

Research Paper

Medico-legal study of the hymen

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ABSTRACT

Background: The study of hymen morphology and injuries is critical in forensic medicine, particularly in Iraq and other Asian countries. Problems with the hymen can have serious social consequences.

Aim of the study: The aim of this study is to shed light on various hymen's variants, as well as the possible causes of their injuries and their medicolegal significance.

Method: This study was carried out at Baghdad's medico-legal directorate (M.L.D.) from January 1st to March 31st, 2017. There were 127 cases in total. They ranged in age from two to sixty. The morphology of the hymens, their injuries, and other relevant details were documented using a specific questionnaire.

Results: Compared to other varied examinations undertaken, such as infertility, impotence, and others, the examination of the hymen made up (5.1%) of all examinations conducted in the Medico-Legal Directorate (M.L.D.) clinic in Baghdad. The majority of the women tested were over the age of 14. The annular hymen was the most common variant (57.3%). The elastic hymens percentage was 14.6% while the Imperforated variant had the lowest prevalence (0.8%). The majority of the properties of the examined hymens were smooth free edge, medium consistency, and medium sized hymen opening. The majority of the cases involved female children (pre-pubertal girls) who were accidentally injured, followed by sexual assaults and wedding night doubts. The majority of hymen tears (40.2%) were old. Multiple tears (47.5%) outnumbered single tears (37.3%). Fresh tears were only observed in adult girls.

Conclusion: The annular variant of the smooth free edge, average consistency, and average hole size is the most common hymens. The elastic hymens were a main reason for the referral of cases for medical examination due to wedding night doubts. In more than half of the cases, the hymens were smooth with no transection or deep notches.

1. Introduction

According to dominant ideology in many countries, virginity means abstaining from premarital sexual intercourse.¹ In females, this concept primarily refers to the safety of the hymen as well as the condition of the introitus, vagina, fossa navicularis, fourchette, labia majora and minora, and breasts.²

Anatomically, the hymen is a fold of the vaginal membrane located 2–3 cm above the vulval surface,² and it may or may not be formed.³ It is found in humans and some quadrupeds, particularly monkeys.⁴

The hymen in obese females is deeper than in slim females. The

deepest recorded hymen was 4.6 cm above the vaginal surface, while the nearest was 1.5 cm.³

Histologically, hymen is composed of non-keratinized stratified squamous epithelium that covers a core composed mainly of collagenous and elastic tissues with few nerve fibers. The Hymen contains no glandular or muscle elements, and it is a relatively avascular membrane in adults.⁵

Embryologically, the hymen develops at the lower part of the vagina from the Mullerian duct and the sinovaginal bulbs, which originate from the urogenital sinus epithelial membrane. It appears around the nineteenth week of pregnancy as a fold aligning the anterior opening of the

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vaginal canal, with the upper part formed by the union of Mullerian ducts and the lower part formed by the remnant of urogenital sinus.

The hymen is a rudimentary organ that is not fully developed and has no physiological or biological significance. In newborn babies, it has a superficial location with numerous vessels.³ Because of the effect of maternal oestrogen, the hymen is thick and redundant during the newborn period and it thins out and becomes translucent over time.⁶

The shape of the hymen, which is determined by the number and location of the holes, is one of the its characteristics. If the hole in the middle is single, the membrane is said to be annular. If the membrane's growth in the area following the external urethral orifice is inadequate, the membrane is described as horseshoe one. Crescent growth refers to growth that is deficient in the upper half. If the membrane has two holes, it is septate; [Supplementary Fig. S1](#) shows the septate variant.⁷ If there are more than two holes, it is cribriform.⁸⁻¹⁰

The hymen with no hole is known as imperforate hymen. This is a congenital disorder with surgical implications because it causes menstrual blood accumulation after puberty.^{11,12} Imperforate hymen can cause social problems for women because relatives may believe she is pregnant from a non-marital relationship.¹⁰ Certainly, there has been some improvement in people's awareness of the facts connected with hymen in recent years.

Repeated intercourse and birth would alter the shape of the membrane, transforming it into small pieces known as carunculae myrtiformes.⁷ [Supplementary Fig. S2](#) shows the carunculae myrtiformes.

The hymen's free edge can be smooth, serrated, fimbriated, or form gulfs like invaginations.³ The membrane is thin if it is less than 1 mm thick, as it is in children (prepubertal girls), average if it is 2 mm thick, or thick if it is greater than 2 mm. Elastic membranes have the ability to expand, allowing the erect penis or anything similar to pass through without rupture.¹²

The hymen hole can be narrow enough that the little finger cannot pass through, or it can be as wide as 4 cm in diameter.⁴

The examination of the hymen is legally significant because its injury is evidence of sexual intercourse, and thus the relevant laws were enacted. The examination of the hymens in the medico-legal centers in Iraq are done for several reasons the most important are:

1. Accidental injuries to the genital area
2. Suspicion of female virginity at marriage, or following escape or abduction
3. Cases of adultery and rape
4. Charges of infertility and impotence.⁷ However, in these cases, the forensic doctors may refer them to the official hospital's clinical departments of gynecology, psychiatry, or others, but the final report must be written in the medicolegal centre in accordance with Iraqi laws and rules.¹⁰

A temporary, mild bleeding and pain could occur along with hymen injury. The rupture's edges typically develop reddish and swollen edges. There can be ecchymosis nearby. A bloody serum begins to leak from the edges a few hours later, but it ceases after one or two days. In 10–15 days, all alterations gradually disappear at each edge alone.¹⁰ The middle of the vestibular half of the hymen, or the location of 6 o'clock, is the site of injury that occurs most frequently.² In a study of 100 ladies' first coital experiences, bleeding and pain were reported as the most common occurrences. In this study, 56% of females reported bleeding with various severity levels (light, moderate, and heavy), while 68% reported pain of various intensity (slight, moderate, and severe).¹³

Although most medical disciplines in Iraq adhere to the British model, medicolegal practice adheres to the European Continental System of criminal justice with some modifications to accommodate Iraqi circumstances. According to this system, the legal authority is represented by the courts and police stations, and it has the authority to order medicolegal examinations on both dead and alive victims.¹⁴

This study will shed light on various hymen's variants, as well as the

probable causes of their injuries and their medicolegal significance.

2. Methods

This case-control study was carried out in Baghdad's Medico-Legal Directorate (M.L.D.) over a three-month period, from January 1st to March 31st, 2017.

The M.L.D. clinic in Baghdad conducts a variety of examinations, including those for sodomy, infertility, impotence, exposure to external violence, hymen examinations, and others. The total number of cases examined over three months was 2514, and in this time frame, 127 hymens (5.1%) were examined. The proportion of hymens examined remained stable during the three months of this study.

All cases of hymen examinations referred to the M.L.D. clinic in Baghdad from Baghdad and other governorates using established procedures in Iraq. A letter from an investigating authority, a police station, or a court specified the type of examination, according to the Continental system to which the Iraqi Medico-legal system belongs. This letter included the female's name and personal photos, and it was sealed by the authority. No medicolegal examination could be performed in Iraq without an official referral from a court or police station.

In accordance with Iraq's Forensic Medicine Act (number 37 on 2013), a committee of three forensic doctors conducted each examination in the M.L.D. clinic, assisted by a forensic nurse. Prior to the examination, the female provided a brief history of the event. The caretaker provided the history if the female was a nonverbal child. The test was performed in a supine position with antero-lateral labial traction. A clock face diagram of the vaginal orifice is also used as a frame of reference to document the various trauma sites or tears to the hymen. In Iraq, forensic doctors have the authority to request further information regarding the case from the police or the examined women and their relatives, such as information about the menstrual cycle, hormonal therapy, or anything else relevant to the specific case.

Females who were being investigated gave their consent for photographs of the hymens used in this study. Swabs could also be taken for further investigation utilising the knee-elbow posture if necessary. Swabs also may be used as an additional piece of equipment to handle and inspect the hymen. However, there was no possibility to employ video recordings or magnification (for example, by colposcopy). If necessary, the forensic committee could have referred the case to a Gynaecological examination at a neighbouring official hospital (Medical City in Baghdad). The legal and ethical approval for this study was given by the director general of the M.L.D. in Baghdad.

A special questionnaire created specifically for that purpose was used to obtain the necessary data. To document the results that would later be reviewed and debated, all the data were transformed into a table and figures.

The questionnaire used for the examination recorded the date of examination, age, marital status, and the reason for the examination. In addition to a complete description of the hymen, which included the following information: hymen variant, hymen hole size, type of free edge, hymen thickness, hymen state of integrity, and number of tears, if present.

Table (1)

Numbers and percentages of females examined by age group.

Age group (Years)	No.	Percentage %
0-6	10	7.9%
7-12	27	21.3%
13-18	52	40.9%
>18	38	29.9%
Total	100	100%

3. Results

As indicated in Table 1, the age groupings of the females who were studied are divided into four categories. 13–18 years old was the most investigated female age group 52 cases (40.9%).

The most common reason for referral to the examination was an accidental fall on the genital area 57 cases (44.9%), followed by sexual assaults 46 cases (36.2%), and wedding night doubts 24 cases (18.9%). Fig. 1 shows hymen examinations classified according to the reason for referral.

More than half of the hymens examined, 68 (53.5%), had no injuries, and were smooth with no transections or deep notches. In such cases, the forensic pathologist could still not conclude that penetration had not occurred in accordance with their history. Among those women with documented hymenal tears, 40.2% (51 cases) were more than two weeks old. Another 6.3% (8 cases) had tear(s) less than two weeks old in consistence with their history of recent penetration. Hymenal tears occurred between 5 and 7 o'clock in the lower portion of the hymen membrane. All of the cases in this study had a complete tear of the hymen up to the base. The number of tears was either single 22 (37.3%) or multiple 28 (47.5%) or carunculae myrtiformis 9 (15.2%). All eight fresh hymenal tears were documented in mature girls (post pubertal girls) as a result of sexual assaults, whereas those females documenting smooth hymens with no transections or deep notches were children (prepubertal girls) as a result of an accidental fall on the genitals.

The annular variant was the most common in this study 60 cases (47.2%), followed by the horseshoe variant 44 cases (34.6%). The crescent 3 cases (2.4%) and imperforate one case (0.8%) were the least common variants. Fig. 2 shows variations in hymen morphology in this study. Supplementary figures S3, S4 and S5 shows the annular, the horseshoe and cribriform hymens respectively.

The most common hole size was average or medium, accounting for 45 of the total 127 cases (35.4%). The proportions of wide and narrow holes were 37 (29.10%) and 35 (27.6%), respectively. Carunculae myrtiformis and imperforate were the least common variants 10 (7.9%).

The smooth edge hymen was the most common, accounting for 94 of the 127 total cases (35.4%). The fimbriate came next 19 cases (14.9%). Carunculae myrtiformis and imperforate were both represented by 10 cases (7.9%). Finally, the serrated was the least observed in 4 cases (3.2%).

The most common, accounting for 59 of the total 127 cases (46.5%), were hymens of average thickness. Fig. 3 shows the distribution of hymens in this study based on thickness.

4. Discussion

In this study, it was found that the rate of examination of the hymens in the department of clinical forensic medicine in M.L.D. was low when compared to other examinations. The research also revealed no significant difference in the numbers examined during the first three months of 2017. The average percentage of this three-month hymn study was 5.1%, which was lower than Alaugaily's study of 6.2% in 2001–2002. However, this percentage was based on a six-month study.⁷

This may be explained by the stability of social situations and religious beliefs among Iraqis, as well as the desire of Iraqi women to preserve the most valuable thing they have, their honor, despite the country's difficult circumstances.

The most common age group examined was 13–18 years old, followed by the older age group because sexual functions are at their peak at that age, making them more vulnerable to rape and doubts about their virginity.

When examining the hymen, the forensic physician should pay attention to a number of signs that are medicolegally significant. They are as follows: Acute hymenal laceration, hymenal transections, and hymenal ecchymosis (bruises). The presence of these signs is regarded as conclusive proof of blunt force and penetration.^{15,16}

The annular variant hymen was discovered to be the most common in this study, which differs from the findings of Al-Kayssi, Al-Musawi, and Al-Augaily, who encountered that horse shoe hymens were the most common.^{3,7,9} This could be due to differences in study duration and sample size between this and previous Iraqi studies.

Annular variant hymens were also the most common in a study of 2–3 years old female children in the United States, but crescent membranes predominated at the age of 5–7 years. The number of dentations at the membrane's free edge decreases with age.¹⁷ A Saudi study that examined the genitalia of 345 newly born females to determine the shape of the hymen revealed that the annular hymen was present in 82% and the crescent variant was present in only 4.9%.¹⁸

The annular hymen of thin consistency, narrow hole, and smooth free edge were the characteristics of the membrane in younger girls, and

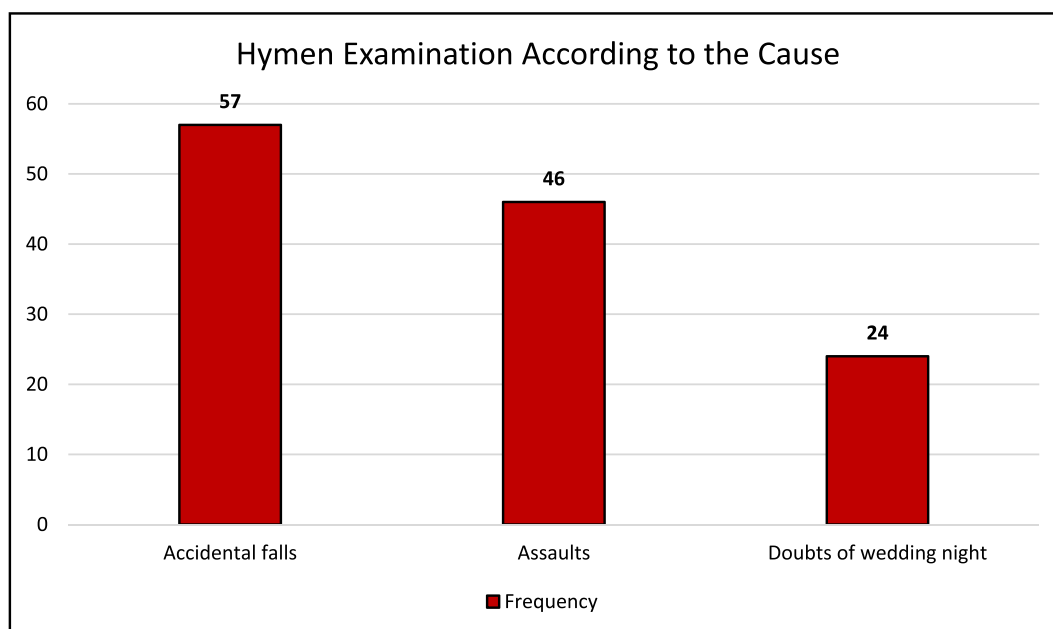


Figure (1). Hymen examinations classified according to the reason for referral.

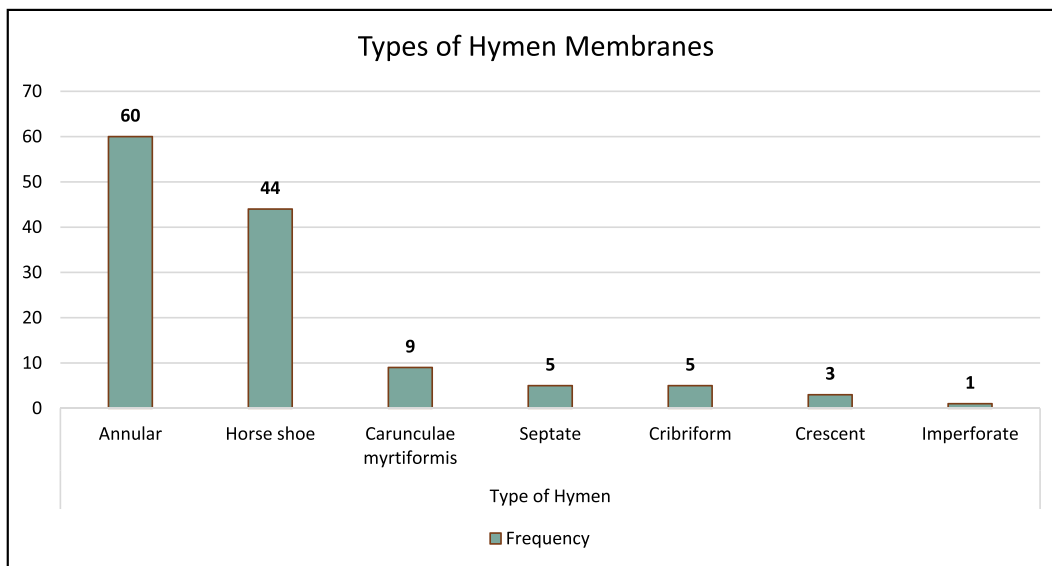


Fig. 2. Shows variations in hymen morphology.

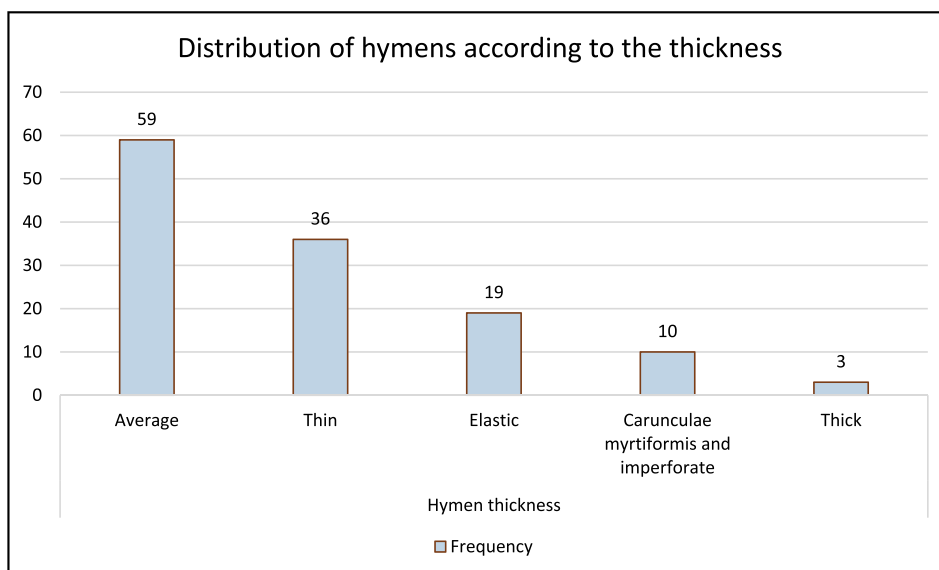


Fig. 3. Distribution of hymens according to the thickness.

changes in the thickness, shape, and size of the hole, and other features of the hymen may occur as the girl grows older. However, measuring the hymenal hole size has no medicolegal significance in assessing the hymen condition, and many authors do not recommend it.^{15,16} The reason for this is that various illnesses, such as vaginismus, which is described as recurring or persistent involuntary spasm of the muscular of the outer part of the vagina, can influence the size of the hole into the vagina.¹⁹

Bruising, petechiae, or abrasions on the hymen, as well as acute laceration of the hymen, of any depth; partial or complete, is a finding of acute trauma to genital/anal tissues rather than child sexual abuse, according to Joyce Adams et al., 2018. Furthermore, she claims that healed hymenal transection/complete hymen cleft, defined as a defect in the hymen below the 3–9 o'clock position that extends to or through the base of the hymen with no hymenal tissue detectable at that site, is highly suggestive of trauma.²⁰ The most common sites for hymenal tears are between 5 and 7 o'clock, which agreed with prior Iraqi studies.^{9,10}

The elastic membrane was found to account for 14.9% of the

examined cases and to be a major source of doubts about the night of marriage for medical examination. In cases of elastic hymens, it is preferable for the senior forensic doctor to explain and clarify this to the examined female and her family in order to avoid any social consequences. More than half of the cases examined lacked an injured membrane. In these cases, the forensic physician explained to the police and legal authorities in his report that the hymen is elastic and flexible and is not necessarily injured even during the initial penile penetration/coital debut.

It is important to keep in mind that estrogen hormone affects the development of the hymen at two stages in a girl's life: the first from birth through the first year or so of life, and the second when puberty begins and continues throughout the reproductive years. The estrogen has two effects on the hymen. First, it causes the hymen to thicken, and second, it causes the hymen to widen.²¹

During the course of the investigation, there was one instance of imperforate hymen, which necessitates surgical intervention. Complex social issues can arise because it is assumed that the female is pregnant

when this sort of hymens is present. Fortunately, the study's case was accidentally found in a small child after a fall on the genitalia.

The first reason for referral to the exam, particularly in children, was an accidental fall on the genital region. Fortunately, no hymen damage from that cause was found in this investigation. In most cases, these accidents do not harm the hymen.³

The role of health and sexual education, particularly for young people planning to marry, is critical, as evidenced by wedding night doubts. Despite the fact that these were the least common reasons for referral in this study (18.9%), it is critical to educate young people about what married couples should expect on the first night in order to avoid any social consequences. It is important to note that some females will not experience bleeding or pain during their first coital experience. Whitley's study revealed that 32% of females did not suffer pain, while 44% of females did not experience bleeding.¹³ Many authors have also looked into the etiology of pain and bleeding in females' first sexual intercourse.^{22,23}

Hymen examinations should not be performed in private clinics due to a lack of experience in this field among other doctors and to avoid potential problems. This agrees with other studies that emphasize the examining physician in cases of suspected sexual abuse should have forensic medicine experience.^{24,25} Those examinations should only be conducted in official medico-legal centers, which have the authority and responsibility to write and organize the final reports of those examinations and send them to the investigative authority that referred the female and requested the examination in accordance with local laws and instructions.

Virginity is a concept fogged and obscured by superstition, folklore, false science and the fear induced by repressive 'honour' societies. Its importance in most Western communities, which peaked during the colonial era, declined significantly after that, probably reaching a nadir in the 1970s and 1980s. Anxiety about female virginity may be at an all-time high in Muslim societies right now, as growing religious fundamentalism encounters and opposes Western values.²⁶

M.L.D. examines wedding night doubts cases in Iraq. According to Iraqi laws, because the examinations include hymens, they should only be performed by forensic doctors in response to a court or police order based on an official complaint, mostly from the spouse.

Hymen exams are socially significant in Iraq but may be of negligible or little significance in other cultures, particularly in Western societies. Any advice offered to the examined woman, her relatives, or her husband plays no or little role on its own, although it could be given to them if the examination revealed a non-ruptured hymen.

5. Conclusions

Accidental falls, particularly in young children, are the most common reason for hymen examination. Elastic hymens or those with big holes may not be injured by penile penetration, especially if both traits are present at the same time, and so the hymen was not torn in more than half of the cases. The annular hymen is the most common variant, while the imperforate hymen is the least common. As the female ages, the membranes thicken, the holes widen, and striations appear along the free edges. The elastic membrane was a minor component of the total, but it was a major source of concern on wedding night.

Laboratory investigations, such as hormonal tests, like estrogen level, which may influence some of the decisions linked to the state of the examined hymen, and hymenal changes that occur due to ageing, should be considered in hymenal examination.

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Declaration of interests

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jflm.2023.102579>.

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