value throughout the gestational period [11]. The LHR was originally defined as the contralateral lung area determined using a two-dimensional perpendicular linear measurement, divided by the head circumference [5]. However, two other methods to determine the lung area were subsequently proposed [9,21], and the tracing method was finally found to be the most reproducible method to measure the lung area [21,23].

The L/T ratio has been widely used in Japan, because it was first described in 1990 for the assessment of pulmonary hypoplasia in CDH [6], and has been applied for the assessment of pulmonary hypoplasia in CDH neonates since then [15,16,26]. The L/T ratio was originally reported to be constant throughout the gestational period in normal fetuses [6]. This parameter was redefined as the contralateral lung area, to make it more consistent with the LHR, divided by the area of the thorax as measured by the tracing method [19], although the original definition was determined by using the area of both lungs. Thus, there are several similarities between these two parameters. First, both parameters exhibit constant values throughout the gestational period, and the other is that only the contralateral lung area is measured by using the tracing method. However, the relationship between these two parameters has not been studied, despite their similarities.

A strong positive correlation between the L/T ratio and the O/E LHR was found, and a linear regression equation between the L/T ratio and the O/E LHR was obtained. According to this linear regression equation, several important cut-off values of both parameters can be interchanged. Interestingly, a 25% O/E LHR, the cut-off value for the most severe cases as used in the TOAL trial for fetal CDH, was found to be equivalent to an L/T ratio of 0.08, a commonly accepted cut-off

Table 3
The respiratory status, circulatory status, intraoperative findings and outcomes according to the prenatal risk-stratified classification [16].

Definition of the group [16]	Group A	Group B	Group C	P
	L/T ratio ≥ 0.08 with liver-down	L/T ratio ≥ 0.08 with liver-up[a] or L/T ratio < 0.08 with liver-down	L/T ratio < 0.08 with liver-up[a]	
Number of patients	151	71	17	
Apgar score at 1 min	5 (3–7) (n = 143)	4 (2–5) (n = 66)	2.5 (1.25–4) (n = 16)	<0.001
Highest preductal PaO_2 (Torr)[b]	257 ± 134* (n = 145)	199 ± 135** (n = 69)	75 ± 70*** (n = 17)	<0.001
Best oxygenation index[b]	5.7 ± 5.9* (n = 143)	14.3 ± 17.5** (n = 68)	32.0 ± 24.5*** (n = 17)	<0.001
Right to left shunting at ductus[b]	55/143 (38.5%)	40/68 (58.8%)	13/17 (76.5%)	0.001
Use of HFOV	130/145 (89.7%)	64/69 (92.8%)	16/17 (94.1%)	0.680
Use of iNO	85/151 (56.3%)	63/71 (88.7%)	15/16 (93.8%)	<0.001
Use of prostaglandin E_1	45/149 (30.2%)	35/71 (49.3%)	14/17 (82.4%)	<0.001
Use of ECMO	4 (2.7%)	9 (12.7)	5 (29.4%)	<0.001
Inoperable cases	2 (1.3%)	10 (14.1%)	6 (35.3%)	<0.001
Diaphragmatic defects ≥ 75%[c]	27/149 (18.1%)	38/61 (62.3%)	8/11(72.7%)	<0.001
Patch closure	31/149 (20.8%)	40/61 (65.6%)	8/11 (72.7%)	<0.001
Survival to discharge	141 (93.4%)	51 (71.8%)	6 (35.3%)	<0.001
Intact discharge	131 (86.8%)	41 (57.8%)	3 (17.7%)	<0.001

HFOV, high-frequency oscillatory ventilation, iNO, nitric oxide inhalation; ECMO, extracorporeal membrane oxygenation.
[a] Liver-up, liver occupying more than one-third of the thoracic space.
[b] The highest pre PaO_2, best oxygenation index and the right to left shunting at ductus were determined within 24 h after birth.
[c] The size of the diaphragmatic defect was rated by a surgeon according to the surgical record.
* $P < .05$ A vs B.
** $P < .05$ B vs C.
*** $P < .05$ C vs A.

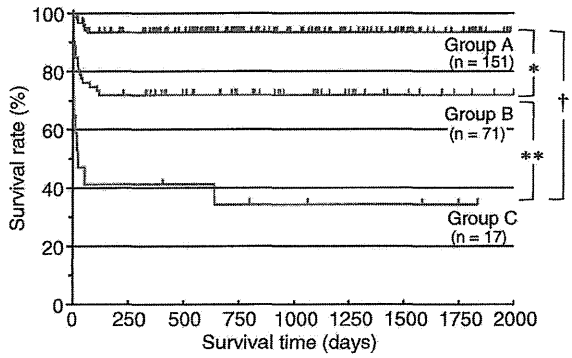

Fig. 3. The survival curves for patients with isolated CDH, compared using the prenatal risk-stratified classification [16]. *$P < .001$; **$P < .001$; †$P < .001$.

value for identifying the most severe cases of fetal CDH in Japan. These results suggested that the patients considered to be the most severe cases in Japan also met the criteria for fetal intervention for left CDH patients with severe pulmonary hypoplasia in the TOTAL trial protocol, which was the first international prospective randomized controlled trial for fetoscopic tracheal occlusion [12,13]. In the nationwide Japanese survey for fetal CDH, 57.7% of the patients were measured for the L/T ratio, and only 42.3% of the patients were measured for the O/E LHR. However, owing to this conversion equation, both of the parameters can be generated for the evaluation of the patient CDH severity if either of the parameters was measured.

To verify the accuracy and the universal applicability of the prenatal risk-stratified classification, which was proposed by Usui et al., and was defined as the combination of the L/T ratio and the presence of liver herniation [16], we applied the classification to this cohort as a different population from the original cohort using the conversion equation. Although the patient demographics except for the side of the hernia, were similar between the three groups classified using this system, the prenatal and postnatal profiles, including the stomach position, parameters indicating the respiratory status, circulatory status, surgical findings and outcome were significantly different between the three groups, suggesting that the prenatal risk-stratified classification is also valid in other cohorts, such as that in the nationwide Japanese questionnaire survey. The indication for a fetal intervention of the patients proposed by Deprest et al. [25] can be estimated by using the conversion eq. in the patients whom the L/T ratio was solely measured without measurement of LHR. The rate of survival to discharge was 93% in the mild group, 80% in the moderate group, 52% in the severe group and 43% in the extreme group (Fig. 2). Compared to this four-step stratification used in the TOTAL trial, our prenatal risk-stratified classification therefore seems to have better discrimination of disease severity. It is possible to describe the prenatal risk-stratified classification as shown in Table 4 using the O/E LHR instead of the L/T ratio according to the linear regression equation (Table 4).

When the characteristics of both parameters were compared, the gestational variation and the procedure of the lung area measurements were similar. However, there were concerns that the individual fetal growth variation is not considered when determining the O/E LHR. There may be a possibility for an overestimation in a small-for-date fetus, as the O/E LHR of these fetuses, which should have a lower LHR compared to an appropriate-for-date fetus, would be evaluated based on the normal mean value. The L/T ratio includes, by nature, individual fetal growth variation, and it can be determined with standard values for gestational age or with for a relevant population. More importantly, calculating the L/T ratio is a simple task to perform.

A major limitation of this study is that it was conducted in a retrospective manner using a questionnaire. Many of the institutions had a small number of cases, and the treatment strategies, including the indication criteria for surgery, were determined by each institution. There may have been inaccurate measurement of both parameters due to the limited experience of the physicians with such infants. More accurate prospective studies and an analysis of the correlation based on the timing of the measurement are therefore needed to confirm the present findings. Despite these limitations, an excellent positive correlation was observed between the L/T ratio and O/E LHR in the present study, and these two parameters proved to be compatible according to a linear regression equation. These results suggested that the linear regression equation may become a useful tool for all populations.

Table 4
The prenatal risk-stratified classification described using the O/E LHR instead of the L/T ratio.

Group A	O/E LHR ≥ 25% with liver-down
Group B	O/E LHR ≥ 25% with liver-up [a], or O/E LHR < 25% with liver-down
Group C	O/E LHR < 25% with liver-up [a]

[a] Liver-up, liver occupying more than one-third of the thoracic space.

Acknowledgments

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■ 特集　直腸肛門奇形術後遠隔期の評価と再手術

直腸肛門奇形術後の高度排便機能障害に対して antegrade continence enema 法を導入した3例

西　功太郎* 仁尾正記* 和田　基*
佐々木英之* 風間理郎* 工藤博典*
田中　拡* 中村恵美* 天江新太郎**

はじめに

直腸肛門奇形に対しては，近年は腹腔鏡下手術が導入されるなど，さまざまなアプローチで根治術がなされているが，高位例や脊椎脊髄病変合併例では便秘失禁汚染のコントロールにしばしば難渋する。これは児のQOLを著しく低下させる要因となり，ときに再度の人工肛門造設を余儀なくされることもある。このような高度排便機能障害に対してMaloneら[1]によりMACE(Malone antegrade continence enema) 造設による順行性洗腸法の有用性が報告され，以後広く行われている。今回われわれは，直腸肛門奇形術後の高度排便機能障害患児に対してMACE造設を行い，QOL向上につながったと考えられる3例について，治療の詳細や問題点などについて報告する

Ⅰ．症　例

3例の要点を示す（表）。

1．症例1

13歳男児。二分脊椎，脊髄脂肪腫による係留症候群，左腎無形成，右膀胱尿管逆流症を合併している高位鎖肛(直腸尿道瘻)で6カ月時にposterior sagittal anorectoplasty (PSARP) を施行。1歳1カ月時に脊髄脂肪腫摘出術を施行され，その際に行った注腸造影ではrectal angulation形成不良で

表　症例のまとめ

症例	年齢 性別	鎖肛病型	合併疾患	鎖肛根治術式 年齢	ACE術式 年齢	観察 期間	現在の注入液，量 回数	dry time 所要時間
1	13歳 男児	高位 直腸膀胱瘻	二分脊椎 脊髄脂肪腫 神経因性膀胱 左腎無形成	PSARP 6カ月	虫垂瘻/右下腹部 5歳	7年	ニフレック液50 ml GE 30 ml・ 1回	24時間 60分
2	14歳 女児	高位 無瘻孔	脊髄脂肪腫 左腎低形成 右水尿管症 胆道閉鎖症	PSARP 10カ月	虫垂瘻/臍 7歳，10歳	7年	ニフレック液700〜 1,000 ml 1回	24時間 60分
3	16歳 男児	中間位 無瘻孔	アスペルガー 症候群	PSARP 1日	盲腸ポート 7歳	8年	GE 120 ml 1回	24〜48時間 30分

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に誘導する。

女児の新膀胱では排尿困難を生じることがあり，パウチが後屈することによってパウチ尿道角が急峻となる「パウチ脱」とよばれる形態が原因の一つとされている。これを防止するために膣前壁あるいは子宮・膣の温存が有効と考えられている。子宮合併切除を施行した場合には，pouchcele や膣瘻の予防として，パウチ前壁の恥骨後面への固定，頸部の周囲への大網充塡，膣前壁の恥骨への吊り上げなどの工夫が推奨されている。

3）直腸肛門膀胱造設術

尿管S状結腸吻合術とその改良型であるS状結腸直腸パウチ造設術は手術手技が簡便で，術後に使用する器具が必要ない方法であるが，小児で施行されることは少ない。

IV. 術後管理

留置したカテーテルが多いが術後の離床は積極的に進め，腸管利用尿路変向術の場合は3〜5日で経口摂取を開始する。腹腔内ドレーンは排液量が減少すれば抜去し，尿管カテーテル（シングルJカテーテル）を術後1〜2週で抜去するが，1日間をおいて一側ずつ抜去する。抜去後に尿量の減少・発熱・背部痛の有無を観察する。

自己導尿型パウチの場合には，術後1〜2週で導尿路カテーテルを抜去し自己導尿を開始する。膀胱瘻を留置した場合には，自己導尿が問題なく行われれば術後3週に抜去する。なお，週に2〜3回のパウチ内洗浄を行う必要がある。

自然排尿型新膀胱の場合には，術後2週から尿道カテーテルのクランプ・間欠的開放を開始してパウチ容量を確認後，尿道カテーテルを抜去し自然排尿を開始する。自尿と尿失禁の量を計測し，不慮の事態に備えて自己導尿ができるように指導する。膀胱瘻を留置した場合には，排尿困難がなければ術後3週に抜去する。なお，やはり週に2〜3回の新膀胱内洗浄を行う必要がある。

また，ストーマ狭窄，導尿困難，尿管吻合部狭窄などの合併症のほかに，腸管粘膜からの再吸収により電解質・代謝異常（高Cl性代謝性アシドーシス，骨粗鬆症など），パウチ内結石形成，続発性悪性腫瘍発生が起こりうるので注意深いfollow upを要する。

おわりに

小児の膀胱腫瘍に対して膀胱全摘術および尿路変向術を施行する際には，根治性を目指しつつ患児のQOLを考慮して尿路変向の手術術式を決定することが重要である。術後の放射線治療のために照射野から離れた位置に失禁型尿路変向術を施行することが最良の選択であった場合でも，術後長期生存症例においては成長に伴って尿禁制型尿路変向術への変換を希望することがあり，応用が利く尿路変向術を習得しておくべきである。

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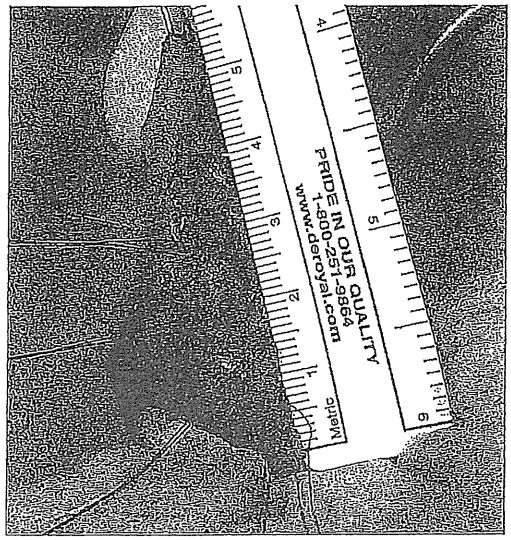

図 1 虫垂根部を盲腸内に埋没し，虫垂内にカテーテルを留置（症例 1）

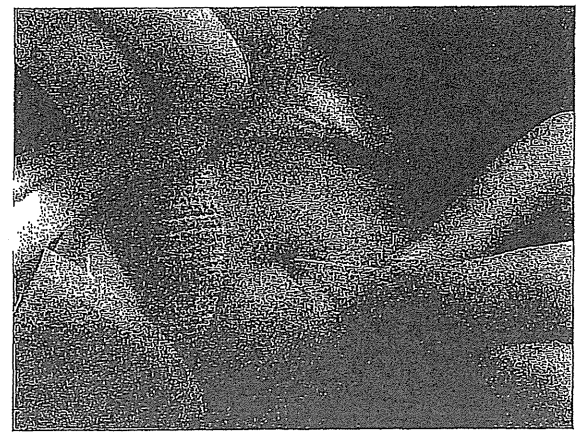

図 2 再形成後の虫垂臍部皮膚瘻にカテーテルを挿入（症例 2）

あったが，1 歳 10 カ月時に人工肛門を閉鎖した。術後自力排便は不能で，当初グリセリン浣腸（GE）で排便していたが徐々に反応不良となったため 3 歳時に中止され，以後失禁と摘便を繰り返す状況となった。4 歳時の直腸肛門奇形研究会排便スコアは失禁，汚染ともに 0 点で，逆行性洗腸では注入液が漏れて無効であったため 5 歳時に MACE を導入することとした。手術は虫垂をそのまま盲腸漿膜下に埋没することで逆流防止とする MACE 造設を行った（図 1）。周術期の合併症なく経過し，注入液は生理食塩水では反応不良，GE では腹痛をきたしたが，経口腸管洗浄剤（ニフレック®）では腹痛なく反応良好であった。ニフレック液 150 m*l*×2 回で開始し，外来で徐々に濃度や注入量を調節し，初期には 2～3%ニフレック液 1,000 m*l*×1 回としていたが，現在は 50 m*l* 程度のニフレック液注入後に GE 30 m*l* を使用している。注入には 6～8 Fr の栄養チューブを使用し，排便は注入後 10～15 分で始まり，1 時間以内には終了していた。現在術後 7 年経過し，注入液や便の逆流や導管皮膚開口部狭窄は認めず，排便機能も失禁 2 点，汚染 1 点と改善している。

2．症例 2

14 歳女児。脊髄脂肪腫，左腎低形成，右水尿管症を合併した高位鎖肛（無瘻孔）で，のちに胆道閉鎖症を発症し，生後 26 日に葛西手術，10 カ月時に PSARP が施行された。当初より排便障害が継続し，逆行性洗腸を要していたがコントロール不良で，失禁汚染スコアは 0 点であった。7 歳時に虫垂を用いた MACE を造設した（開口部は臍部皮膚）。MACE は術後 4 日目から使用し，GE 60 m*l* 1 日 2 回注入で開始したが，退院時には微温湯 500 m*l* で排便および禁制を保つことが可能となった。その後肝機能が悪化し MACE 造設 9 カ月後に生体肝移植術が施行された。移植術後より瘻孔からの便の逆流を頻繁に認めるようになり，使用不可能となった。再び逆行性洗腸による管理を開始したが，MACE 造設前と同様に管理に難渋した。その後虫垂皮膚瘻は外観上閉鎖し，10 歳時に MACE を再開すべく再開腹術を施行した。虫垂のラッピング，固定が外れていたため，これを再度盲腸内に埋没した。導管開口部は閉鎖しておらず，ブジーにより使用可能となった。術後 7 日に 1 日 1 回 500 m*l* の 3%ニフレック液注入で開始し，最終的に 700 m*l* で良好な排便管理が可能となり退院した。現在再手術より 3 年経過しているが，ニフレック液 700～1,000 m*l* で 1 日 1 回の洗腸を継続しており，漏れや再狭窄なく自力で処置可能であり（図 2），まれに汚染を認める程度で失禁は認めていない。

3．症例 3

16 歳男児。中間位鎖肛（無瘻孔）で日齢 1 に PSARP を施行。GE，下剤内服による排便管理を

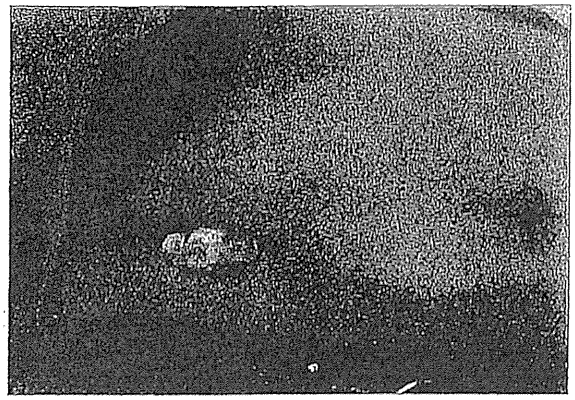

図 3　盲腸ポート　造設後 8 年経過（症例 3）

行っていたが，2 歳以降徐々に便秘が進行した。失禁・汚染に関しても，排便スコアで 4 歳時それぞれ 3 点，1 点だったものが，7 歳時にはともに 0 点と悪化していた。洗腸には 1 日 2 回微温湯 1〜2 *l* に加えてニフレック 500 m*l* を使用したが，S 状結腸がきわめて拡張していたため有効ではなかった。さらに多動傾向（同時期にアスペルガー症候群と診断されている）のため自宅での逆行性洗腸は困難であると考えられ，7 歳時に逆行性洗腸を導入することとした。なるべく処置が簡便になるように，MACE にはポートを用いることとした。ポートはシャフト長 44 mm のボタンタイプで，盲腸部に挿入し右下腹部に造設した。併せて拡張 S 状結腸切除も行った。術後経過は良好で，ニフレック 200 m*l*，GE 80 m*l* 注入（内服は同様に併用）で良好な排便コントロールが得られた。外来経過観察中に GE 120 m*l* のみでの管理とし，30 分ほどで洗腸は完了している。現在術後 8 年経過しているが，ときにポート留置部（図 3）に若干の肉芽形成がある程度で便貯留は認めず（図 4），排便スコアも失禁 3 点，汚染 1 点と改善した。ボタンは 3 カ月ごとに交換しているが，年齢とともに交換を拒否し難渋するようになっている。

II. 考　察

MACE は，1990 年に Malone ら[1] により報告された順行性洗腸法であり，高度排便機能障害に対する治療法として広く世界で施行されている。適応としては，直腸肛門奇形や Hirschsprung 病術後，二分脊椎などの基礎疾患があり，下剤内服，坐薬浣腸，逆行性洗腸では便秘や失禁のコントロールが将来にわたって困難が予想され，1 時間弱の処置時間をトイレ内で我慢できる理解力を有する児と考えている。

当初報告された原法では虫垂を反転させて盲腸に吻合し，盲腸漿膜下に埋没させた逆蠕動性虫垂

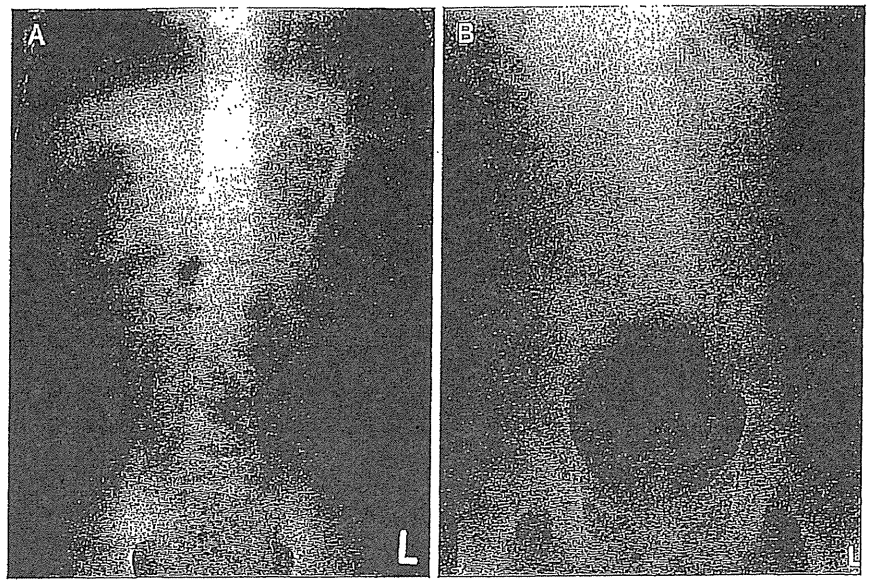

図 4　盲腸ポート留置前（A）と現在（B）の腹部 X 線写真
現在はほとんど宿便を認めない（症例 3）。

皮膚瘻であったが，その後，虫垂を反転させずにそのまま盲腸漿膜下に埋没させる方法[2]，腹腔鏡による造設[3]，結腸導管[4]，胃瘻用ボタンを用いる方法[5]などが報告されている。造設部位に関しても，右結腸や虫垂ではなく左結腸に造設する報告もあり[6,7]，左結腸造設例では1回の洗腸の所要時間は短く，必要注入量も減量でき，再手術にいたることも少ないが，洗浄の頻度は多くなる傾向もある。当科の症例では2例の順蠕動性虫垂皮膚瘻例，1例のボタン型ポートを用いた例の全例で右結腸に造設し，1例で再手術にいたっている。

手術時期は1例が5歳で，2例が7歳時であった。低年齢でのコンプライアンス不良傾向も報告されており[4]，導入時期は重要と考えられる。しかし幼児期後半には，臨床経過などからコントロール不能な重度排便機能障害が今後も持続するであろうことが判定可能であり，QOLの改善を見込むことはできない。児本人の理解や受け入れは個々によって異なっており，児に対するインフォームドコンセントが十分可能な場合には，QOLの改善には同時期からの積極的なACE導入が考慮されるべきである。症例3においては導入時期にアスペルガー症候群と診断されており，なるべく児に負担のかからない方法を選択することも，考慮に入れるべきである。一方，症例1では導入後順調に施行していたが1年後に家庭内の問題から処置に消極的な時期があったが，その後再び処置可能となっており，導入後も外来での十分なフォローが必要と考えられる。

注入液は微温湯，生理食塩水，GEなどの報告があり，症例によって必要量は50～1,000 mlとさまざまであり，それぞれ症例に合わせ試行錯誤していると考えられる。当科でも微温湯，GE，ニフレック液をさまざまに組合せて使用しているが，複数の併用，とくにニフレック液注入が有用な印象である。

造設後の合併症としては，導管皮膚開口部の狭窄，肉芽形成，カテーテルの挿入困難，便の逆流があげられる。もっとも多いのは開口部の狭窄であり，皮膚レベルではあるが再手術を要することも多い[8]。対策として皮膚との吻合の工夫のほか，ストッパーを留置することで便の逆流を増やすことなく狭窄例を減少させている報告もある[9]。

これまでの報告や当科の経験例において，ACE導入により児のQOLは大幅に改善していると考えられるが，当科の例では現在のところ最年長でも16歳であり，保護者の庇護のもとに処置を施行している状態である。症例3では，高校生活が忙しくなるにつれ処置を怠ることがときにみられるようになり，幸い排便停止や失禁汚染は再燃していないが，今後懸念されるところである。また，社会人となり生活環境や食事内容の変化，飲酒機会などにより，便性の変化をきたしたり，通院困難，処置が不十分になるなどして，排便状況が不良になる可能性も考えられ，われわれ医療者を含め周囲のケアは継続的に必要である。こういった症例と電子媒体を使用し連携を行っている報告もみられる[10]。

おわりに

当科で経験したMACE術後長期経過例3例を報告した。いずれにおいても児のQOLは向上し，重度排便機能障害に対してMACEはきわめて有用であると考えられるが，成人期においての有用性の評価や，治療上の問題点など，さらに長期に経過を観察する必要がある。

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