

# Investigation of sphincter muscle complex



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## Abstract

**Background:** The exact anus reconstruction is the critical in patients with imperforate anus which is related to the correct diagnosis of sphincter complex.

**Objectives:** The aim of this study is exact investigation of the prineal region for ultrasound detection of place and pathway of sphincter muscle complex.

**Patients and Methods:** This descriptive cross-sectional study was performed at Mashhad medical university during 2016. Transperineal sonography was done in ten patients (6-12 week age, 8 male and 2 female) with imperforate anus.

**Results:** The shortest distance between rectal pouch and skin was between 8 to 20 mm, but the distance between rectal pouch and skin via the anal sphincter path was longer (11 to 23 mm).

The multi-layer view of anal tubercle was seen in all patients except one. It had a curved and occasionally parasagittal path and eccentric than muscle complex. Anal muscle sphincter complex could be seen in all patients with 2-3. 6 mm, occasionally asymmetric.

**Conclusion:** The multi-layer view of anal tubercle and the anal sphincter complex are the two important sonographic findings, which can better differentiated the level of anal malformation and act as an indicator for the location of pull through.

Keywords: Anal sphincter muscle complex; Anorectal malformation (ARM); Imperforate anus (IA); Child

## 1. Background

Colon cancer is a Imperforate anus is one of the anorectal malformations (ARM) which is characterized with abnormal termination of the hindgut. The anus reconstruction and fecal continence is one of the critical aspects of treatment and surgery of these patients which is related to the correct diagnosis of sphincter complex position and the anus reconstruction in the appropriate place within the sphincter muscle complex .

There are various surgical approaches and procedures for anus reconstruction, including the use of preoperative MRI for diagnosis of type and level of anorectal malformation . In addition, there are some articles about the use of MRI in the detection of sphincter complex and the anus path guidance . However, later technique has some limitations and no available in all pediatric surgery centers.

In Imperforate anus (IA) patients, sonography is used to determine the level of disorder (low, intermediate, high), which may be divided to three groups according to the distance between perineal skin surface and rectal pouch. However, there isn't an exact cut off for their differentiation and there is some diagnostic overlap . Some articles consider above 15mm as high type and below 10 mm as low type ARM , although another numbers between 5-25 mm are also considered as cut off point in articles. The passage of rectum from levator ani muscle in transverse view of infra-coccygeal plan is another method that can help in differentiation between high and low groups.

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Furthermore, it is also used for diagnosis of internal fistula (rectourethral, rectovaginal and etc) which can be helpful in determining level of disorder .

However in practice, these criteria have a little value for operation protocols and the surgical planning is mostly according to clinical criteria and intraoperative findings.

The exact localization of anal tubercle and muscle sphincter complex with preoperative sonography can help the surgeon to select the less invasive surgical technique and improve surgical results.

## 2. Objectives

The aims of this study is exact investigation of the prineal region for detection ultrasonic criteria of place and pathway of muscle complex and anal sphincter in the children with Imperforate anus.

## 3. Patients and Methods

This descriptive cross-sectional study was performed at Dr. Sheikh pediatric Hospital during 2016 after being approved by the Institutional Review Board of Mashhad University of Medical Sciences, Iran and with its grant.

In this study, ten patients (6-12 week age) with imperforate anus were selected after obtaining informed consent from their parents. Nine patients had previous colostomy within the two days of life and in another remaining one with rectovestibular fistula didn't previously performed it.

Patients were also evaluated for associated congenital anomalies (VACTERL-H and etc.).

The children were placed in lithotomy position and Foley catheter was passed from distal limb of colostomy to the rectum and the balloon was inflated and retracted backward and fixed. For better visualization of rectal pouch, normal saline was injected through fixed Foley catheter in rectum. After prep & drape as the first step, transperineal sonography was done by an experienced pediatric radiologist. Sterile gel and Betadine were used for sonographic window.

The ultrasound devices used in this study was sonosite Model S Nerve with a 12 MHz linear superficial probe.

The sonographic criteria such as shorten distance of rectal pouch from the surface of skin, distance of rectal pouch from the surface of skin in anal sphincter complex pathway , the presence of internal fistula, multi-layered view of anal tubercle, state of anal sphincter complex were evaluated in both sagittal and coronal planes. The Distance between rectal pouch from the surface of skin in the shortest path and this distance in correlation with sphincter complex were separately measured.

The distance between the rectal pouch and the surface of the skin and the presence of internal fistula were evaluated in the sagittal sonographic plane.

Internal fistulas can be identified by changing of the rout the echogenic mucus of the rectum toward urethra or vagina.

The multi-layered view of anal tubercle is exactly similar to gut signature, and visualized as a peripheral hypoechoic layer with two central parallel

echogenic lines just below the skin (dermis). It has vertical position than to anal pit (Fig. 1A) and is visible only in coronal plan.

Anal sphincter complex is noticeable as circular muscular tissue in the depth of the subcutaneous perineal area and is visible in coronal plan (Fig. 1B).

#### 4. Results

Table 1 showed the demographic and sonographic findings of ten imperforate anus patients with were selected for this study. Eight patients were male and other two were female.

The shortest distance between the rectal pouch and the skin surface was between 8 to 20 mm, but the distance between the rectal pouch and the surface of skin via the anal sphincter path was longer and between 11 to 23 mm, that it was 3- 8 mm. (4. 7 mm mean) longer.

There were rectourethral fistula in 7, rectovaginal fistula in 1, rectovestibular fistula in 1, and in another one patient no fistula was detected. In patient with rectovestibular fistula, anal sphincter complex was pushed back toward the coccygeal tip due to fecal material pressure.

The multi-layer view of anal tubercle was seen in all patients except one (rectovestibular fistula patient). The maximum outside diameter was 3-4 mm, but in patient with cloacal anomaly, it had about 10 mm in sagittal plan on the posterior of prineal orifice. In often patients, the anal tubercle path until center of muscle complex had a curved and occasionally parasagittal path and it wasn't straight (Fig. 1C). The visible length of multi-layer view of

anal tubercle was 5-8 mm, and it attaches to the mucus of muscle complex eccentric or concentric (Fig. 1D).

Anal muscle sphincter complex could be seen in all patients. The muscle complex thickness had 2- 3. 6 mm which occasionally was asymmetric (Fig. 1E).

## 5. Discussion

Imperforate anus is a congenital disease with abnormal termination of hindgut which have a wide spectrum of muscle sphincter complex development (from near-normal muscles to complete absence of the sphincter muscle). Routinely, depending on the level of the obstruction in above, middle and below of muscle sphincter, this anomaly is categorized into three groups (High, intermediate, low type) . The numerous factors especially the fecal continence after the surgery related to the diagnosis of the exact place of sphincter muscle complex .

There are many articles about the role of preoperative MRI in the determining of the type and level of anorectal malformation which can be helpful in planning and the prediction of the prognosis and also investigation of the spinal and urethral anomalies which indirectly effect on the management of disease and operation . MRI has also a role in these patients for demonstration of the status of sphincter muscle complex, the symmetry of the sphincter, the perirectal fibrosis . The post-operative MRI is use to evaluate surgical results and the passage of pulled-through bowel from the center of sphincter complex . Recently, there are some few articles about the

use of MRI in the localization of sphincter complex and the anus pathway as a guidance instrument .

The sonography is usually used to determine the level of disorder (low, intermediate, high) indirectly basis on the distance between perineal skin surface to the rectal pouch and the internal fistulae visualization. Although, this approach isn't very determinative and there are a lot of diagnostic overlap in this field .

In review article, we find only one paper about the detection of the passage of rectum from levator ani muscle in transverse view of infra-coccygeal plan that can be helpful for differentiation of high and low groups .

The pre-operative exact localization of anal tubercle and especially sphincter muscle complex with sonography can be helpful for surgeons to select less invasive approaches that determines the future fecal continence of patient.

In this study, with exact ultrasound investigation of prineal region, we noticed two sonographic findings which can be helpful in patients with imperforate anus to determine the proper path of anal canal for pull-through operation. These findings were multi-layered view of anal tubercle and sphincter muscle complex.

Multi-layered view of anal tubercle is exactly similar to gut signature and was determined as a peripheral hypoechoic layer with two central parallel echogenic lines. This view was probably the result of fetal anal tubercle as a result non-ruptured anal membrane and non recanalized anal canal. This view wasn't seen in patient with recto-vestibular fistula. Although it had 3-4



mm diameter, in Cloacal anomaly patient, it had about 10 mm anterior-posterior diameters in sagittal plan that probably due to fetal merge of anal and vaginal orifices.

In most of patients anal tubercle wasn't straight and had parasagittal position and slightly curvature with eccentric attachment to center of sphincter muscle complex. These can explain pathophysiology of disease.

Anal sphincter and muscle complex was seen as a circular muscular tissue bulk that surrounds the echogenic mucus of gastrointestinal tract. It was visible on the coronal plane at depth of subcutaneous fat of the perineal area with 2-3. 6 mm thickness. This complex was visible in all of our 10 patients.

In a patient with rectovestibular fistula, this complex pushed backward to the near of coccyx probably due to fecal retention. Although most patients with Imperforate anus and recto-perineal fistula categorized as low type, but this patient had high type malformation because the sphincter complex has been pushed backward and tract of fistula lie above of muscle complex. In this patient, based on the distance of rectal pouch to the skin (9 mm) and based on clinical findings alone and without attention to muscle sphincter, the probability of successful surgery was too low without sonography guide. Then, visualization of the sphincter muscle complex and rectal pouch is an important sonographic findings in imperforate anus patients that can differentiate better the patients to the high and low malformation.

In addition, the result of this study shows that the distance between rectal pouch and skin without attention to muscle sphincter is unreliable and can make a serious pitfalls and unaware complications. In all patients, the

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distance between rectal pouch and skin through anal tubercle and muscle complex (11mm) was longer than shorten distance between rectal pouch and skin (3-8 mm mean: 4. 7 mm).

In lithotomy position, it is important to notice that multi-layered view of anal tubercle and anal sphincter complex was only visible in coronal view and was invisible in routine sagittal and transverse view, then it may be ignored and didn't notice to it in literatures. In the review of articles, we did not encounter a similar publication about the use of this findings in patients with imperforate anus, although there are many articles about the use of sonography to determine the anal sphincter complex in adults in various diseases .

This is a preliminary cross sectional study with the low number of patients. In addition, the frequency of the ultrasonic probe device were our study limitations. Exact examination of perineal region with high-frequency probes (14 to 20 MHz) with high amount of the patients can provide better and more reliable results.

Conclusion:

The multi-layer view of anal tubercle and the muscular bulk of anal sphincter complex are the two important sonographic findings, which can better differentiated the level of anal malformation and act as an indicator for the location of anal sphincter pull through in patients with Imperforate anus.