

A Novel Technique for the Reconstructive Formation of an Annular Hymen in Cases of Postpubertal Imperforate Hymen

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تقنية جديدة لترميم غشاء البكارة الحلقي لحالات غشاء البكارة الرتقاء بعد البلوغ

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ABSTRACT: Objectives: Imperforate hymen (IH) is a common genital tract anomaly in women which usually presents after puberty. However, surgical treatment is often considered controversial in religious or conservative communities for sociocultural reasons. This study therefore aimed to assess the efficacy of a novel reconstructive technique involving the preservation of the annular hymen. **Methods:** This prospective interventional study was performed between July 2013 and October 2019 at the minimally invasive surgery unit of a tertiary university hospital in Egypt. A total of 36 women presenting with primary amenorrhoea and haematocolpus were diagnosed with postpubertal IH. A circular hymenotomy was performed on each patient using a 10 mm laparoscopy trocar tip and sleeve to form a new annular hymen under general anaesthesia while preserving the annular hymen. The primary outcome measure was the persistence of hymenal patency and integrity at follow-up. The secondary outcome measure included post-operative patient satisfaction and pain relief. **Results:** The reported technique was feasible in all cases without intraoperative complications. Patency of the reconstructed annular hymen was confirmed at follow-up in all cases; moreover, no intraoperative complications were reported. There was a significant post-operative improvement in pain scores ($P < 0.001$). Both the patients and their parents/guardians reported a high level of satisfaction with the technique. **Conclusion:** This novel technique for the correction of IH involving the reconstruction of an annular hymen was found to be a safe, minimally invasive and effective procedure. This technique should be considered a feasible alternative to a conventional hymenotomy as it allows for the resumption of normal hymenal anatomy without overtreatment.

Keywords: Congenital Abnormalities; Imperforate Hymen; Hematocolpos; Amenorrhea; Colpotomy; Reconstructive Surgical Procedures; Treatment Outcome; Egypt.

المخلص: الهدف: غشاء البكارة الرتقاء (IH) حالة شاذة شائعة في الجهاز التناسلي عند النساء و تظهر عادة بعد سن البلوغ. ومع ذلك، غالبًا ما يُعتبر العلاج الجراحي لها مثيراً للجدل في المجتمعات الدينية أو المحافظة لأسباب اجتماعية وثقافية. لذلك هدفت هذه الدراسة إلى تقييم فاعلية تقنية ترميمية جديدة تتضمن الحفاظ على غشاء البكارة الحلقي. **الطريقة:** تم إجراء هذه الدراسة التداخلية المستقبلية بين يوليو 2013 وأكتوبر 2019 في وحدة الجراحة في مستشفى جامعي متخصص في مصر. تم تشخيص 36 امرأة مصابة بانقطاع الطمث الأولي وتدمي المهبل المرافق لغشاء البكارة الرتقاء بعد البلوغ. تم إجراء شق دائري للبكارة لكل مريضة باستخدام طرف مبزل تنظير كمي بطول 10 مم لتشكيل غشاء بكارة حلقي جديد تحت التخدير العام مع الحفاظ على غشاء البكارة الحلقي. كانت النتيجة الأولية استمرار سالكية غشاء البكارة وسلامتها عند المتابعة الطبية. النتيجة الثانوية تضمنت رضی المريضة بعد الجراحة وزوال الآلام. **النتائج:** إن التقنية المذكورة كانت مجدية في جميع الحالات ولم تسجل أي مضاعفات أثناء الجراحة. تم تأكيد سالكية غشاء البكارة الحلقي المعاد ترميمه عند المتابعة في جميع الحالات؛ علاوة على ذلك، لم يتم الإبلاغ عن أي مضاعفات أثناء العملية. كان هناك تحسن كبير بعد الجراحة في درجات الألم ($P < 0.001$). أعربت كل المريضات وأولياء أمورهن عن مستوى عالٍ من الرضا عن هذه التقنية. **الخلاصة:** أظهرت هذه التقنية الجديدة لتصحيح غشاء البكارة الرتقاء والتي تنطوي على إعادة بناء غشاء البكارة الحلقي على أنها إجراء آمن وفعال بأقل قدر من التدخل الجراحي. لذلك من الممكن اعتبار هذه التقنية بديلاً ممكناً لشق غشاء البكارة التقليدي لأنها تسمح باستئناف تشريح غشاء البكارة الطبيعي دون علاج مفرط.

الكلمات المفتاحية: التشوهات الخلقية: غشاء بكارة رتقاء: تدمي المهبل: انقطاع الطمث: شق المهبل: طرق الجراحة الترميمية: نتائج العلاج : مصر.

ADVANCES IN KNOWLEDGE

- This study confirms the safety and efficacy of a novel, simple and minimally invasive technique for the correction of cases of imperforate hymen (IH) involving reconstructive preservation of the annular hymen.
- The new technique was found to be successful both from a subjective standpoint in terms of patient satisfaction as well as objectively in terms of symptom relief and annular hymenal patency.

APPLICATION TO PATIENT CARE

- Based on these findings, this novel technique is recommended as a safe and effective alternative to a classic hymenotomy for cases of IH in which the preservation and restoration of the normal hymenal anatomy is a priority.

IMPERFORATE HYMEN (IH) IS A COMMON GENITAL tract anomaly reported in approximately one in 2,000 women.¹ Generally, the obstructive condition presents at menarche when retained menstrual blood and mucosal tissue begins to accumulate in the vagina, resulting in haematocolpos and amenorrhoea, often accompanied by symptoms of abdominal, pelvic and lower back pain, urinary retention, constipation/*tenesmus* and uterine distension.^{2,3} A diagnosis of IH is usually confirmed via clinical examination of the distended hymenal membrane and ultrasonography showing the haematocolpos.³ Conventional management of the condition involves the surgical drainage of the retained blood via a hymenotomy in which a vertical, cross or T-shaped incision is made in the hymenal membrane, followed by suturing of the edges to maintain patency and prevent restenosis.^{3,4}

However, this traditional surgical approach is often poorly accepted by individuals from religious and conservative communities, resulting in emotional, psychological and even physical deleterious effects due to social stigma and feelings of shame attached to the loss of the hymen and perceived virginity.⁵⁻⁸ Moreover, in certain Islamic countries, an official medical certificate is routinely given to the patient to certify that the hymenal defloration occurred as a result of a surgical procedure prior to marriage.^{8,9} In Jordan, for instance, a forensic consultant is required to attend and produce official forensic reports for all gynaecological procedures performed on unmarried Muslim women in order to reassure patients and their parents/guardians of continuing hymenal patency and to protect the rights of both the gynaecologist and patient in case of unavoidable rupture.⁹

Anecdotally, many women diagnosed with IH along with their parents/guardians express deep concern for the integrity of the hymen and request that the normal hymenal anatomy be preserved as much as possible. Accordingly, this study aimed to describe and evaluate the safety and efficacy of a novel surgical technique for the correction of postpubertal IH involving the reconstructive formation of a normal annular hymen.

Methods

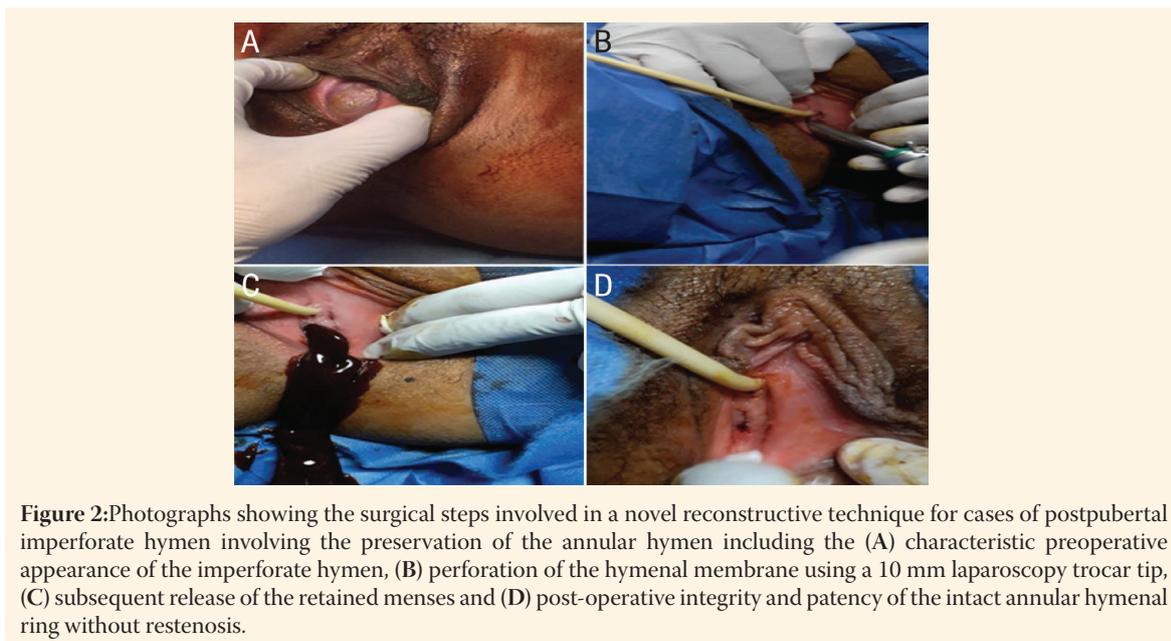
This prospective interventional study was conducted between July 2013 and October 2019 at the minimally invasive surgery unit of the Woman's Health University Hospital, Assiut, Egypt. A total of 43 women with primary amenorrhoea and haematocolpos were evaluated. At presentation, the patients complained of various symptoms including a progressive central abdominal mass, worsening pelvic pain, urinary retention,

dysuria, constipation and dyschezia, either alone or in combination depending on the degree of retained *menses*. Only patients with postpubertal IH without other associated congenital anomalies were included in the study. Women with other forms of menstrual irregularities or types of genital tract anomalies were excluded, as were prepubertal cases of IH due to concerns regarding safety.¹⁰

All patients underwent a clinical examination to confirm the diagnosis of IH. Initially, a downward labial traction technique was used to separate the *labia majora* and *minora* in order to visualise the distal *introitus*. While in a lithotomy position, a graduated uterine sound instrument was inserted into the vaginal dimple. In four patients, the sound was able to move upwards, thereby indicating a diagnosis of low transverse vaginal septum rather than IH, in which the sound would fail to move upwards. Transverse vaginal septum was differentiated from IH as the former first requires an operation to fix the edges of the septum to the *introitus*.^{10,11} In the absence of this prior procedure, a hymenotomy would fail and restenosis would occur due to the thickness of the septum compared to the hymen.¹¹ As such, these four cases were excluded from the study.

Subsequently, the hymen was examined for signs of distension and characteristic bluish discoloration while the patient performed the Valsalva respiratory manoeuvre. Two cases of distal vaginal atresia were excluded at this point due to the absence of these signs, as well as the distance between the haematocolpos and the vulva.¹⁰ In cases where the abdominal mass was deviated to one side, magnetic resonance imaging (MRI) was performed to discount the possibility of type I obstructed hemivagina and ipsilateral renal agenesis (OHVIRA). Only one case of type I OHVIRA (i.e. a blind hemivaginal septum without an opening), presented with primary amenorrhoea due to a rudimentary contralateral horn, was detected and excluded from the study. The diagnosis of IH was confirmed in the remaining 36 patients based on the characteristic appearance of the dark or bluish-coloured protruding hymenal tissue [Figure 1A] and an ultrasound scan confirming haematocolpos. Further MRI scans to assess the vaginal and perineal region were required only in selected cases in which the diagnosis was ambiguous.

All patients underwent a modified hymenotomy technique with preservation of the annular hymen. To begin with, the patient was placed in the lithotomy position on the operating table. Following the induction of general anaesthesia, the perineum was sterilised and towelled dry. An indwelling urethral catheter was inserted and per-rectal examination



was performed to rule out any other anomalies or abnormalities. Subsequently, the sharp triangular tip of a 10 mm laparoscopy trocar (Karl Storz SE & Co. KG, Tuttlingen, Germany) was inserted into the centremost protruding section of the hymenal membrane [Figure 1B]. Once the edge of the sleeve had followed the tip into the hymenal membrane, the tip was not advanced any further to avoid unintentional injury. The trocar was then withdrawn, leaving the sleeve *in situ* to allow drainage of the retained *menses* [Figure 1C]. No suprapubic pressure was applied to avoid ascending infection from the negative pressure. After the flow of retained menstrual blood and tissue had stopped naturally, the sleeve was removed. In most cases, no further intervention was needed; however, gentle bipolar coagulation was applied if there was continuing discharge.

Thereafter, the remaining hymenal ring was evaluated to determine whether it was still intact and circular. After the surgery, the patient remained in the post-operative ward to recover for a few hours before being discharged. Each patient was advised to return to the hospital for follow-up either after their next menstrual cycle or in 40 days if no menstrual bleeding occurred in the interim. At follow-up, a clinical examination was conducted to ensure the patency and integrity of the hymen [Figure 1D]; in addition, ultrasonography was performed to ensure the absence of haematocolpos and to assess the kidneys. Subsequent follow-up visits were optional and recommended to patients only if they noticed any changes in menstrual flow. Telephone consultations were conducted to collect follow-up data including both objective observations of hymenal ring integrity

and subjective reports of patient satisfaction and symptom relief. Self-reported pre- and post-operative pain was assessed using a visual analogue scale (VAS) in which patients drew a mark on a 10 cm line representing a continuum between no pain (scored as zero) and the worst pain imaginable (scored as 10). The primary outcome measure was the persistence of hymenal patency and integrity at follow-up. The secondary outcome measure included post-operative patient satisfaction and pain relief.

Data analysis was conducted using the Statistical Package for the Social Sciences, Version 19 (IBM Corp., Armonk, New York, USA). Results were presented as frequencies and percentages. Either a Chi-squared test or Fisher's exact test was used to compare qualitative variables. A *P* value of ≤ 0.050 was considered statistically significant. Due to the rarity of IH cases, preoperative and post-operative results were compared for the same patient in each case.

This study was approved by the local ethical committee of the Faculty of Medicine at Assiut University (#2156521). Informed consent was received from all patients or their legal guardians following a detailed explanation of the study and surgical procedure.

Results

This study comprised 36 cases with IH. The mean age of the patients was 13.3 ± 1.9 years. Primary amenorrhoea and suprapubic pain were the main presenting complaints in all patients. Loin pain and low grade fever were encountered in 15 (41.6%) and 19 (52.6%) cases, respectively. A total of 25 women (69.4%)

reported being in agonising pain which disturbed their daily activities and was exacerbated on a monthly basis. Haematocolpos was detected in all cases (100%) upon clinical and ultrasound examination. No intra-operative complications were reported during the current reported technique.

Post-operatively, the patency of the reconstructed hymen was confirmed in all cases (100%), with a clinical examination revealing an intact annular hymenal ring without restenosis. Recurrence of the haematocolpos was excluded in all cases by high-resolution trans-abdominal ultrasonography at both the first follow-up and any subsequent visits. Subjectively, all patients reported a high level of satisfaction with the procedure and the relief of former IH symptoms. There was a significant post-operative improvement in pain VAS score ($P < 0.001$). The possibility of restenosis over a longer period of time was excluded by patient reports during telephone consultations of the resumption of normal menstrual flow.

Discussion

Although an intact hymen does not necessarily correspond to virginity from a biological perspective, it is often considered indicative of abstinence from premarital sex in many cultures and thus remains intrinsically tied with concepts of familial pride and honour.^{9,12} Indeed, in some countries, unmarried or newly married women without intact hymens can face severe social consequences ranging from humiliation to ostracism, divorce and even extreme violence or abuse, for instance as a result of corporal punishment (i.e. stoning or lashes), execution or honour killings.^{6,7} As a result, in many Islamic and other conservative communities, conventional hymenectomy procedures are often considered unacceptable due to the inherent surgical risk of hymenal rupture.⁵⁻⁹

While it is often challenging for individuals from other cultures to fully understand or accept the importance placed on hymenal integrity in these communities, it remains a critical sociocultural and psychological issue, particularly for young adolescent girls with medical conditions or genital abnormalities such as IH. It is therefore essential that medical practitioners endeavour to respect these cultural beliefs and take measures to ensure the integrity of the hymen as much as feasibly possible.⁹ To this end, the American College of Obstetricians and Gynecologists recently stated that elective vulvar cosmetic surgery should be offered to women to alleviate anxiety, depression and other psychiatric conditions resulting from hymenal rupture.¹³

From a medical standpoint, postpubertal IH can result in serious complications if left untreated, such as secondary endometriosis, hydronephrosis, haematosalpinx rupture, renal failure, lymphovenous obstruction and infection.^{3,14} The primary goal of IH management is to achieve hymenal patency, an objective usually accomplished via conventional hymenotomy.^{3,4} However, the subsequent loss of hymenal integrity can be avoided with concomitant reconstructive surgery to restore the normal anatomy of the hymen. Moreover, there is no need to provide the patient with a medical report to certify hymenal defloration as the post-operative annular hymen mimics the normal hymen in terms of both appearance and function.

Various approaches to surgical IH management have been described in the literature. In most cases, the correction of clinically significant hymenal variations involves the excision of the hymenal tissue and the redundant mucosa.¹⁰ However, the simple incision and drainage of haematocolpos in a patient with IH should be avoided due to the risk of ascending infection and sepsis.¹⁵ Other researchers have recommended surgical resection be performed for thicker hymenal membranes, whereas a vertical incision can be applied to thinner membranes.¹⁰ In addition, fixing the vaginal wall to the *introitus* can help to avoid restenosis and the development of post-operative complications.^{10,14} In a recent literature review, Lee *et al.* reported that most IH patients were treated surgically (83.5%), most often via hymenotomy (35.2%) or hymenectomy (36.4%), without significant differences in outcome.¹⁶ However, previous research has indicated the possibility of IH restenosis following a hymenectomy.¹⁷

Alternative methods of treating IH without affecting hymenal integrity have also been proposed. For example, some researchers have described a technique in which the hymenal membrane can be opened via a 0.5 cm central oval incision using a scalpel, followed by the insertion of an inflated 16F Foley catheter left in place for two weeks to prevent re-adhesion of the edges.^{18,19} However, maintaining a catheter in a cavity filled with retained *menses* for long periods of time is very risky and can potentially result in pelvic inflammatory disease.^{10,20} Moreover, the use of a scalpel to create an incision can result in an opening with irregular edges due to fine tremors in the hands of the surgeon, which can be influenced by different factors such as anxiety, stress or urgency.²¹ In contrast, the current reported technique was found to result in the formation of an even and wide hymenal opening, while still preserving the annular hymen.

Furthermore, a reusable laparoscopy trocar is a dual-function medical instrument readily available

in most gynaecological operating rooms of tertiary hospitals without the need for additional expenses or healthcare resources. Although it can be claimed that scalpels are more readily accessible, it should be noted that the diagnosis and treatment of IH cases should take place exclusively at specialised tertiary centres due to the risk of misdiagnosis with other lower genital congenital anomalies, such as low transverse vaginal septum, agenesis of the lower third of the vagina and OHVIRA.¹⁰ An accurate diagnosis is crucial as inappropriate interventions may result in serious complications as well as incomplete treatment. For this reason, only postpubertal patients were included in the current study. The onset of estrogenisation at puberty allows for a clearer examination of the perineal anatomy as well as recognition of characteristic symptoms, thus reducing the likelihood of misdiagnosis. Moreover, the hymen can be more easily stretched due to the estrogenisation of the vaginal tissue without the risk of spontaneous rupture.¹⁵

As such, a hymenectomy is sometimes recommended to ensure persistent patency. Histologically, the bulk of the hymen is formed of a connective tissue formed of partly elastic and partly collagenous fibres.²² Both surfaces are covered by a stratified squamous epithelium which lacks any evidence of cornification or glandular or muscle elements and without nerve cells and fibres at the free edge. As such, the hymen is easily perforated upon penetration and usually retracts laterally due to the absence of muscle elements. These facts support the use of a laparoscopy trocar tip in the current study, with immediate retraction of the fibrous membrane observed following withdrawal of the laparoscopic sleeve. In addition, no cases of restenosis were identified in any of the patients at either the first or subsequent follow-up visits.

Certain limitations to the present study should be acknowledged, including the lack of a comparison group and the relatively small sample size. Both of these limitations are due to the rarity of IH cases. In addition, the study was restricted to postpubertal cases for reasons of safety and to ensure the accuracy of the diagnosis. Finally, objective preoperative assessment of the psychological status of the patients was difficult in many cases due to their young age, high levels of pain and the atmosphere of stress, fear and anxiety surrounding the concept of hymenal integrity. However, while any research involving a novel procedure for patients with rare conditions will be subject to methodological limitations, the data from the present study may nevertheless be helpful in generating a hypothesis that can be tested in further analytical studies.²³

Conclusion

The current study described a novel, minimally invasive approach for the surgical correction of postpubertal IH involving the formation of a new orifice using a laparoscopy trocar and the reconstruction and preservation of an annular hymen. This technique was found to be both safe and effective, resulting in high levels of patient and family satisfaction. As such, this approach should be considered in circumstances where resumption of the normal anatomy of the hymen is a matter of considerable sociocultural and psychological importance.

CONFLICT OF INTEREST

The author declares no conflicts of interest.

FUNDING

No funding was received for this study.

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