The Role of Transperineal Ultrasonography in Determination of the Level of Anorectal Malformations

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Background: *Early assessment and accurate diagnosis of the level of anorectal malformations (ARM) are essential. Transperineal ultrasonography may be an excellent imaging modality for reviewing the distal end of the rectal pouch.*
Objective: *To assess sensitivity, specificity and the usefulness of transperineal ultrasonography in determination of ARM level*
Materials and Method: *Prospective study of all inborn ARM patients and those referred to Siriraj Hospital within the first day of life between 1 May 2011 and 30 April 2015 was conducted. Rectal pouch to perineum distance (P-P distance) was recorded and compared between transperineal ultrasonography and prone lateral cross-table film and correlated to operative findings.*
Results: *In our series 70 patients were recorded, 49 males and 21 females. Twenty-two patients were included; 14 patients were low type ARM and 8 patients were non-low type ARM. The sensitivity, specificity and the accuracy of transperineal ultrasonography in the determination of ARM level was 100%, 92.8% and 95.4% respectively (95% confidence interval was 77.1 to 99.8%).*
Conclusion: *Transperineal ultrasonography is a good modality for earlier diagnosis and accurate evaluation of ARM, no radiation exposure and simple technique, which can be done by pediatric surgeons.*

Keywords: *Anorectal malformations, Imperforate anus, Transperineal ultrasonography*

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Anorectal malformation (ARM) is a common congenital anomaly which occurs in about 1 in 5,000 live births. Most cases have a fistulous communication between the rectum and urogenital tract or perineum[1] whereas only 10% of all cases present with isolated imperforated anus without fistula. The latter group needs additional imaging investigation to determine the level of the most caudal portion of the rectum.

Prone cross-table lateral film has been reported since 1983 and currently used as the most accurate standard investigation for demonstration of the level of rectum in neonates with ARM. The patient must be investigated within 16 to 24 hours after birth[2] for best accuracy.

Recent studies showed high sensitivity and specificity of ultrasonography in the evaluation of ARM, with advantages in providing immediate objective confirmation without having to wait 24 hours. Additionally, in the hands of an experienced radiologist such as Haber HP et al[3], the sensitivity was 100%, specificity was 86% and accuracy was 95%.

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Objective

1) To assess sensitivity and specificity of transperineal ultrasonography in the determination of ARM level.

2) To compare the results of transperineal ultrasonography in the determination of ARM level to the results of prone lateral cross-table film and surgical findings.

3) To determine the usefulness of the transperineal ultrasonography in ARM patients.

Material and Method

Imaging findings of all ARM patients both inborn and referred to Siriraj Hospital, from 1 May 2011 to 30 April 2015 were compared. Patients who underwent surgery from outside hospitals were excluded. Low-type ARM both with and without fistula patients were included in our study to find the accuracy in

demonstrating low-type ARMs as well as to confirm the cut point in differentiating low to non-low type ARMs. Rectal pouch to perineum distance (P-P distance) of less than 1 cm was considered as low type anomaly[3].

Diagnostic ultrasonography procedure

Position: Supine without specific preparation, hips flexed.

Probe: Linear-array transducer.

Approach: Transperineal approach in midline sagittal plane (confirmed by visualized sacral spine) through the perineum to identify rectal pouch to perineum distance (P-P distance).

Interpretation: P-P distances of less than 1 cm suggest low type anomaly whereas P-P distances of more than 1 cm suggest non-low type anomaly.

Patients diagnosed as low type anomaly will undergo anorectoplasty procedure, whereas non-low type level will require colostomy. The definite diagnosis was determined in the operative field during surgery (Posterior Sagittal Anorectoplasty: PSARP).

The rectal pouch to perineum distance (P-P distance) was recorded and compared between transperineal ultrasonography and prone lateral cross-table film and correlated to operative findings as demonstrated in Fig. 1.

Ultrasonography was done by well-trained pediatric surgeon and resident in pediatric surgery division, Siriraj hospital. Prone lateral cross table film defined type of ARM according to Pubococcygeal line and Ischial line.

Results

In our series, 70 ARM patients were recorded, including 49 males and 21 females. Forty-eight patients were excluded; 45 patients were referred and performed colostomy from other hospitals, 2 patients were lost to follow-up and 1 patient died before undergoing definitive surgery. Finally there were 22 patients included in our study; 14 patients were low type ARM and 8 patients were non-low type ARM. Eight patients were ARM without fistula, 8 patients had perineal fistula, 3 patients had recto vestibular fistula and 3 patients presented with anvestibular fistula.

All of the first and second ultrasonographic measurements showed the same results. There were 9 patients that transperineal ultrasonography diagnosed as non-low type ARM, in which only 1 was confirmed by intra-operative findings as low type ARM. All of the 13 low type ARMs, demonstrated by transperineal ultrasonography, were surgically confirmed accurate (Table 1).

The sensitivity, specificity and accuracy of transperineal ultrasonography in the determination of ARM level were 100%, 92.8% and 95.4% respectively (95% confidence interval was 77.1 to 99.8%).

Eight patients, who had ARM without fistula, had prone lateral cross-table film taken at 16 to 24 hours after birth. There was 1 out of 6 patients with prone

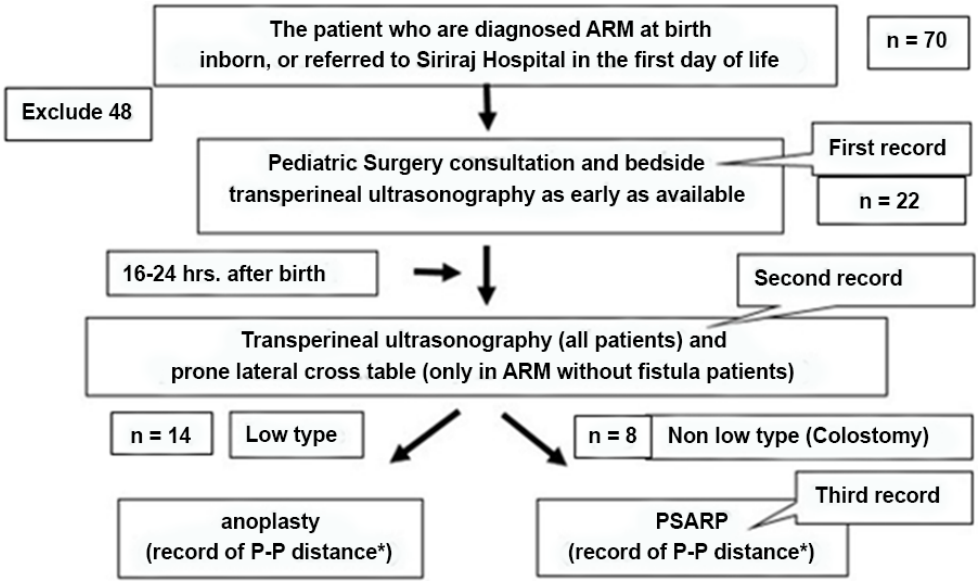

Fig. 1 Research methodology and study flow.

lateral cross table film suggested non-low type anomaly although intra-operative findings confirmed a low type anomaly (Table 2). Sensitivity, specificity and accuracy of prone lateral cross table film in the determination of ARM were 100%, 66.6% and 87.5% respectively (95% confidence interval was 47.3 to 99.6%) The results of prone lateral cross table film corresponded to transperineal ultrasonography in all patients.

Discussion

In our study, all transperineal ultrasonography measurements were performed by pediatric surgeons. Regarding intra-operative findings as the gold standard, the results of transperineal ultrasonography in determination of ARM were 100% sensitivity, 92.8% specificity and 95.4% accuracy.

Low-type ARM was included in our study for confirmation of our criteria in the diagnosis of low type anomaly. P-P distance of less than 1 cm was considered as low type anomaly. All low type ARMs were accurately diagnosed by transperineal ultrasonography according to this criterion. The P-P distance criterion was proven to be practical and efficient in this study.

Fig. 2 demonstrates the diagnostic process, according to Fig. 1, of one patient with low type ARM and no fistula that was referred to our hospital. By using the transperineal ultrasonography, the ARM level could be determined earlier than 24 hours before lateral cross table film was performed. From this study, the transperineal ultrasonography could be used for determination of the ARM level, which patients could benefit from early diagnosis and early management including definitive procedure, when compared to prone lateral cross table film with the additional benefit of no radiation exposure.

In 8 ARM patients without fistula which underwent prone lateral cross-table film and transperineal ultrasonography at 16 to 24 hours after birth (the second record). All 8 patients had the same results including 1 patient that both ultrasonography and lateral cross-table film determined as non-low type anomaly however intra-operative finding was low type. So we can assume that ultrasonography had the same

Table 1. The results of transperineal ultrasonography compared to Intra-operative findings

	Intra-operative finding	
	Non-low type	Low type
Transperineal ultrasonography		
Non-low type	8	1
Low type	0	13

Table 2. The results of prone lateral cross table film in ARM without fistula

	Intra-operative finding	
	Non-low type	Low type
Prone lateral cross table film		
Non-low type	5	1
Low type	0	2

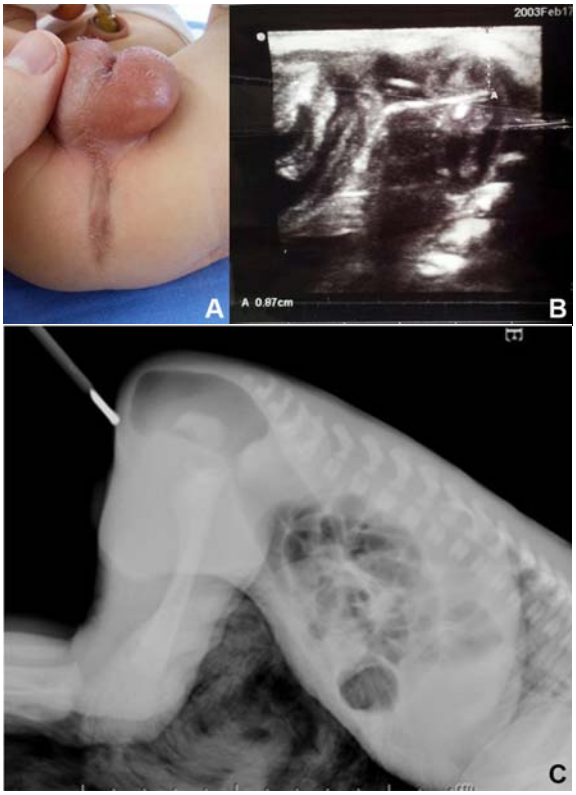

Fig. 2 A) A male infant, which was referred to Siriraj Hospital on the first day of life. Physical examination showed ARM without fistula. B) Transperineal ultrasound showed low type ARM which P-P distance was 0.87 mm at 14 hours after birth. C) Rectal gas was presented as low-type anomaly in prone-lateral cross table film at 24 hours after birth.

benefit in determining the level of ARM when compared to prone lateral cross-table film.

In low type ARM with fistula patients; 8 perineal fistula, 3 anovestibular fistula and 3 rectovestibular fistula, the transperineal ultrasonography could confirm the diagnosis and clearly demonstrated fistula tract in all cases.

Limitation of our study is the population. Although we had 70 ARM patients, but only 22 cases enrolled in our study. A future and larger study might answer the proper P-P distance in different weights and the other factors.

The determination of the level of ARM is very important for a definitive treatment such as anoplasty or colostomy. Lateral prone cross-table film requires a period of air passage to the rectum and radiation exposure. Ultrasonography can be done practically at bedside in early period of life. Early diagnosis will be beneficial for the early treatment in appropriate time.

Conclusion

Transperineal ultrasonography is the new modality for determining of the ARM level with good accuracy, no radiation exposure, earlier diagnosis and a simple technique that can be done by pediatric surgeons.

What is already known on this topic?

Determination of the level of ARM is very important for the decision making plan of treatment. Standard guideline in non-fistula patient depends on lateral prone cross-table film which needs a period of air passage within 16 to 24 hour after birth.

What this study adds?

We compared the results of new modality (transperineal ultrasonography) to the conservative management and gold standard, which is the intra-operative finding. Also the usefulness of the transperineal ultrasonography in ARM patients was demonstrated.

Potential conflicts of interest

None.

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การใช้อัลตร้าซาวนในการประเมินระดับลำไส้ใหญ่ส่วนปลายสำหรับทารกแรกเกิดที่ไม่มีรูทวารหนัก

พัชรีภรณ์ ตันมิ่ง, มงคล เลาหเพ็ญแสง

ภูมิหลัง: *ในการดูแลทารกแรกเกิดที่ไม่มีรูทวารหนัก จำเป็นต้องอาศัยการตรวจวินิจฉัยระดับของลำไส้ใหญ่ ส่วนปลายที่ถูกต้องและรวดเร็ว การทำอัลตร้าซาวน์น่าจะมีประโยชน์ในการตรวจเพื่อวางแผนการรักษา*

วัสดุและวิธีการ: *การศึกษาแบบไปข้างหน้า (Prospective study) ในทารกแรกเกิดที่มีภาวะไม่มีรูทวารหนักทุกราย ที่คลอดในโรงพยาบาลศิริราช หรือที่ส่งตัวมารักษาภายในวันแรกหลังคลอด ระหว่าง วันที่ 1 พฤษภาคม พ.ศ. 2554 ถึง 30 เมษายน พ.ศ. 2558 โดยเปรียบเทียบระยะห่างระหว่างผิวหนังถึงปลายลำไส้ใหญ่ที่วัดได้จากการทำอัลตร้าซาวน์เทียบกับ ฟิล์มเอกซเรย์ และผลการผ่าตัด*

ผลการศึกษา: *ผู้ป่วยทั้งหมด 70 คน เป็นชาย 49 คน และหญิง 21 คน อยู่ในเกณฑ์งานวิจัยทั้งหมด 22 คน โดยแบ่งเป็นภาวะไม่มีรูทวารหนักชนิดต่ำ 14 คน ไม่ใช่ชนิดต่ำ 8 คน ค่าความไว ความจำเพาะและความแม่นยำ ในการตรวจแยกระดับประเภทของภาวะไม่มีรูทวารหนักด้วยการทำอัลตร้าซาวน์ คือ 100%, 92.8% และ 95.4% ตามลำดับ*

สรุป: *การทำอัลตร้าซาวน์สามารถวินิจฉัยระดับประเภทของภาวะไม่มีรูทวารหนักได้อย่างแม่นยำ รวดเร็ว และสามารถทำได้โดยกุมารศัลยแพทย์อย่างปลอดภัย*