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ORIGINAL ARTICLE

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Testicular microlithiasis in children: sonographic features and clinical implications

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Abstract *Background*: The natural history of incidentally discovered testicular microlithiasis in children has not been well defined. Although a benign condition, this entity has been found to be associated with testicular malignancies. *Objective*: To determine the spectrum of sonographic findings and clinical implications in children with testicular microlithiasis. *Materials and methods*: During a 3.5-year period, 850 scrotal examinations with grey-scale US detected testicular microlithiasis in 16 boys (1.9%), age range 6–18 years. The US records of these patients were retrospectively analysed for distribution and pattern of this finding. The presence of intratesticular pathology was determined and the medical records and pathological reports were reviewed. In five patients, US re-evaluation up to 6 years could be performed. *Results*: Typical punctate hyperechoic foci were found bilaterally in all cases except five, which showed only unilateral foci. Additional pathology was depicted in four patients (chorioncarcinoma $n=1$; a cystic lesion in a patient with a large-cell calcifying Sertoli-cell tumour, $n=1$; diffuse structural alterations after orchidopexy, $n=2$). No testicular tumour developed during clinical follow-up. *Conclusions*: The association with benign and malignant testicular tumours, as described in adults, also seems valid in the paediatric age group. Therefore, children with testicular microlithiasis should have clinical and US long-term follow-up.

Keywords Testis · Microlithiasis · Calculi · Ultrasound · Infants and children

Introduction

Testicular microlithiasis (TM) is a well known, but rare finding in the paediatric age group. The typical US appearance of this disease consists of diffuse, intratesticular, non-shadowing echogenic foci [1, 2, 3]. Although reports indicate up to 40% association of TM with germ cell neoplasms in adults [1], the natural course of this entity remains unclear. We retrospectively analysed 16 patients to evaluate the US spectrum of TM, clinical outcome and associated testicular pathology in children.

Materials and methods

Sixteen consecutive patients with characteristic TM who underwent US examination in our institution between January 1996 and July 1999 were retrospectively evaluated. Their ages ranged between 6 and 18 years (mean 10.5 years). All US examinations were performed with the same equipment (model 128XP, Acuson, Mountain View, Calif.), using a 7.5-MHz linear-array transducer.

In each case we examined the complete inguinal region and scrotal contents bilaterally in different planes to compare both sides with regard to morphological abnormalities and to detect additional pathological findings (e.g. testicular retention). Testicular volumes were obtained using the approximation of a prolate

ellipsoid: volume = length×width×depth×0.523. Individual testicular volume was analysed according to age groups [4].

All US scans were evaluated with regard to number, pattern and distribution of testicular microcalcifications. The number of calcifications was roughly quantified as few (5–50) or multiple (over 50) in a single representative plane. Patients with isolated echogenic foci were excluded from this series. The distribution was characterised as diffuse or focal and unilateral or bilateral. Focal distribution was defined as clustering of foci in one-third only or in the periphery of the testicular parenchyma. Follow-up examinations up to 6 years (mean 19 months) in five patients were performed. Finally, the medical and pathological records of all patients were evaluated.

Results

The indications for initial referral are summarised in Table 1. US examination of a palpable scrotal mass revealed two patients with varicocoele and one with no abnormality except TM. A boy scanned after trauma showed an inguinal haematoma.

In 16 patients (1.9%), US exhibited the typical pattern of hyperechoic small foci in the testicular parenchyma without acoustic shadowing. TM was bilateral in 11 boys and unilateral in five, four of whom had unilateral disease after orchidopexy and one with an inguinal testis. In all but one patient the distribution of TM was a diffuse pattern with small foci scattered throughout the parenchyma (Fig. 1). In one boy only with Wilms' tumour and a symptomatic varicocoele, TM was clustered in the periphery (Fig. 2). Symmetry of echogenic foci was present in 15 boys; only the patient with symptomatic varicocoele showed side-to-side asymmetry. In four patients (two with retained testes, one with a spermatocoele and one with chorioncarcinoma) US depicted multiple calcifications; the others revealed only a few echogenic foci.

Testicular volumes were diminished in two boys after orchidopexy, two patients with inguinal testes and one with a spermatocoele. The initial US examination of the 13-year-old patient with metastatic germ-cell neoplasm revealed a hypoechoic lesion in his left testis (Fig. 3) and a retroperitoneal mass. He first presented with dyspnoea and a chest radiograph showed multiple metastases. Orchidectomy after multiple courses of chemotherapy gave histopathological proof of germ-cell tumour.

Table 1. Indications for testicular ultrasound

	No. of patients
After orchidopexy	4
Cryptorchidism	4
Peutz-Jeghers syndrome	2
Palpable scrotal mass	3
Trauma	1
Pulmonary metastases	1
ALL	1

Multiple US examinations of the two patients with histologically proven, large-cell, calcifying Sertoli-cell tumour associated with Peutz-Jeghers syndrome, failed to show any abnormality except TM. One of these boys demonstrated a testicular cystic lesion 4 years after initial diagnosis.

Re-evaluation of five patients was possible up to 6 years. One patient with a Sertoli-cell tumour showed reduction in the size of the echogenic foci over a period of 4 years. In all other boys the number and pattern of TM remained unchanged. Pathological results were available in four patients. Intratubular microcalcification was confirmed in three, while in one patient, sonographically detectable TM was not present in the biopsy specimen.

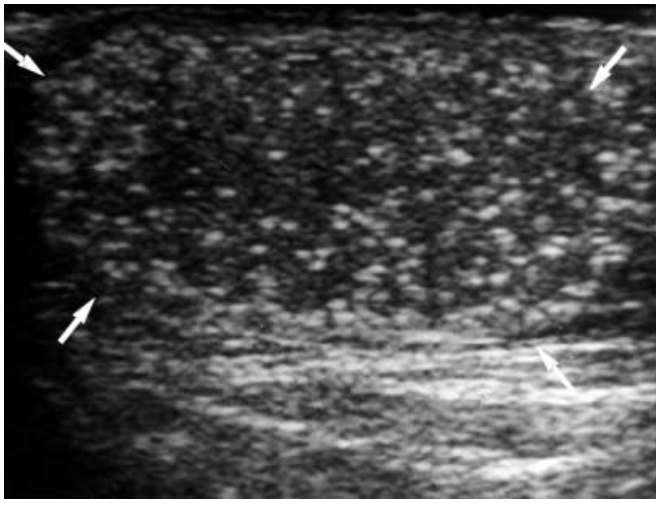

Fig. 1. Sagittal US in a 13-year-old boy shows innumerable echogenic foci in an otherwise unremarkable testis (*arrows*)

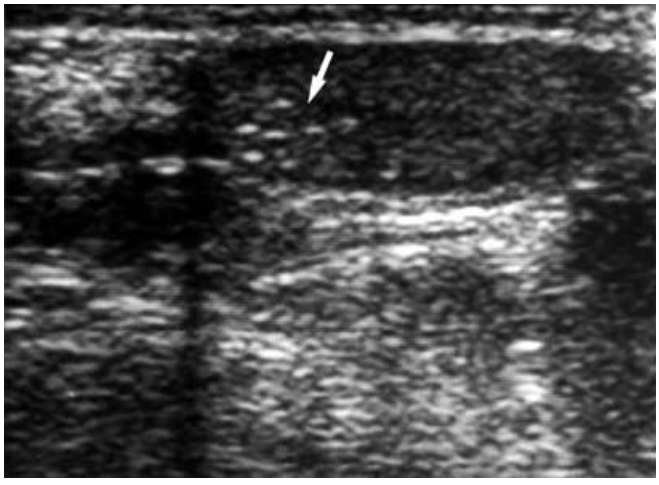

Fig. 2. Sagittal US in a 7-year-old boy with few foci (*arrow*) clustered in the upper third of the testicular paenchyma

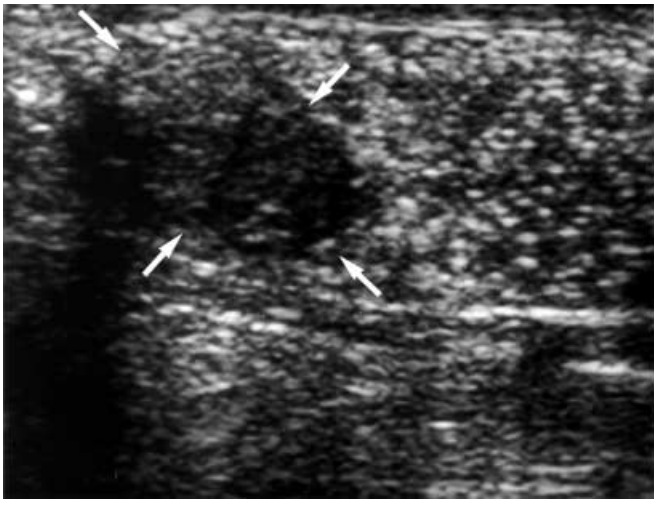

Fig. 3. Sagittal US in a 13-year-old boy demonstrates diffuse microlithiasis and a hypoechoic area (*arrows*) at the upper pole of the left testis representing a germ-cell tumour

Discussion

Since the observation of Priebe and Garret [5], TM has become a well-recognised US entity with a proven histological background of intratubular calcifications originating from atrophied and degenerated tubular cells [6, 7]. Initial reports indicated a distinctive pattern with diffuse, bilateral and symmetrical distribution of small foci of high echogenicity throughout the testicular parenchyma [1, 2, 3, 6, 8]. Recent publications coincide with our findings of greater variability of the US appearance [9, 10, 11, 12]. In our study, four boys who had undergone orchidopexy and one with an inguinal testis showed unilateral calcifications. Furness et al. [13] found 21 bilateral and five unilateral cases, but concomitant diagnoses were not specified. Thomas et al. [14] noted unilateral TM only in infertile men; five of their patients had minimal and five had marked calcification. Regarding the degree of involvement, we found only four patients (25%) with multiple echogenic foci; all but one had diffuse and symmetrical alterations. Because of variability of field of view, beam profile and spatial resolution, we did not adopt the arbitrary classification of TM into classic and limited disease used by Bennett et al. [15]. The retrospective study of Backus et al. [1] on 42 patients with an age range of 14–70 years showed 8 cases (19%) with multiple (over 50) microliths. In 30 (71%) patients, the foci were distributed in a diffuse pattern; symmetry of TM was present in 28 (67%) patients.

Because TM is asymptomatic and coexists with benign and malignant conditions, the true incidence of these microcalcifications in adults and children is unknown. Prior to high-resolution US, the diagnosis of TM was established by testicular biopsy or orchidectomy. Nistal et al. [16] observed only 1 case (0.05%) among 2,100 autopsies in boys and 1 case (0.16%) among 618 testicular biopsies done in children. They found a low mean tubular diameter and postulated an initial tubular dysgenesis. In most cases with sonographically detected microlithiasis, pathology specimens show lamellated calcified bodies [3]. In agreement with our experience, some pathology examinations fail to prove TM diagnosed by US. No calcifications were observed in two patients with TM and orchidectomy secondary to necrosis by Furness et al. [13]. Backus et al. [1] reported 11 patients with typical TM and no pathological evidence of microliths, probably related to problems with preparation or sampling error.

Table 2. Reported cases of pediatric patients with TM

Reference	No. of patients
Furness et al. [13]	26
Dell'Acqua et al. [11]	6
Nistal et al. [16]	4
Vegni-Talluri et al. [7]	4
Weinberg et al. [40]	1
Moran et al. [41]	1
Kwan et al. [22]	1
Jaramillo et al. [23]	1

The incidence of TM in adults varies between 0.6 and 2% [8, 10, 17, 18], but studies in men with infertility, oligospermia and suspected testicular tumour revealed higher rates between 1.3 and 9% [9, 14, 19, 20]. In our study, 16 patients (1.9%) showed microcalcifications. Table 2 lists case reports of TM in the paediatric age group. The studies of Janzen et al. [3] and Backus et al. [1] included children, but patient age was not clearly specified.

Testicular calcifications are found in cryptorchidism [3, 6, 9, 16, 21], infertility/subfertility [3, 9, 10], varicocoele [3, 9], epididymitis [3], torsion of the testis or appendix testis [10, 22, 23] and testicular intraepithelial neoplasia [24]. An association between rare diseases such as Klinefelter's syndrome, Sertoli-cell tumour with gynaecomastia [13] and alveolar microlithiasis [25] is also reported. In our study, two patients with large-cell, calcifying Sertoli-cell tumour and TM failed to show the diffuse increase of testicular echogenicity reported by other authors [26].

The association of TM with concurrently diagnosed testicular and extratesticular malignancy in adults is well known; a review of the literature reveals an incidence between 15 and 45% [2, 8, 10, 18, 20, 27, 28]. Scrotal US studies by Breen et al. [17] and Cast et al. [29] emphasize a 19.8–21.6-fold relative risk of tumour development in the setting of TM.

There are only a few reports of testicular tumour in association with TM in the paediatric population. McEniff et al. [30] discovered a yolk-sac tumour of the

testis on a routine annual US of a 17-year-old boy. Howard et al. [31] reported a 15-year-old-boy with a mediastinal germ-cell tumour and bilateral microlithiasis. Unfortunately, age groups are not clearly specified by some authors [3, 27, 32].

The natural history of TM in adults and children is not well defined, but review of the current literature reveals seven cases of interval testicular tumour development [30, 33, 34, 35, 36, 37, 38]. Average patient age was 25 years (range 11–47 years) and average time between diagnosis of TM and testicular tumour was 45 months (range 6–132 months). For the paediatric age group, McEniff et al. [30] and Bieger et al. [37] encountered tumour development 4–6 years after the diagnosis of TM. Other authors have not verified these findings, probably because of insufficient duration of follow-up. In our study, re-evaluation of five patients up to 6 years showed no testicular tumour.

Until now, the risk of tumour development in a testis with previously diagnosed TM is unknown and recommendations for follow-up examinations in the literature are controversial. Routine US every 6–12 months, monitoring of tumour markers and education of patients about the association of TM and testicular malignancy are suggested by many authors [10, 29, 33, 34, 35, 39]. Because of the low risk of tumour development in patients with isolated TM, Bennett et al. [15] did not recommend regular US follow-up. For epidemiological reasons, Rosenfield [39] advocated yearly screening in adults between 20 and 50 years. Miller et al. [27] suggested CT scans of the abdomen and chest to exclude extratesticular germ-cell neoplasms, but chest radiographs and abdominal US examinations seem more suitable for children [31]. Testicular biopsy or surgical treatment should only be considered in patients with focal lesions [11, 13].

Since the introduction of high-resolution US into paediatric sonography, TM is being observed more frequently. To our present knowledge, the occurrence of TM is related to atrophy and degeneration of seminiferous tubules and may increase the potential for metachronous tumour development. Our findings indicate that TM in children shows variability of US appearance and can be associated with benign and malignant testicular tumours. Therefore, multi-institutional and prospective studies in children with TM should be started. Especially in children, close clinical and annual US follow-up until the age of peak incidence of germ-cell tumours seems to be indicated.

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