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The impact of preoperative ultrasound on correct diagnosis of urachal remnants in children

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Abstract

Background: Ultrasound is a noninvasive imaging method used widely in urachal diagnostics. This study investigated the effectiveness of ultrasonography in correctly depicting urachal anomalies in children.

Methods: Preoperative ultrasound findings of all patients who were operated on for suspected urachal anomalies between 1990 and 2008 were retrospectively compared with the final diagnosis.

Results: Fifty-three patients (31 female, 22 male; ~2.6 years; range, 0-17 years) were reviewed. In 37 patients, the final diagnosis of an urachal anomaly matched the ultrasound findings. In 7 patients, there was a false-positive ultrasound finding, and in 9 patients, there was a false-negative ultrasound finding. Three of 4 patients with urachal cysts, 23 of 29 patients with urachal fistulas, and 8 of 10 patients with urachal sinuses were correctly identified by ultrasonography. In 10 patients, no urachal rests were found intraoperatively: in 7 of these patients, urachal rests were falsely suspected by ultrasound. The positive predictive value for ultrasound is 83%, whereas the negative predictive value is 25%. The sensitivity for this diagnostic method is 79% and the specificity 30%.

Conclusions: Ultrasound helps to identify urachal anomalies in case of their presence but is not helpful to rule out a nonexisting urachal anomaly.

The urachus is a fibrous midline cord that extends from the dome of the bladder to the umbilicus. Its embryologic origin represents an incomplete regression of the allantois—a fingerlike derivate of the yolk sac that connects to the cloaca—the cephalic extension of the urogenital sinus [1-4]. When the fetal bladder descends from the umbilicus into the pelvis around the fourth or fifth month of gestation, the allantois stretches and progressively narrows to an epithelialized fibromuscular tubular structure, the urachus, which progressively obliterates by fibrous proliferation and remains as a fibrous band lying in the pyramidal, retropubic, preperitoneal perivesical space between the transverse fascia and the parietal peritoneum [4,5]. Its length varies from 3 to 10 cm and from 8 to 10 mm in diameter [6,7].

A patency of the embryologic urachal remnant after birth may give rise to various clinical problems. Symptoms of a patent urachal anomaly include umbilical discharge, local infection, lower abdominal pain, and urinary tract infection, although an urachal remnant may also be asymptomatic [8,9]. In adult life, urachal tissue may give rise to urachal tumors being either benign or malignant [10-14]. Although, urachal malignancies are very rare (0.17%-0.34% of all bladder neoplasms), they are associated with a

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poor outcome, because they have often already metastasized at presentation [14-17].

In general, urachal remnants are considered rare. Regarding pediatric autopsy studies, the incidences of 1 in 7,610 cases for patent urachus and 1 in 5,000 cases for urachal cysts have been documented [18].

The definitive preoperative diagnosis may be difficult to make because patients may have nonspecific symptoms. Multiple diagnostic imaging methods such as ultrasonography (US), computed tomography (CT), voiding cystourethrogram (VCUG), or fistulography have been used in finding the accurate diagnosis. Ultrasonography has been described as an excellent modality for evaluation of the urachus and has been recommended as the initial imaging tool in urachal diagnostics [19-21]. Nevertheless, US results may not always be of additional information to clinical signs and symptoms and may be inaccurate. Furthermore, US results depend on the examiner who needs expertise in US technique and knowledge of the anatomy of the urachal remnant [22].

This study aimed at evaluating retrospectively the impact of ultrasound examination on finding the correct diagnosis in children who underwent surgery for a suspected urachal anomaly.

1. Materials and methods

We performed a retrospective medical record review of all pediatric patients who were operated for suspected urachal anomalies and underwent preoperative US examination between 1990 and 2008. Ultrasonography examinations were performed by a number of pediatric surgeons and/or pediatric radiologists (7 pediatric surgeons and 3 pediatric radiologists) who were all well trained in the US technique. There was no difference in the equipment used by pediatric surgeons and/or pediatric radiologists. The decision for surgical excision of the urachus was driven by the clinical signs and symptoms such as umbilical discharge, umbilical infection, umbilical granuloma, and associated abdominal pain and/or urinary tract infection. Ultrasound findings were also included into the decision making concerning operative exploration of the suspected urachal anomaly. The final diagnosis of an urachal remnant disease was defined on the basis of the intraoperative findings and histopathologic results. The final diagnosis was then compared with preoperative US findings. The impact of US results on the correct diagnosis was evaluated for sensitivity, specificity, and positive and negative predictive values.

2. Results

Fifty-three patients operated for suspected urachal remnant during the study period were included into the study. There were 31 girls (59%) and 22 boys (41%), with a median age of 2.6 years (range, 1 month-17 years). Clinical signs and symptoms of an urachal anomaly included umbilical discharge, umbilical granuloma, inflamed umbilicus, abdominal pain, and urinary tract infection (Table 1). Further 7 patients (5 patients with a patent urachus, 1 patient with an umbilicourachal sinus, and 1 patient with an urachal diverticulum) received surgery for urachal anomaly during the study period but did not undergo a preoperative US examination and could therefore not be included into the present study.

Ultrasonography disclosed urachal anomalies such as patent urachus (n = 26), umbilicourachal sinus (n = 8), and urachal cyst (n = 7) in 41 cases. In 12 patients, US examination was interpreted as being nondiagnostic for urachal anomalies. Despite of the negative US findings, surgery was performed in these latter patients because of the clinical symptoms suspicious for an urachal anomaly. These were umbilical discharge (in 8 patients), umbilical granuloma (in 4 patients), inflamed umbilicus (in 5 patients), lower abdominal pain (in 2 patients), and urinary tract infection (in 1 patient). In 9 of these patients, an urachal anomaly was found intraoperatively with the final diagnosis of a patent urachus in 6, an umbilicourachal sinus in 2, and an urachal cyst in 1 patient. Three of the latter patients had an additional omphaloenteric duct that was also excised. In the remaining 3 of those 12 patients with nondiagnostic US findings, the negative US diagnosis for an urachal remnant was confirmed intraoperatively and histopathologically; the final diagnoses were a squamous cyst, an obliterated urachus–fibrous cord, and an omphaloenteric duct.

Comparing the definite diagnosis of an urachal anomaly with the clinical symptoms at presentation, we found that umbilical discharge was the main symptom in most patients with patent urachus and umbilicourachal sinuses, whereas patients with an urachal cyst presented mainly with abdominal pain (Table 2).

Comparing US findings to the definite diagnosis (Table 3) led to the results that in 37 patients (70%), the final diagnosis of an urachal anomaly correctly matched the preoperative ultrasound results. Ultrasonography correctly identified 3 of 4 patients with urachal cysts, 23 of 29 patients with a patent urachus, and 8 of 10 patients with umbilicourachal sinuses. Three of 10 patients who did not have any urachal remnant at surgery and histopathology were correctly identified by ultrasound as negative for an urachal anomaly. In the

Table 1 Clinical symptoms at presentation (n = 53)

	Umbilical discharge	Umbilical granuloma	Inflamed umbilicus	Abdominal pain	Urinary tract infection
No. of patients, n (%)	41 (77)	23 (43)	14 (26)	8 (15)	4 (7.5)