Original Article

A Comparative Study between Transperineal Ultrasonography and Prone Lateral Cross-Table Radiography to Differentiate Subtype of Imperforate Anus

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Background: Diagnosis of imperforate anus using transperineal ultrasonography, pouch-perineum distance less than 10 mm has been defined as the cut-off for low type imperforate anus which can be safely treated with immediate anoplasty. While the distance greater than 15 mm has been defined for intermediate and high type imperforate anus, diverted colostomy is still required.

Objective: To compare the accuracy of transperineal ultrasonography to prone lateral cross-table radiography in order to define the type of imperforate anus.

Materials and Methods: Subjects are five neonates with imperforate anus admitted from April 2016 to January 2018. The distance between distal rectal pouch and perineum (P-P distance) was measured with both transperineal ultrasonography and prone lateral cross-table radiography. The transperineal ultrasonographic findings were compared with prone lateral cross-table radiographic and surgical findings.

Results: The mean distance between distal rectal pouch and perineum (P-P distance) in the 5 imperforate anus neonates measured with transperineal ultrasonography, prone lateral cross-table and operative findings were 1.12±0.6 (SD) mm, 1.95±0.85 mm (SD) and 1.20±0.27 (SD) mm, respectively. The P-P distances in transperineal ultrasonography were observed to be more closed to those of precise operative measurement. All patients were classified as low type imperforate anus and underwent immediate anoplasty.

Conclusion: Transperineal ultrasonography is a non-invasive imaging technique that can accurately define the type of imperforate anus. Ultimately, all 5 patients underwent immediate anoplasty with accurate diagnosis.

Keywords: Transperineal ultrasonography (US), Imperforate anus (IA), Pouch-perineum (P-P) distance, Prone lateral cross-table radiography

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Anorectal malformations are congenital anomalies with the terminal portion of hindgut lying partially or completely outside the sphincter mechanism[1], and occurring in approximately 1 in 5,000 live births. Perineal inspection is one of the important clues to identify types of malformations. If meconium is visualized on the perineum, anoplasty is the procedure of choice, whereas meconium presents in urine, colostomy should be more prudent. After 24 hours of life, if meconium is still not present anywhere, a prone lateral cross-table radiography should be obtained to detect level of rectal gas for dictating the proper procedure, immediate anoplasty or diverted colostomy. The distance between distal rectal gas and metallic anal marker is still not documented a cutoff for type of imperforate anus.

The various pre-operative diagnostic modalities, transperineal ultrasonography (US) have been used to determine and differentiate the type of imperforate anus by measuring the distance from the distal rectal pouch to the perineum[2,3]. Cut-off point for diagnosis of low type imperforate anus is less than 10 mm whereas that of greater than 15 mm for intermediate to high type imperforate anus[4]. Due to improvement in US resolution, the transperineal US is applied for identifying the rectal pouch location and fistula. The purpose of this study is to compare the diagnostic accuracy between transperineal ultrasonography and prone lateral cross-table radiography to operative finding[3,5-7].

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Materials and Methods

Patient population and study design

Between April 2016 and January 2018, five newborns with imperforate anus (IA) without meconium appearing on perineum or in urine were recruited, all neonates (4 boys, 1 girl) had transperineal US after birth as soon as possible to determine the type of imperforate anus and to be additionally evaluated on the associated neural, spinal and KUB anomalies. All patients also got prone lateral cross-table radiographies filmed at about 24 hrs of life as standard guideline.

Imagings

All transperineal US were obtained with a high-resolution real-time scanners, 12-5, 14-5 MHz linear array transducers (Toshiba Barrio 200, Philips iU22, Philips CX50 portable). The gray-scale sonograms were obtained by pediatric diagnostic and therapeutic radiologist. Transperineal US was performed before radiographic studies and definitive surgical repair.

The neonates were examined in Lithotomy position, the US transducer was placed in midsagittal plane on the perineum (Figure 1). The distal rectal pouch was identified on the basis of the presence of hypoechoic meconium or gas within the rectum (Figure 2). The distance between that pouch and the perineum was measured with electronic calipers of US; the presence of fistula was also discovered. The distance was then compared with that measured from the prone lateral cross-table radiography and surgical measurement.

For the prone lateral cross-table radiography performed after 20 hrs of life, the babies would be placed in a prone position with hip flexed and elevated up to 45 degrees for at least 3 minutes. The radiographic center was focused on the greater trochanter. A radiologic marker was routinely placed at the expected anal center (Figure 3).

Statistical analysis

Statistical analysis used Descriptive statistics as a mean of study due to a small number of patients. Analyses were carried out using the STATA program version 14.

Figure 1. Patient was position in lithotomy and transducer was placed in the mid-sagittal on the perineum (from: Pediatric surgery, Department of Surgery and Department of diagnostic and therapeutic radiology, Faculty of Medicine Ramathibodi Hospital).

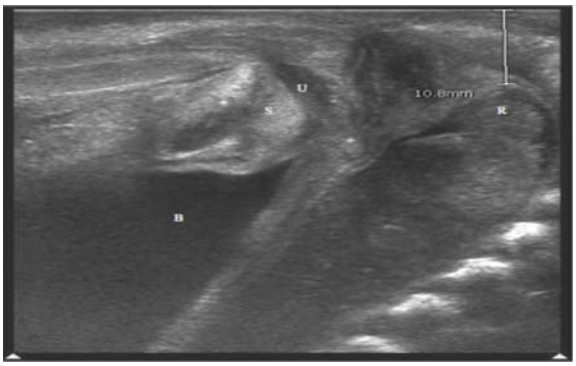

Figure 2. A 23 hr-old boy with imperforate anus without fistula. Pouch-perineum was 10.8 mm (solid line) between distal rectal pouch (R) and perineum. S = pubic symphysis, U = urethra, B = bladder (From: Pediatric surgery, Department of Surgery and Department of diagnostic and therapeutic radiology, Faculty of Medicine Ramathibodi Hospital).

Results

Patient demographics

Patients data, pouch-to-perineum (P-P) distances, radiographic and surgical measurements were summarized in Table 1. Transperineal ultrasonography was feasible in all patients. The mean time of sonography and prone lateral cross-table radiography were 22.48 hr (range, 8 to 41) and 49.61 hr (range, 20.45 to 131.44). All patients were concluded as low IA from ultrasonographic findings. A single patient passed meconium after transperineal ultrasonography was performed, then prone lateral cross-table film was abandoned and went on surgery.

The mean distance measurements from transperineal US and prone lateral cross table films were 1.12 and 1.95 cm (Table 2). The rectocutaneous and rectovaginal fistula were detected on transperineal US of 2 patients. All patients were diagnosed with low type ARM and anoplasties were performed. Rectocutaneous and rectovaginal fistulas were operatively confirmed in 2 patients. Mean P-P distance measurement in operative field was 1.2 cm. The P-P distance graphs from Table 1 (Figure 4) shows nearly the same distance between transperineal ultrasound and operative field findings, and 2 patients had discrepancy in P-P distance measured from prone lateral cross-table film and transperineal ultrasonography in comparison to that of operative measurement.

Discussion

The prone lateral cross-table radiography has been used to identify type of IA but the impacted meconium can

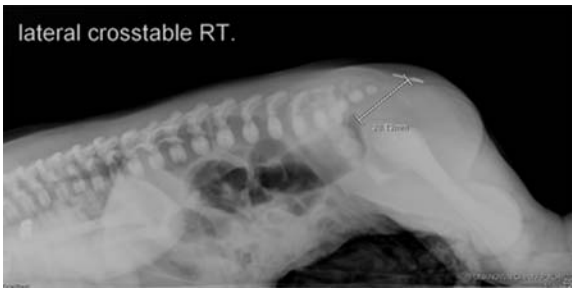

Figure 3. Prone lateral cross-table radiograph revealed high rectum pouch (air above the coccygeal level) (from: Pediatric surgery, Department of Surgery and Department of diagnostic and therapeutic radiology, Faculty of Medicine Ramathibodi Hospital).

prevent gas reaching the most distal rectal pouch, therefore the distal rectal gas may appear higher than it should be. Yeon KM et al reported that IA type was correctly diagnosed by the use of transperineal US in 85%[8]. The advantages of US are the ability to image the distal rectal pouch regardless of whether it is impacted with meconium as well as simplicity, safety, non-radiation exposure, non-invasiveness and additionally, it is not as expensive as MRI or CT scan. The roles of its use for IA are to determine the level of distal rectal pouch and location of internal fistula. It is also able to determine associated anomalies such as KUB and vertebral anomalies[8,9]. However, the discrepancy in P-P distance measurement may be caused by degree of pouch distension, probe pressure on the perineum and may relate to age of neonate at the time of examination[8].

There were 2 patients that prone lateral cross-table radiography showed high type IA with the P-P distance 2.8 and 2.56 cm, whereas in transperineal US they were classified as low type IA with the P-P distance 1.1 and 1 cm. All of them underwent anoplasty without colostomy and the intraoperative measurements were 1.5 cm in both patients, confirming the ultrasonographic measurement.

The accuracy of pre-operative identification of fistula and distal rectal pouch distance is key to determining the optimal surgical procedure. With the improvement in US resolution, the transperineal US becomes an excellent modality to determine internal fistula or type of IA[3,5-7]. From our study, the IA types were correctly diagnosed by the use of only transperineal US in all patients (100%). Taking into consideration the advantages and the high accuracy of transperineal US, it can be used as an initial modality instead of prone lateral cross-table radiography for IA-type diagnosis.

Limitations of our study

There are small number of patients, new experience on transperineal approach for well-trained sonographers and the lack of standard reference in measurement for various body sizes

Table 1. Patients' data, pouch-to-perineum (P-P) distance, radiographic and surgical measurements

Patient	Time to transperineal ultrasound (hr.)	Distance between distal rectal pouch and perineum (cm)	Time to prone lateral cross-table (hr.)	Distance between distal rectal pouch and perineum (cm)	Time to surgery (hr.)	Distance between distal rectal pouch and perineum (cm)	Definite diagnosis
ID 1	20.54	1	Not done due to pass meconium from area above anal dimpling R/O Rectocutaneous fistula	-	42.3	1	Rectocutaneous fistula
ID 2	41.43	1.4	131.44	1.1	155	1	Rectovaginal fistula
ID 3	22.45	1.1	22.56	1.35	25	1	IA without fistula
ID 4	20	1	24	2.56	28	1.5	IA without fistula
ID 5	8	1.1	20.45	2.8	24	1.5	IA without fistula

Table 2. Demographic of Pouch-to-perineum (P-P) distance on transperineal ultrasound, prone lateral cross-table film and surgical measurement

Data	Mean	SD	Median	Range	Mean different (base on surgery)
Time (hr)					
Surgery	54.86	±56.46	28	24, 155	-
Transperineal ultrasound	22.48	±12.03	20.54	8, 41.43	-32.38
Prone lateral cross-table	49.61	±54.57	23.28	20.45, 131.44	-5.25
Distance between distal rectal pouch and perineum (cm)					
Surgery	1.20	±0.27	1	1.0, 1.5	-
Transperineal ultrasound	1.12	±0.16	1.1	1, 1.4	-0.08
Prone lateral cross-table	1.95	±0.85	1.95	1.1, 2.8	0.75

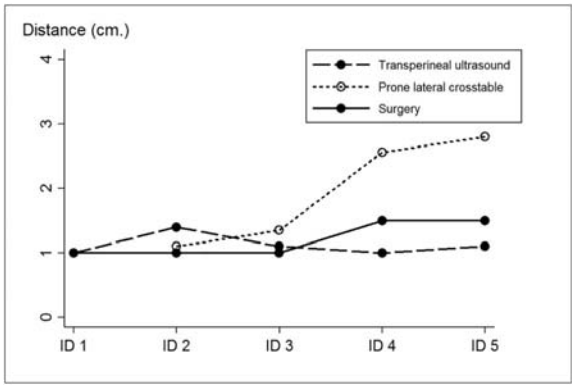

Figure 4. P-P distance graphs from Table 1.

Conclusion

From the previous studies[5-9], the transperineal US is more efficient than prone lateral cross-table radiography. It is worse to use transperineal US as an imaging of choice to determine the type of IA in neonatal period for deciding the definitive procedure of choice. Newly-trained ultrasonographers in the area of perineum still can detect the internal fistula with variation in P-P distances depending on axis of ultrasound probe.

The transperineal US should be encouraged to be used as diagnostic test instead of prone lateral cross-table radiography. Even with a small number of patients, the advantage of transperineal US in dictating the treatment plan in 2 patients (40% of cases) support the usefulness of this modality.

Acknowledgements

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What is already known on this topic?

Transperineal US has reliable accuracy in identification type of IA and should be encouraged to be diagnostic test instead of prone lateral cross-table radiography.

What this study adds?

Transperineal US is an excellent modality to determine the type of IA and guide for optimal surgical procedure.

Potential conflicts of interest

The authors declare no conflicts of interest.

References

1. Levitt MA, Pena A. Anorectal malformations. In: Scott Adzick N, editors. Pediatric surgery. 7th ed. Philadelphia: Mosby; 2012. p. 1289-309.
2. Teele RL, Share JC. Transperineal sonography in children. AJR Am J Roentgenol 1997;168:1263-7.
3. Kim IO, Han TI, Kim WS, Yeon KM. Transperineal ultrasonography in imperforate anus: identification of the internal fistula. J Ultrasound Med 2000;19:211-6.
4. Haber HP, Seitz G, Warmann SW, Fuchs J. Transperineal sonography for determination of the type of imperforate anus. AJR Am J Roentgenol 2007;189:1525-9.
5. Hosokawa T, Hosokawa M, Tanami Y, Hattori S, Sato Y, Tanaka Y, et al. Comparison of diagnostic accuracy for the low-type imperforate anus between prone cross-table radiography and sonography. J Ultrasound Med 2017;36:1679-86.
6. Nemati M, Oskouei RA, Aslanabadi S. Assessment of diagnostic value of transperineal ultrasonography in determining type of imperforate anus. J Am Sci 2013;9:91-5.
7. Niedzielski JK. Invertography versus ultrasonography and distal colostography for the determination of bowel-skin distance in children with anorectal malformations. Eur J Pediatr Surg 2005;15:262-7.
8. Choi YH, Kim IO, Cheon JE, Kim WS, Yeon KM. Imperforate anus: determination of type using transperineal ultrasonography. Korean J Radiol 2009;10:355-60.
9. Alehossein M, Mollaeian M, Salamati P. Validity of transperineal ultrasound in infants with imperforate anus. Iran J Radiol 2004;2:43-7.