



ADDRESS

Timisoara, Romania
Gospodarilor Street, nr. 42
Tel: +4-0256-439441
cod 300778
e-mail: boiaeugen@yahoo.com

JURNALUL PEDIATRULUI – Year XXII,
Vol. XXI, Nr. 87-88, july-december 2019
www.jurnalulpediatrului.ro
ISSN 2065 – 4855

REVISTA SOCIETĂȚII ROMÂNE
DE CHIRURGIE PEDIATRICĂ
www.srcp.ro

EDITOR IN CHIEF

Eugen Sorin BOIA

CO-EDITORS

Radu Emil IACOB

Liviu POP

Maria TRAILESCU

SECRETARY

Radu Emil IACOB

Vlad Laurentiu DAVID

EDITORIAL BOARD

O Adam

Valerica Belengeanu

Marioara Boia

Rodica Elena Cornean

A Craciun

M Gafencu

Daniela Iacob

Otilia Marginean

A Pirvan

CM Popoiu

Maria Puiu

R Spataru

I Velea

EDITORIAL CONSULTANTS

M Ardelean – Salzburg, Austria
Valerica Belengeanu – Timisoara, Romania
Jana Bernic – Chisinau, Moldavia
ES Boia – Timisoara, Romania
Maria Bortun – Timisoara, Romania
V Fluture – Timisoara, Romania
S Garofallo – Milano, Italy
DG Gotia – Iasi, Romania
C Ilie – Timisoara, Romania
Tamás Kovács – Szeged, Hungary
Silvo Lipovšek – Maribor, Slovenia
E Lazăr – Timisoara, Romania
J Mayr – Basel, Switzerland
Eva Nemes – Craiova, Romania
Gloria Pelizzo – Pavia, Italy
L Pop – Timisoara, Romania
I Popa – Timisoara, Romania
Maria Puiu – Timisoara, Romania
J Schalamon – Graz, Austria
I Simedrea – Timisoara, Romania
R Spataru – Bucuresti, Romania
Penka Stefanova - Plovdiv, Bulgaria
C Tica – Constanta, Romania
I Velea – Timisoara, Romania
Gabriela Zaharie – Cluj-Napoca, Romania

CONTENTS

1. MODIFIED K-WIRE PIN ENTRY POINT PLACEMENT METHOD IN DISPLACED PEDIATRIC DISTAL FOREARM FRACTURES NF Țepeneu.....	3
2. GITELMAN SYNDROME - THE IMPORTANCE OF IONOGRAM AND BLOOD GASES IN DIAGNOSIS R Stroescu, M Gafencu, G Doros, R Isac, C Olariu, M Gligor, A Nicolescu, O Marginean.....	9
3. FUTURE PROSPECTS IN THE TREATMENT OF PEDIATRIC BURNS. A REVIEW OF THE NILE TILAPIA DERIVED BIOLOGICAL OPTIONS FOR TREATING SUPERFICIAL PARTIAL THICKNESS BURNS B Ciornei, VL David, ES Boia	14
4. INTERCEPTIVE ORTHODONTICS IN PRIMARY AND MIXED DENTITION: THE IMPORTANCE OF EARLY DIAGNOSIS R Oancea, C Funieru, R Sfeatcu, D Jumanca.....	18
5. UNEXPECTED CAUSE OF RECURRENT VOMITTING IN AN INFANT A Pilsu, C Pienar, L Bota, V David, L Pop.....	25
6. POSSIBILITIES AND LIMITS OF ENDOCRINE IMAGING IN CHILDREN R Stroescu, T Bizerea, M Gafencu, G Doros, O Marginean.....	29
7. CONGENITAL PERINEAL LIPOMA IN A FEMALE NEWBORN – CASE REPORT FD Enache, A Nicolau.....	38
8. ORAL HEALTH PROFILE, KNOWLEDGE AND BEHAVIOUR IN A GROUP OF PRESCHOOLERS – A PILOT STUDY R Sfeatcu, R Oancea, IM Gheorghiu, A Totan	41
9. VARIATIONS OF THE REX BYPASS FOR EXTRAHEPATIC PORTAL VEIN OBSTRUCTION. REVIEW OF THE LITERATURE IA Dumitru, V Zembrod, ER Iacob, VL David, ES Boia.....	45
10. NEONATAL ISCHEMIA OF THE LOWER LIMB – CASE REPORT S Cerbu, F Bîrsășteanu, ER Heredea, D Iacob, ER Iacob, MC Stănciulescu, CE Timofte, DM Timofte, ES Boia.....	51
11. DARIER-WHITE DISEASE: GENETIC DETERMINISM FOR VESICULOBULLOUS REACTIONS RZ Ionescu.....	55
12. SYSTEMIC DISEASES AND DISORDERS INVOLVED IN ORAL MUCOSA AND PERIODONTIUM PATHOLOGY IN CHILDREN: A CROSS-SECTIONAL CLINICAL SURVEY IN BUCHAREST C Funieru, R Oancea, M Cărămidă, E Funieru, RI Sfeatcu.....	59
13. HYDATID CYST IN CHILDREN-15 YEARS OF EXPERIENCE P Fuicu, CM Popoiu, N Babeu, ER Iacob, ES Boia.....	62
MANUSCRIPT REQUIREMENTS.....	69

MODIFIED K-WIRE PIN ENTRY POINT PLACEMENT METHOD IN DISPLACED PEDIATRIC DISTAL FOREARM FRACTURES

NF Țepeneu¹

Abstract

In completely displaced pediatric distal metaphyseal forearm fractures, achieving satisfactory reduction with closed manipulation and maintenance of reduction with casting is difficult. Therefore, the majority of these fractures requires closed or open reduction of the fracture and osteosynthesis of the radius or radius and ulna. There are mainly two established methods for closed reduction and K-wire fixation of these fractures, which basically both derive from the technique used in adult displaced distal radial fractures: the Willenegger and the Kapandji technique. 23 pediatric patients with displaced distal metaphyseal forearm fractures in children 6 to 14 years old were treated with closed reduction and K wire fixation with modified radial entry points. In all patients 2 radial Kirschner wires were used for osteosynthesis of the radius.

Postoperative immobilization was enforced for 3 to 6 weeks with a short arm plaster of Paris cast, after which time the K-wires were removed. Patients were followed for a minimum of 3 months. Mean patient age was 9.5 years. Near-anatomical reduction was achieved in all fractures. On follow-up, there was no loss of reduction; remanipulation was not performed in any case. There was 1 pin-related complication, where the pins were left outside the skin. In 11 cases the pins were left over the skin, in 12 cases the pins were buried under the skin. All fractures healed, and full function of the wrist and forearm was achieved in every case.

Keywords: distal metaphyseal forearm fractures, K-wire fixation

Introduction

Forearm fractures are the most common long bone fractures in children. Among all forearm fractures, the distal radius and ulna are most commonly affected. Due to the greater forces borne and imparted to the radius, as well as the increased porosity of the distal radial metaphysis,

distal radial fractures are far more common than distal ulnar fractures and so, isolated distal radius fractures do occur regularly [1]. However, fractures of the distal ulna most often occur in

association with fractures of the distal radius. Whereas undisplaced fractures are generally treated by nonsurgical methods, completely displaced and angulated fractures are treated by several methods, including closed reduction and casting under anesthesia, closed reduction and percutaneous K-wiring under anesthesia, and open reduction and K-wiring.

Achieving good reduction of the fracture may be difficult by a regular closed technique consisting of traction and fracture manipulation. The bayonet deformity is difficult to overcome in several cases. Traction was found to be ineffective in many cases, especially in intact ulnar or greenstick ulnar fractures, and completion of a greenstick ulnar fracture or osteoclasia of an intact ulna has been suggested to obtain radial fracture reduction [2-5].

In displaced distal forearm fractures loss of reduction and redisplacement after closed manipulation and casting is frequent. The risk factors for redisplacement can be categorized into primary and secondary factors. The primary factors include age older than 10 years, complete initial displacement, fracture translation greater than 50%, angulation greater than 20°, oblique fracture line, presence of comminution, dorsal bayonet pattern, both bones fractured at the same level. Secondary factors include failure to achieve initial perfect reduction, suboptimal casting technique with a cast index greater than 0.8, repeated reduction maneuvers, and reduction under sedation or hematoma block rather than general anesthesia [6].

Although mild angulations remodel well, especially in smaller children, remodeling may take several months and may be incomplete in older children. Deviations (dorsal angulation or radial deviation) more than 30° after age 8 years, more than 20° after age 10 years, and more than 15° after age 13 years may not achieve spontaneous remodeling through the growth process [7,8]. Loss of fracture reduction may necessitate remanipulation, open reduction, calloclasis or osteoclasia, and fixation with K-wire or plate and screws, depending on the timing of the procedure after initial injury and the age of the patient. Several authors consider initial complete displacement a major risk factor for re-displacement [9,10].

¹Department of Pediatric Surgery, "Victor Babes" University of Medicine and Pharmacy Timișoara
E-mail: tepeneu.narcis@umft.ro

Materials and method

Over a period of 3 years patients younger than 15 years who sustained completely displaced, closed, nonphyseal distal forearm fractures were retrospectively enrolled in the study.

23 pediatric patients with displaced distal metaphyseal forearm fractures in children 6 to 14 years old were treated with closed reduction and K wire fixation with modified radial entry points. Preoperative antero-posterior (AP) and lateral radiographs were obtained. Informed consent for the surgical procedure was obtained from the parents or caregivers.

After suitable anesthesia, the limb was placed on a radiolucent side table. Closed reduction of the fracture was obtained in all cases. 1.5-mm K-wires were used in smaller children, and 1,8-mm or 2-mm K-wire were used in larger children.

Under fluoroscopic control a Kirschner wire (No. 1) was passed slowly through the distal radius into the medullary canal. With this type of osteosynthesis the fracture was stabilized so that there was no redisplacement during intraoperative manipulation. Then a small incision

was made over the radial styloid process and under protection of the radial sensory nerve and extensor tendons a smooth pin (No. 2) is then inserted into the distal fracture fragment and passed obliquely in a proximal and ulnar fashion, crossing the fracture site and engaging the far ulnar cortex proximal to the fracture line. Fluoroscopy is used to guide proper fracture reduction and pin placement. The pin may be placed within the distal radial epiphysis and passed across the physis before engaging the more proximal metaphyseal fracture fragment. Alternatively, the pin may be placed just proximal to the distal radial physis; while theoretically decreasing the risk of physeal disturbance, this has not been well demonstrated in the published literature.

Stability of the fracture was then evaluated with flexion and extension and rotatory stress under fluoroscopy.

In all patients 2 Kirschner wires were used for osteosynthesis of the radius. With this kind of osteosynthesis the fractures were found to be stable only with osteosynthesis of the radius and no additional pins had to be used.

The K-wires were bent just outside the skin and cut or buried under the skin (Figure 1 and Figure 2).



Figure 1 - Preoperative X-ray: displaced distal metaphyseal radius fracture with a greenstick distal metaphyseal ulnar fracture.



Figure 2 – Healed fracture with K-wires in situ (before removal).

In 11 cases the pins were left outside the skin, in 12 cases the pins were buried under the skin. Sterile gauze dressings were positioned between the K-wire and the skin's surface in cases where the K-wires were left outside the skin.

A well-padded below-elbow split plaster of Paris cast or a splint was placed in all cases after K-wiring. Postoperative analgesia was obtained with oral medication with Paracetamol or Ibuprofen or a combination of both. The patients were all discharged the next day after surgery.

Postoperative AP and lateral radiographs were obtained before discharge. An initial review was performed on postoperative day 3, then on postoperative day 7. In cases where the pins left were left outside the skin the

dressings were changed weekly. All other cases were seen only at 7 days and 3 to 6 weeks after surgery.

After 3 to 6 weeks, radiographs were obtained. If healing was satisfactory, K-wire removal was performed as an out-patient procedure in the cases where the K-wires were left outside of the skin and under general anesthesia in cases where the K-wires were buried under the skin.

A compression bandage was applied, and wrist mobilization was started after K-wire removal. Patients were followed for a minimum of 3 months postoperatively. A telephone interview was conducted with the parents or caregivers at 1 year postoperatively or later to ascertain the appearance and function of that wrist. When there was any complaint related to the operated forearm they were advised

to return to the hospital for clinical and, if needed, radiographic examinations.

Results

23 pediatric patients with displaced distal metaphyseal forearm fractures in children 6 to 14 years old were treated with closed reduction and K wire fixation with modified radial entry points. Mean patient age was 9.5 years. Two K-wires were used for radius fixation in all patients.

Anatomical or near-anatomical fracture reduction was achieved in all cases. Open reduction was not performed in any case. On immediate postoperative radiographs, there was no residual posterior angulation or translation. A residual lateral translation (mean=1 mm) was seen in 6 cases. On final radiographs just before K-wire removal, there was no posterior or lateral translation or angulations.

Thirteen patients had a total duration of 3 weeks of wrist immobilization in a short arm plaster of Paris cast. The rest of the patients were immobilized for 4 to 6 weeks, with a short arm plaster of Paris cast for the first half of the time and a wrist splint for the second half. Mean follow up was 4,5 months (range 3-6 month).

All fractures healed and all patients achieved full wrist flexion and extension and forearm rotation. Mean time to achieve full wrist range of motion after immobilization was 4 weeks (range 3-5 weeks). There was no loss of reduction or remanipulation. No cast-related complications were observed. There was one pin-related complication, where the pins were left outside the skin, but the patient responded well to local treatment and antibiotherapy and the pins didn't have to be removed early.

After 1 year or more, telephone interviews were conducted with the parents or caregivers of the patients. Except for 3 patients, the caregivers neither detected any visible difference between the injured and uninjured wrists nor reported any complaints related to the operated wrist. There was a suspicion of difference between the injured and uninjured wrists by the caregivers of 3 patients. These 3 patients were reviewed in the hospital with clinical and radiographic examination. All patients had full range of motion of the wrist and forearm with no clinical deformity or radiographic physal arrest.

Discussion

Three treatment methods are available for completely displaced distal metaphyseal forearm fractures: closed reduction and casting under anesthesia, closed reduction and K-wiring under anesthesia or open reduction and K-wiring under anesthesia. In cases of displaced distal radial fractures with a greenstick ulna fracture gentle molding without proper reduction and casting in casualty without anesthesia is an accepted method in children younger than 10 years.

Completely displaced distal metaphyseal forearm fractures are at risk for redisplacement after closed manipulation and casting. Redisplacement may require a second intervention or prolonged follow-up after malunion. Despite good long-term functional and radiographic outcomes in a majority of malunited fractures, loss of

reduction is a concern. It is not uncommon for parents or caregivers to request repeated radiographs until the disappearance of clinically visible deformity, which may take months to years. Some factors that need to be considered before selecting a particular method of treatment are the age of the child, the severity of initial angulation or redisplacement angulation that is acceptable in a given child, the duration of time that may be required for remodeling and reintervention if required, whether a second intervention could give the same result as the primary intervention, the overall duration of treatment, the overall cost involved, and parent or caregiver anxiety.

Although achieving optimal closed reduction by any technique is the essential first step, the more important step is the technique by which the reduction can be maintained throughout the fracture healing period. A good 3-point molded cast and percutaneous K-wiring are 2 options available for maintaining fracture reduction. Although perfect casting is sought, it may not be possible because of inadequate or excessive padding, too-quick or too-delayed handling of plaster of Paris, soft tissue swelling, or suboptimal anesthesia. More-than-normal swelling can be present at presentation because of high-velocity trauma, associated displaced ulnar fracture or absent first aid splinting. Swelling can increase after repeated forced manipulations, especially in cases of delayed presentation. Subsidence of swelling a few days after casting can result in later fracture redisplacement.

Cast-related issues can be avoided with K-wiring. In a prospective randomized controlled trial, McLauchlan et al.[11] compared 33 children treated by closed reduction and casting under anesthesia with 35 children treated by closed reduction and K-wiring. They observed loss of reduction in 14 of 33 patients treated by closed reduction and casting. Remanipulation was required in 7 patients in the first group and none in the second group. They concluded that K-wire fixation maintained reduction significantly better and reduced the need for follow-up radiographs and further procedures to correct the loss of position.

In the current study no secondary displacement of the fracture was observed.

Postoperative radiographs were obtained only twice: once in the immediate postoperative period and once at K-wire removal.

Closed reduction and casting under anesthesia is usually performed under image intensifier control. To avoid redisplacement, a perfect casting is attempted, and rechecks with fluoroscopy are generally performed while applying the cast. On the other hand, with closed reduction and K-wiring, once fixation is done, good casting is performed with no C-arm rechecks. The overall duration of surgery, anesthesia, and radiation exposure is nearly the same for both closed reduction and casting and closed reduction and K-wiring. Above-or below-elbow cast application is done at the discretion of the surgeon. In this study children under the age of 10 years received a above-elbow cast, the rest a below-elbow cast.

There is also also the issue of postoperative periodical hospital visits and postoperative radiographs. Patients treated with closed reduction and casting often need weekly clinical and radiographic examinations in the first 2 to 3 weeks after the accident, whereas patients treated with K-wire fixation, especially where the K-wires were buried under the skin, needed only 2 to 3 postoperative examinations. The accrued costs of periodical hospital visits, cast changes, and radiological examinations with closed reduction and casting may be equal to that of closed reduction and K-wiring. Also, the surgeon may have to spend more time with parents or caregivers during every visit with patients treated without K-wire fixation.

There is also an ongoing discussion whether it is better to leave the K-wires above skin level and remove them without anesthesia as an outpatient procedure, or leave them buried under the skin and remove them under general anesthesia. There are advantages and disadvantages for both methods. The only complication in this study is a superficial pin-tract infection in the group where the K-wires were left above the skin.

Only 2 follow-up examinations after K-wire removal where performed, the first after 3 to 4 weeks and the second 4 weeks after the first. The caregivers were satisfied with the wrist cosmesis at the first visit after K-wire removal. By the second visit most patients achieved full wrist range of motion and were discharged from observation. McLauchlan et al[12], Ozcan et al[13] and van Egmond et al[14] have also observed increased follow-up intervals and

decreased radiographic frequency in patients treated with K-wire fixation. The author's opinion is comparable to that of van Egmond et al [14], that displaced distal forearm fractures in children with an indication for reduction under general anesthesia should be percutaneously fixated, because of 7–43% redisplacement after closed treatment, requiring secondary reduction procedure. The current authors' total post-operative follow-up period is normally 8 to 12 weeks, depending on the age of the child. For the purposes of this study, a longer follow-up was performed.

A limitation of the current study is perhaps the small number of patients.

Conclusions

The obtained results with the current method of K-wire fixation with modified radial entry points were good and, from study of the literature, comparable to other methods, like the Willenegger and the Kapandji technique.

The described method of K-wiring is useful in achieving and maintaining reduction in displaced distal metaphyseal forearm fractures. Near-anatomical closed reduction can be easily achieved. With no fear of redisplacement, the casting period can be reduced. When no clinical deformity is present, the follow-up period can be shortened.

Regarding the described modified radial entry points K-wiring method, a randomized controlled trial in which the different fixation methods of distal forearm fractures in children is compared would be ideal.

References

- Bailey DA, Wedge JH, McCulloch RG, et al. Epidemiology of fractures of the distal end of the radius in children as associated with growth. *J Bone Joint Surg Am.* 1989;71(8):1225–1231.
- Fernandez DL. Conservative treatment of forearm fractures in children. In: Chapchal G, ed. *Fractures in Children.* New York, NY: Thieme-Stratton; 1981.
- Woodbury DF, Fischer B. An overriding radius fracture in a child with intact ulna: management considerations. *Orthopaedics.* 1985; 8:763-765.
- Skillern PG Jr. Complete fracture of the lower third of the radius in childhood with green-stick fracture of the ulna. *Ann Surg.* 1915; 61:209-225.
- Compere CL, Carr CR, Tracy HW. Management of fractures of the distal forearm in children. *South. Med J.* 1965; 57:540-550.
- Kamat AS, Pierse N, Devane P, Mutimer J, Horne G. Redefining the cast index: the optimum technique to reduce redisplacement in pediatric distal forearm fractures. *J Pediatr Orthop.* 2012; 32(8):787-791.
- Lefevre Y, Laville JM, Bouillet F, Salmeron F. Early correction of paediatric malunited distal metaphyseal radius fractures using percutaneous callus osteoclasts ("calloclastosis"). *Orthop Traumatol Surg Res.* 2012; 98(4):450-454.
- De Courtivron B. Spontaneous correction of the distal forearm fractures in children. Paper presented at: European Pediatric Orthopaedic Society Annual Meeting; 1995; Brussels, Belgium
- Hang JR, Hutchinson AF, Hau RC. Risk factors associated with loss of position after closed reduction of distal radial fractures in children. *J Pediatr Orthop.* 2011; 31(5):501-506.
- Alemdaroglu KB, Iltar S, Cimen O, Uysal M, Alagöz E, Atlihan D. Risk factors in redisplacement of distal radial fractures in children. *J Bone Joint Surg Am.* 2008; 90(6):1224-1230.
- McLauchlan GJ, Cowan B, Annan IH, Robb JE. Management of completely displaced metaphyseal fractures of the distal radius in children: a prospective, randomised controlled trial. *J Bone Joint Surg Br.* 2002; 84:413-417.
- McLauchlan GJ, Cowan B, Annan IH, Robb JE. Management of completely displaced metaphyseal fractures of the distal radius in children: a prospective, randomised controlled trial. *J Bone Joint Surg Br.* 2002; 84:413-417.

13. Ozcan M, Memisoglu S, Copuroglu C, Sari-dogan K. Percutaneous Kirschner wire fixation in distal radius metaphyseal fractures in children: does it change the overall outcome? Hippokratia. 2010; 14(4):265-270.
14. van Egmond PW, Schipper IB, van Luijt PA. Displaced distal forearm fractures in children with an indication

for reduction under general anesthesia should be percutaneously fixated. Eur J Orthop Surg Traumatol. 2012 Apr;22(3):201-207. Epub 2011 Jun 14.

Correspondence to:

Dr. Tepeneu Narcis Flavius,
University of Medicine and Pharmacy "Victor Babes"
P-ta Eftimie Murgu no. 2, Timisoara, Romania
Phone: 0040256220484
Fax: 0040256220484
E-mail: tepeneu.narcis@umft.ro

GITELMAN SYNDROME - THE IMPORTANCE OF IONOGRAM AND BLOOD GASES IN DIAGNOSIS

R Stroescu^{1,2}, M Gafencu^{1,2}, G Doros^{1,2}, R Isac^{1,2},
C Olariu^{1,2}, M Gligor^{1,2}, A Nicolescu^{1,2}, O Marginean^{1,2}

Abstract

Aim: To present a case with severe hypopotassemia, hypomagnesemia, hypocalcemia, hypocalciuria and metabolic alkalosis. **Material:** A 14 years old male patient was admitted for carpopedal spasm, muscle weakness, facial and upper limbs paresthesia, with diminished left<right muscle tone. In the past, he presented 3 similar episodes of carpopedal spasm, vomiting and diarrhea with hydroelectrolytic disturbances which were considered due to gastroenterocolitis and treated therefore. **Results:** Laboratory tests detected metabolic alkalosis, severe hypokalemia, hypomagnesemia, hypocalcemia and hypocalciuria. It was initiated the replacement treatment of electrolytes with a partial correction. Regarding the medical history, the present symptomatology, the difficult correction and after the exclusion of other causes of unexplained severe hypokalemia, hypomagnesemia and metabolic alkalosis, diagnosis of Gitelman Syndrome was established, confirmed by genetic test. Lifelong daily supplementation with magnesium and potassium was recommended. **Conclusion:** For an accurate diagnosis it is essential to interpret correctly both the symptoms and the laboratory tests (ionogram, blood gases) so as further consequences would be excluded.

Keywords: ionogram, blood gases, tubulopathy

Introduction

Gitelman Syndrome is an autosomal recessive disorder with metabolic abnormalities. It is also called tubular hypomagnesemia-hypokalemia and the difference between Bartter Syndrome is the absence of hypercalciuria [1,2]. The characteristic sets of metabolic abnormalities include: hypokalemia, metabolic alkalosis, secondary hyperaldosteronism with hyperreninemia, and sometimes hypomagnesemia [3].

The prevalence of Gitelman Syndrome has been estimated to be between 1 to 10 in 40,000 compared with Bartter syndrome 1 in 1,000,000, therefore it is more frequent [4,5]. Usually it is diagnosed in late childhood or adulthood in contrast to the typical neonatal clinical presentation of Bartter Syndrome [6].

Gitelman syndrome is caused by biallelic inactivating mutations in the SLC12A3 gene encoding the thiazide-

sensitive sodium-chloride cotransporter (NCC) expressed in the apical membrane of cells lining the distal convoluted tubule [7]. The symptoms that appear are similar to that seen with chronic use of a thiazide diuretic [8].

The clinical manifestations are: almost 10 percent of patients present at diagnosis with tetany, cramps of the arms and legs due to hypokalemia and hypomagnesemia. Fatigue may be seen, also poliuria, rarely growth retardation and later on hypertension. In general, these symptoms are associated with other manifestations so often the delay of diagnosis occurs [9].

The tubular defect in Gitelman Syndrome cannot be corrected, thus, treatment focuses on the correction of the electrolytes abnormalities with sodium, potassium and magnesium supplements as well as correcting the volume deficit [10].

Aim

To present a case with severe hypopotassemia, hypomagnesemia, hypocalcemia, hypocalciuria and metabolic alkalosis.

Case report

The 14 years-old boy was admitted to our clinic for carpal spasms and left hand paresthesia, with motor deficit on the same part, no other associated symptoms were reported. The symptoms appeared suddenly, during the night, while the patient was sleeping, determining him to wake up. In the morning, he referred to regional hospital, where the patient was evaluated. Blood tests showed hydro electrolytic disorders (pH=7.5, K= 2.4 mmol/l, Ca= 3,8 mg/dl) and elevated inflammation markers (CRP 45 mg/l). Because of the suspicion of encephalitis, a CT scan was also taken, without revealing any abnormal aspects. From that moment on, the patient was transferred to our hospital.

A physical examination at admission in our clinic revealed a moderate influenced general condition, fatigability, with elevated body temperature (37.8 Celsius degrees), normal colored skin, without any eruptive elements, moderate pharyngeal congestion, no palpable peripheral lymphadenopathy.

¹“Louis Turcanu” Emergency Hospital for Children Timisoara

²“V. Babes” University of Medicine and Pharmacy Timisoara, XI Pediatric Department, First Pediatric Clinic

E-mail: stroescu.ramona@umft.ro, mgafencu@umft.ro, gdoros@gmail.com, ralu_isac@yahoo.com,

olariu.ioanacristina@yahoo.com, gligor.mihaela04@yahoo.com, nana.nicolescu@yahoo.com, omarginean@ymail.com

Also, the pulmonary, cardiovascular, digestive and renal systems examination were normal, the value of blood pressure was 118/68 mmHg. Carpal spasms and paresthesia of the left hand were present, with a negative Chvostek sign.

Personal and disease history: he is the first-born child in the family, from a controlled full-term pregnancy, with no history of drugs use or exposure to radiation. Delivery was completed in the regional hospital.

He had several hospitalizations in the regional hospital. The first one occurred when he was 11-year old due to tetany in which carpal spasms predominated and gastroenterocolitis. The other two hospital admissions were usually for the same signs. In each hospitalization, the symptomatology was thought to be because of gastroenterocolitis which led to disturbances in fluid and electrolyte homeostasis. Each time, the patient was treated with intravenous infusions of electrolytes and fluids and then went at home, without further follow-up visits.

Blood tests showed metabolic alkalosis Ph of 7.49 (NR 7.35 to 7.45 HCO₃-act of 31.9 mmHg (NR 21 to 26 mmHg), HCO₃-std of 30.3 mmHg (NR 24 to 28 mmHg), BE of 7.4 (NR -2.5 to 5), hypocalcemia, ionized Ca of 1.01 mmol/L (NR 1.15 to 1.35 mmol/L), very low serum potassium of 2.04 mmol/L (NR 3.6 to 4.8 mmol/L), normal sodium concentration Na of 138.9 mmol/L (NR 135 to 145 mmol/L), hypomagnesemia Mg of 0.6 mmol/L (NR 0.7 to 1.05 mmol/L), and hypochloremia Cl of 94 mmol/L (NR 95 to 105 mmol/L). Other significant results included leukocytosis WBC of 19.89 x10³/ul (NR 4.8 to 10.8 x 10³/ul) with neutrophilia 15.78x 10³/ul/ 79.6% (NR 1.87 to 8.1 x10³/ul/ 39 to 70%), normal hemoglobin 12.8 g/dL (NR 11.8 to 15.7 g/dL) and elevated inflammation markers CRP of 57.46 mg/L (NR 0 to 5 mg/L). His serum aminotransferases, glycemia, urea, and creatinine levels were normal. Urine/24h has been collected and revealed loss in potassium :128 mmol/24h (NR 35 to 80 mmol/24h) and hypocalciuria: urine Ca of 0.65 mmol/24h (NR 1.75 to 7.5 mmol/24h). Renin and aldosterone were normal in our case. Echocardiography showed no pathological aspect.

Discussion

Hypopotassemia caused by vomiting, diarrhea or due to different drugs (especially diuretics) abuse were excluded. Also, because of the normal range of aldosterone and renin, there is no point in suspicioning a Liddle Syndrome, a primary hyperaldosteronism or a renin secreting tumors. Other diseases were excluded: Fanconi Syndrome (proteinuria, glycosuria, hypercalciuria, nephrocalcinosis), type 1 tubular acidosis (metabolic acidosis, hypopotassemia, hypochloremia). The main differential diagnosis is made with Bartter Syndrome (especially type III, caused by mutation in CLCNKB); the two syndromes can be clinically indistinguishable, but there are some features like the age of the patient (14 years old with normal development in our case, in contrast with Bartter Syndrome, where children are symptomatic since neonatal period or early childhood and have failure in growth).

Genetic tests were performed that showed mutations in the SLC12A3 gene that encodes the thiazide-sensitive sodium-chloride cotransporter (NCC), fact that confirms our suspicion of diagnosis - Gitelman Syndrome.

Because of the severe hypopotassemia, the treatment was urgent. It was administrated potassium intravenous 40mmol/l through peripheral vein with the rythm of 10mmol/h, because greater concentrations may lead to venous sclerosis and magnesium sulphate intravenous, all this time the patient being cardiac monitored. Despite the aggressive treatment, the potassium concentration still didn't achieve normal range. Moreover, the next day, the patient started to acuse heart palpitations and we opted the next three days for substitutive oral treatment, with potassium chloride oral 50 ml, magnesium orotate and gluconate calcium. Only after those three days of treatment, the potassium reached the targeted range of over 3.00 mmol/L (3.09 mmol/L) (Fig. 1). The magnesium levels were still below the normal range (Mg of 0.61 mmol/L) (Fig. 2).

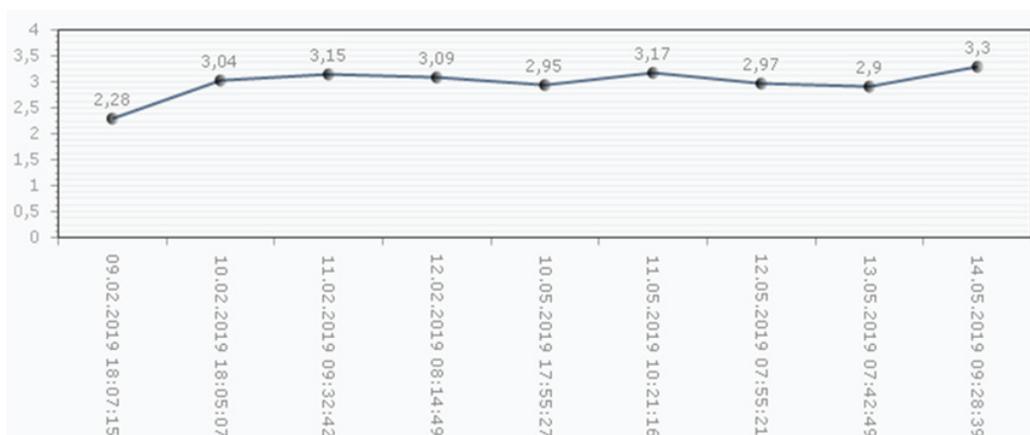


Fig 1. Potassium levels during the admittance.

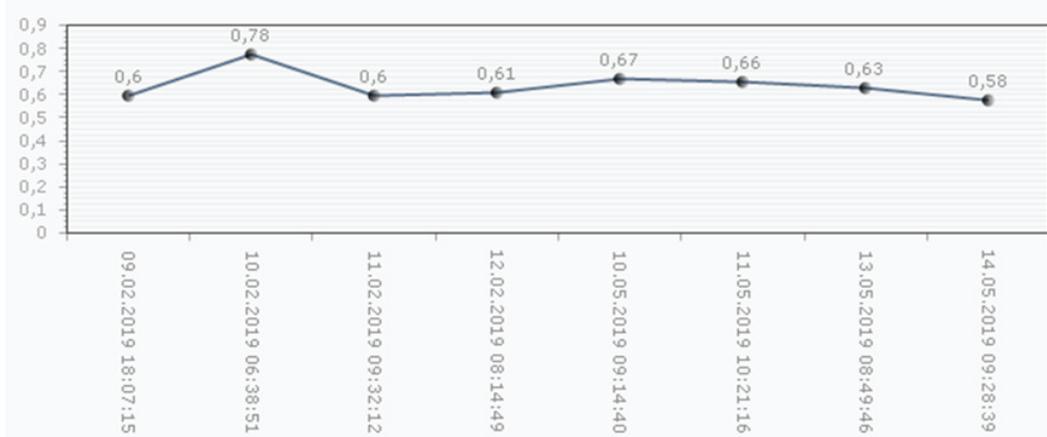


Fig. 2 Magnesium levels during the admittance.

Clinically, the patient had a good general condition, without any other symptomatology. At home oral substitutive treatment, with magnesium orotate, lactic calcium and potassium and magnesium supplement (Aspacardin) for long term and nonsteroidal anti-inflammatory drugs (Indomethacin) oral 50mg/day for seven days were prescribed.

Individualized lifelong oral potassium or magnesium supplementation or both is the mainstay of treatment for patients with Gitelman syndrome. The KDIGO guidelines recommend a target K of 3 mmol/l and a target Mg of 0.6

mmol/l in patients with Gitelman syndrome [11]. In the presence of hypomagnesemia, magnesium supplementation should be considered first, because magnesium repletion will facilitate potassium repletion and reduce the risk of tetany and other complications. Intravenous KCl may be necessary either when the patient cannot take oral drugs or when the potassium deficit is very severe, causing cardiac arrhythmias, quadriplegia, respiratory failure, or rhabdomyolysis. Also, a series of drugs should be avoided or used with caution (table 1) and a diet rich in magnesium and potassium is recommended [12,13].

Table 1 Drugs associated with hypokalemia and hypomagnesemia.

Site of loss	Drugs
Hypokalemia	
Shift from extracellular fluid to intracellular fluid compartment	β_2 -receptor agonists Insulin (high dose) with glucose Xanthines (theophylline, caffeine) Verapamil (in overdose) Sodium bicarbonate
Extrarenal	Laxatives
Renal	
Antimicrobials	Nafcillin, ampicillin, penicillin, aminoglycosides, amphotericin B, foscarnet
Diuretics	Acetazolamide Furosemide and other loop diuretics Thiazides Mannitol
Mineralocorticoids	Fludrocortisone
Antiepileptic	Topiramate

Site of loss	Drugs
Hypomagnesemia	
Extrarenal	Proton pump inhibitor
Renal	
Antimicrobials	Drug-induced renal Fanconi syndrome: Aminoglycosides (gentamycin, streptomycin, tobramycin), pentamidine, amphotericin B, foscarnet, antiretroviral therapy
Diuretics	Furosemide Thiazide
Antitumoral	Cisplatin Tyrosine kinase inhibitors
Immunosuppressants	Calcineurin inhibitors (cyclosporine, tacrolimus) Mycophenolate Anti-EGF receptors (cetuximab, panitumumab)

Long-term studies are needed to assess the natural history of GS and the individual risks of chronic hypokalemia and hypomagnesemia in terms of metabolic syndrome, cardiac arrhythmias, chronic kidney disease, blood pressure control, and propensity to develop chondrocalcinosis. To date, there is no evidence that GS affects life expectancy [14]. Caution should be taken when patients with GS undergo anesthesia. Hypokalemia and hypomagnesemia can potentiate the effects of local and general anesthetic agents [15].

The patient returned for monthly follow-up visits. After three months, he accused again fatigability, carpal spasms and muscle awareness. At admission, the potassium and magnesium levels were low, but the patient and the parents admitted that the boy didn't took the medication at

home for a few days. He was administrated potassium intravenous and as a result the electrolytes reached normal range, from what we understand the importance of the continuous treatment and individualized, with appropriate change with time and demands.

Conclusions

The purpose of our article is to remind us that the diagnosis of Gitelman Syndrome can be taken into consideration when we are in front of an unexplained hypokalemia, hypomagnesemia and metabolic alkalosis. For an accurate diagnosis it is essential to interpret correctly both the symptoms and the laboratory tests (ionogram, blood gases).

References

1. Knoers NV, Levchenko EN. Gitelman syndrome. *Orphanet J Rare Dis.* 2008;3:22. Published 2008 Jul 30. doi:10.1186/1750-1172-3-22
2. Gitelman HJ, Graham JB, Welt LG. A new familial disorder characterized by hypokalemia and hypomagnesemia. *Trans Assoc Am Physicians.* 1966;79:221–235.
3. Cruz DN, Shaer AJ, Bia MJ, Lifton RP, Simon DB. Gitelman's syndrome revisited: An evaluation of symptoms and health-related quality of life. *Kidney Int.* 2001;59:710–717. doi: 10.1046/j.1523-1755.2001.059002710
4. Knoers NVAM, Starremans PGJF, Monnens LAH. Hypokalemic tubular disorders. In: Davidson AM, Cameron JS, Grunfeld J-P, Ponticelli C, Ritz E, Winearls CG, van Ypersele C, editor. *Oxford Textbook in Clinical Nephrology.* Third. Oxford University Press; 2005. pp. 995–1004.
5. Cunha TDS, Heilberg IP. Bartter syndrome: causes, diagnosis, and treatment. *Int J Nephrol Renovasc Dis.* 2018;11:291–301. Published 2018 Nov 9. doi:10.2147/IJNRD.S155397
6. Bartter FC, Pronove P, Gill JR, Maccardle RC. Hyperplasia of the juxtaglomerular complex with hyperaldosteronism and hypokalemic alkalosis. A new syndrome. *Am J Med.* 1962;33:811–828.
7. D.B. Simon, C. Nelson-Williams, M.J. Bia, et al. Gitelman's variant of Bartter's syndrome, inherited hypokalaemic alkalosis, is caused by mutations in the thiazide-sensitive Na-Cl cotransporter *Nat Genet.* 12 (1996), pp. 24-30
8. L. Calo, L. Punzi, A. Semplicini. Hypomagnesemia and chondrocalcinosis in Bartter's and Gitelman's syndrome: review of the pathogenetic mechanisms. *Am J Nephrol.* 20 (2000), pp. 347-350

9. M. Peters, N. Jeck, S. Reinalter, et al. Clinical presentation of genetically defined patients with hypokalemic salt-losing tubulopathies. *Am J Med*, 112 (2002), pp. 183-190
10. A. Blanchard, D. Bockenhauer, D. Bolignano, L. A. Calò, E. Cosyns, O Devuyst, et al. Gitelman syndrome: consensus and guidance from a Kidney Disease: Improving Global Outcomes (KDIGO) Controversies Conference, *Kidney International*, Volume 91, Issue 1, 2017, 24-33, ISSN 0085-2538, <https://doi.org/10.1016/j.kint.2016.09.046>.
11. A Blanchard et al.: Gitelman syndrome: a KDIGO conference report. *Kidney International* (2017) 91, 24–33
12. N.V. Knoers. Gitelman syndrome *Adv Chronic Kidney Dis*, 13 (2006), pp. 148-154
13. G.H. Kim, J.S. Han Therapeutic approach to hypokalemia. *Nephron*, 92 (suppl 1) (2002), pp. 28-32
14. O. Devuyst, H. Belge, M. Konrad, et al. Renal tubular disorders of electrolyte regulation in children.
15. E.D. Avner, W.E. Harmon, P. Niaudet, et al. (Eds.), *Pediatric Nephrology* (7th ed.), Springer, New York, NY (2016), pp. 1201-1271 Gallagher H, Soar J, Tomson C. Guideline for the perioperative management of people with inherited salt-wasting alkaloses (Gitelman's syndrome and Bartter's syndrome) undergoing non-urgent surgical procedures. UK Renal Association. Available at: <http://www.renal.org/docs/default-source/guidelines-resources/joint-guidelines/rarcoa-guideline-on-peri-operative-management-in-people-with-swa.pdf?sfvrsn=2>. Accessed March 11, 2016.

Correspondence to:

Ramona Stroescu,
University of Medicine and Pharmacy "Victor Babes"
P-ta Eftimie Murgu no. 2, Timisoara, Romania
Phone: 0256/220479
E-mail: stroescu.ramona@umft.ro

FUTURE PROSPECTS IN THE TREATMENT OF PEDIATRIC BURNS. A REVIEW OF THE NILE TILAPIA DERIVED BIOLOGICAL OPTIONS FOR TREATING SUPERFICIAL PARTIAL THICKNESS BURNS

B Ciornei^{1,2*}, VL David^{1,2}, ES Boia^{1,2}

Abstract

Burn wounds represent one of the hardest to tackle traumatic pathologies for medical systems around the world, but more so for the small patients. WHO estimates that around 11 million people worldwide are affected by burns, out of which 180,000 die annually because of these incidents. The treatment is complex, both medical and surgical, firstly by trying to eliminate the cause and spread of the causal agent and to restore biological vital functions. The second part concentrates on infection prevention, cleaning the burn site of any debris resulted from the trauma and last to restore devitalized tissue. The Nile Tilapia is a subspecies of fish from the Tilapia family, with a vast habitat in Africa, that ranges from Egypt to the central african continent, and even Israel. The interest for the use of Nile Tilapia skin for the treatment of burnt wounds has increased in the last 15 years, due to the fact that it's properties have been studied across this time and the need for better and cheaper options has always existed. Today partial thickness burn wounds are treated by the use of silver sulfadiazine and mafenide acetate solutions, whilst in our clinic we use an ointment based on plants cleared for human use. This article's purpose is to present a promising candidate for the regenerative treatment of the skin after burn trauma, through the use of a biological compound found in the skin of the Nile Tilapia (*Oreochromis Niloticus*). Fish origin collagen and peptides have been studied *in vitro* in regards to their potential for healing stab or burnt wounds. The focus of these studies has been put to *in vitro* use of a combination of prohealing substances, mainly chitosan and electrospinning marine peptides derived from tilapia collagen. The use of Nile tilapia skin as a whole, has been timidly used experimentally, with a single brazilian contingent of researchers performing them. They have conducted their experiments on murine models, a randomized control trial on 30 children and an ongoing phase III clinical trial on adult subjects. In conclusion the use of Nile Tilapia skin or biological compounds like chitosan and marine peptides hydrogels, in the treatment of skin burns is still at the beginning. Studies

show promising results, but there is a need for more evidence that it really does have an impact on the socio-economic and medical aspect of burn wound treatment.

Keywords: partial-thickness burns, Nile Tilapia, Chitosan, Marine peptide hydrogel

Introduction

Burn wounds represent one of the hardest to tackle traumatic pathologies for medical systems around the world, but more so for the small patients. WHO estimates that around 11 million people worldwide are affected by burns, out of which 180,000 die annually because of these incidents [1]. Burns can be caused by objects or substances that release heat, either by friction, through electric energy, radiation exposure or by exogen chemical reaction. The classification of burn trauma takes into account Total Body Surface Area (TBSA) as well as depth of penetration (Fig. 1) [2].

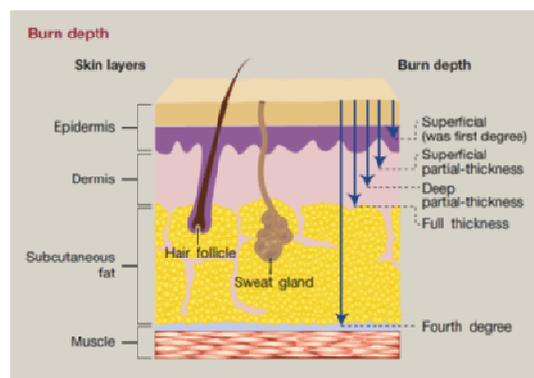


Fig.1. Diagram of burn depth assesment.

Johnson C. *Management of burns, Surg. (United Kingdom)*, vol. 36, no. 8, pp. 435–440, 2018.

¹“Victor Babes” University of Medicine and Pharmacy, Department of Pediatric Surgery and Orthopedics, Timisoara, Romania

²“Louis Turcanu” Clinical Emergency Hospital for Children Timisoara

* Phd Student

E-mail: ciornei91@gmail.com, david.vlad@umft.ro, boiaeugen@yahoo.com

The treatment is complex, both medical and surgical, firstly by trying to eliminate the cause and spread of the causal agent and to restore biological vital functions. The second part concentrates on infection prevention, cleaning the burn site of any debris resulted from the trauma and last to restore devitalized tissue. An additional part would be the management of wound healing complications such as keloid scar or any other acquired deformities [3].

This article's purpose is to present a promising candidate for the regenerative treatment of the skin after burn trauma, through the use of a biological compound found in the skin of the Nile Tilapia (*Oreochromis niloticus*). Classical methods are vast, and range from using ointments derived from plants, to surgical transplantation of allograft skin, to synthetic analogs of extracellular matrix, or even transplantation of skin cultured from stem cells in a Petri dish. All have benefits and pitfalls, but the most common denominator is the high cost, that is prohibitive for most medical systems [4-7].

The Nile Tilapia

The Nile Tilapia is a subspecies of fish from the Tilapia family, with a vast habitat in Africa, that ranges from Egypt to the central African continent, and even Israel. They are freshwater fish that tolerate muddy waters, with a varying temperature scale that ranges from 8 to 42 degrees Celsius. They have a life cycle of about 9 years, adults can reach around 4,3 Kgs and 60 cm in length. The Nile Tilapia is an omnivorous fish, that feeds on plancton and aquatic plants [8]. Studies have shown that its use can even spread to other areas of applicability, because of its high capacity for the consumption of Anopheles mosquitoes [9].

The interest for the use of Nile Tilapia skin for the treatment of burnt wounds has increased in the last 15 years, due to the fact that its properties have been studied across this time and the need for better and cheaper options has always existed. Today partial thickness burn wounds are treated by the use of silver sulfadiazine and mafenide acetate solutions, whilst in our clinic we use an ointment based on plants cleared for human use. These solutions are of great help in determining the wound to heal itself, but are lacking in biological content, thus the wound can heal and close, but in a matter that does not resemble prior status, forming keloid scar

Promising treatment

Fish origin collagen and peptides have been studied *in vitro* in regard to their potential for healing stab or burnt wounds. The focus of these studies has been put on *in vitro* use of a combination of prohealing substances, mainly chitosan and electrospinning marine peptides derived from tilapia collagen. Chitosan is a linear polysaccharide obtained through deacetylation of chitin, a structural element found in the exoskeleton of crustaceans. Its use in

the food, agricultural and medical industry has been present since the 1980's. A chitosan based hemostatic has been used by the US military in the wars in Iraq and Afghanistan (10-12). Ongoing studies try to make use of this material for the purpose of drug delivery through the skin. Marine derived peptides from tilapia skin collagen, have a similar composition to that of human skin collagen found in the extracellular matrix of the skin, containing 8 essential amino acids (AA) and 9 non-essential ones. The benefits of using tilapia collagen derived peptides are good biocompatibility, biologic origin, reduced to no immunogenicity and low price, whilst the disadvantages take into account that they have a fairly great molecular instability and are prone to bacterial degradation [13,14].

The combination of chitosan and marine peptides derived from tilapia skin collagen has been found to have a synergistic effect, by stimulating cellular proliferation, healing, neovascularisation of experimental wound and decreased inflammatory response from the host body. Furthermore studies have shown an antibacterial effect of chitosan/MP compound against *E.coli* and *Staphylococcus aureus*, recognizing its antibacterial properties and making it a promising tool in the treatment of wound healing [11,15,16]

Other options are focused on the use of allografts and xenografts, which seem to have the same outcome in regards to healing [17,18]. The use of Nile tilapia skin as a whole, has been timidly used experimentally, with a single Brazilian contingent of researchers performing them. They have conducted their experiments on murine models, a first single case report, a randomized control trial on 30 children and an ongoing phase III clinical trial on adult subjects.

In the murine model authors report better adherence of the skin graft to the wound bed, less inflammatory response cells and consecutively better and faster healing compared to the control groups [19]. Based on their prior findings they have attempted the same treatment, in a case study, to a 3 year-old boy admitted to their facility for a superficial partial thickness scald burn on the face, neck, thorax, abdomen and left arm (Fig.2). Their results reveal a good adherence of the fish skin to the wound, no infectious episodes, less dressing changes and less pain medication needed [20].

Thus an RCT study has been launched by the same facility which included a number of 30 children aged 2-12 years old (15 tests and 15 controls). The subject were randomly attributed to the test or control group. In the test group they had undergone a tilapia skin treatment and in the control group subject were treated conservatively with a 1% silver sulfadiazine cream solution. The results revealed less time spent with dressing changes, less pain medication, less need for anesthesia, but it also showed no significant difference in hospital stay and no differences in regards to time to full wound healing [21].



Fig. 2. A. Aspect of burnt area preop B. Removal of necrotic tissue and blister show a superficial partial thickness burn C. Application of tilapia skin graft to burnt area D. After six days the dressing has been removed showing good adherence to the wound bed E. Removal of the tilapia skin after 10 days showing complete re-epithelization F. 1 week after dressing removal (Costa BA, Lima Júnior EM, de Moraes Filho MO, Fachine FV, de Moraes MEA, Silva Júnior FR, et al. Use of Tilapia Skin as a Xenograft for Pediatric Burn Treatment: A Case Report. J Burn

Future perspectives

Burn trauma management today, still hasn't found a way of dealing with some aspects of skin regeneration after burns. Researchers experimenting with this treatment must also answer questions regarding the long term outcome of the newly formed skin, what happens with the annexes of the skin, does hair grow back, do sweat glands still participate in the perspiration process, are there any potential malignant threats?

Conclusions

In conclusion the use of Nile Tilapia skin or biological compounds like chitosan and marine peptides hydrogels, in the treatment of skin burns is still at the beginning. Studies show promising results, but there is a need for more evidence that it really does have an impact on the socio-economic and medical aspect of burn wound treatment.

References

1. World Health Organization. Burns, Fact sheet N°365. April 2014. 2014.
2. Johnson C. Management of burns. Surg (United Kingdom) [Internet]. 2018;36(8):435–40. Available from: <https://doi.org/10.1016/j.mpsur.2018.05.004>
3. Grosfeld JL, O'Neill JA, Fonkalsrud EW, Coran AG. Pediatric Surgery. 2006.
4. Seth AK, Friedstat JS, Orgill DP, Pribaz JJ, Halvorson EG. Microsurgical Burn Reconstruction. Clin Plast Surg [Internet]. 2017;44(4):823–32. Available from: <http://dx.doi.org/10.1016/j.cps.2017.05.014>
5. Fredman R, Katz AJ, Hultman CS. Fat Grafting for Burn, Traumatic, and Surgical Scars. Clin Plast Surg [Internet]. 2017;44(4):781–91. Available from: <http://dx.doi.org/10.1016/j.cps.2017.05.009>
6. Ghieh F, Jurjus R, Ibrahim A, Geagea AG, Daouk H, El Baba B, et al. The Use of Stem Cells in Burn Wound Healing: A Review. Biomed Res Int. 2015;2015.
7. Strong AL, Neumeister MW, Levi B. Stem Cells and Tissue Engineering: Regeneration of the Skin and Its Contents. Clin Plast Surg [Internet]. 2017;44(3):635–50. Available from: <http://dx.doi.org/10.1016/j.cps.2017.02.020>
8. Job BE, Antai EE, Otogo GA, Ezekiel HS. Proximate Composition and Mineral Contents of Cultured and Wild Tilapia (*Oreochromis niloticus*) (Pisces : Cichlidae) (Linnaeus , 1758). 2015;14(4):195–200.
9. Abebe A, Natarajan P, Getahun A. Efficacy of tilapia, *Oreochromis niloticus* and *Tilapia Zilli* for the control of mosquito larvae around Fincha Valley, Oromia region, Ethiopia. 2018;5(3):35–41.
10. Muñoz I, Rodríguez C, Gillet D, M. Moerschbacher B. Life cycle assessment of chitosan production in India and Europe. Int J Life Cycle Assess. 2018;
11. Bhattarai N, Gunn J, Zhang M. Chitosan-based hydrogels for controlled, localized drug delivery. Advanced Drug Delivery Reviews. 2010.
12. Zhang YJ, Gao B, Liu XW. Topical and effective hemostatic medicines in the battlefield. Int J Clin Exp Med. 2015;

13. Hu Z, Yang P, Zhou C, Li S, Hong P. Marine collagen peptides from the skin of Nile Tilapia (*Oreochromis niloticus*): Characterization and wound healing evaluation. *Mar Drugs*. 2017;15(4).
14. Wu CJ, Chai HJ, Li JH, Huang HN, Li TL, Chan YL, et al. Effects of sizes and conformations of fish-scale Collagen peptides on facial skin qualities and transdermal penetration efficiency. *J Biomed Biotechnol*. 2010;2010.
15. Ouyang QQ, Hu Z, Lin ZP, Quan WY, Deng YF, Li SD, et al. Chitosan hydrogel in combination with marine peptides from tilapia for burns healing. *Int J Biol Macromol* [Internet]. 2018;112:1191–8. Available from: <https://doi.org/10.1016/j.ijbiomac.2018.01.217>
16. Zhou T, Wang N, Xue Y, Ding T, Liu X, Mo X, et al. Electrospun tilapia collagen nanofibers accelerating wound healing via inducing keratinocytes proliferation and differentiation. *Colloids Surfaces B Biointerfaces* [Internet]. 2016;143:415–22. Available from: <http://dx.doi.org/10.1016/j.colsurfb.2016.03.052>
17. Hermans MHE. Porcine xenografts vs. (cryopreserved) allografts in the management of partial thickness burns: Is there a clinical difference? *Burns*. 2014;
18. Chiu T, Burd A. “Xenograft” dressing in the treatment of burns. *Clin Dermatol*. 2005;
19. Lima-Junior EM, Picollo NS, Miranda MJB De, Ribeiro WLC, Alves APNN, Ferreira GE, et al. Uso da pele de tilápia (*Oreochromis niloticus*), como curativo biológico oclusivo, no tratamento de queimaduras. *Rev Bras Queimaduras*. 2017;
20. Costa BA, Lima Júnior EM, de Moraes Filho MO, Fêchine FV, de Moraes MEA, Silva Júnior FR, et al. Use of Tilapia Skin as a Xenograft for Pediatric Burn Treatment: A Case Report. *J Burn Care Res*. 2019;40(5):714–7.
21. Lima Júnior EM, de Moraes Filho MO, Costa BA, Fêchine FV, Alves APNN, de Moraes MEA, et al. Pediatric Burn Treatment Using Tilapia Skin as a Xenograft for Superficial-Partial Thickness Wounds: a Pilot Study Authors: *J Burn Care Res*. 2019;

Correspondence to:

Vlad Laurentiu David,
University of Medicine and Pharmacy “Victor Babes”
P-ta Eftimie Murgu no. 2, Timisoara, Romania
E-mail: david.vlad@umft.ro

INTERCEPTIVE ORTHODONTICS IN PRIMARY AND MIXED DENTITION: THE IMPORTANCE OF EARLY DIAGNOSIS

R Oancea¹, C Funieru², R Sfeatcu³, D Jumanca¹

Abstract

The main objectives of interceptive treatment are to reduce to a minimum the impact of malocclusion development in permanent dentition. A systematic detection of potential orthodontic problems during primary and mixed dentition is more effective than doing nothing to improve the existing situation and ending up by requiring more complex treatment.

In a high number of cases, a second phase of the treatment may be necessary, but interceptive procedures may produce acceptable clinical situation reducing the severity of malocclusion. The proper results will be reached at a much younger age and the child's acceptance in the social environment and also the psychological well-being will be improved before reaching the years of adolescence. A very persuasive attention regarding the eruption and development of the primary and permanent dentitions is an integral part of the care of paediatric patients. This guidance should contribute to the development of a permanent dentition that is in a harmonious, functional and aesthetically acceptable occlusion.

This paper presents the most common orthodontic problems that can be present in the childhood and also some interceptive possibilities in primary and mixed dentition.

Keywords: primary dentition, mixed dentition, interceptive orthodontics

Introduction

In 1982 Richardson defined interceptive orthodontics as the prompt intervention addressing the unfavourable features of a developing occlusion that may make the difference between achieving a satisfactory result by simple intervention, reducing the overall treatment time and providing better stability, functional and aesthetic results [1].

Interceptive orthodontics includes procedures to restore a normal occlusion from a malocclusion that has begun to develop. This intervention can be defined as a treatment that

eliminates or reduces the severity of malformations and may decrease the need or simplify the subsequent treatment.

The function of the primary dentition is to maintain the arch length, so that the permanent dentition, which replaces have sufficient space to erupt. The main objectives of interceptive treatment are to minimize the degree of malocclusion development by maintaining the median line, avoiding crowding, preventing the development of class II and III malocclusion. Early orthodontic intervention has as primary objectives enhancing skeletal, dentoalveolar and muscular development before complete eruption of the permanent dentition. In addition, interceptive procedures can be perceived as useful ways to improve the patient's self-image, eliminating destructive habits, facilitating normal teeth eruption and improving growth models [2,3]. Although in most of the clinical situations, interceptive orthodontics does not produce final orthodontic results without a second phase of treatment in permanent dentition, several studies suggested that applying interceptive measures in primary and mixed dentition could contribute to a significant reduction in the need for treatment after the age of 12.

Anterior open bite treatment brings significant dentoalveolar changes in the anterior region, correcting the open bite by incisor extrusion and up righting. In posterior crossbite cases, results are maintained years after expansion [4].

The percentage of children that could benefit from interceptive orthodontics varies from 14% to 49% [5-7]. Systematic program of orthodontic interceptive treatment during mixed dentition is more effective than doing nothing to improve malocclusions [8]. Studies indicated the presence of long term results after implementing orthodontic interceptive treatment in early mixed dentition, justifying the burden of treatment as compared to single-phase treatment during permanent dentition [9,10]. The aim of this article is to review the most common orthodontic problems that should be treated in primary and mixed dentition and to present the most common management approaches in light of the existing evidence.

¹Preventive, Community Dentistry and Oral Health Department, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, Timișoara, Romania

²Preventive Dentistry Department, Faculty of Dental Medicine "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

³Oral Health and Community Dentistry Department, Faculty of Dental Medicine "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

E-mail: roancea@umft.ro, thycristi@yahoo.com, ruxandra.sfeatcu@gmail.com, dejumanca@gmail.com

Common problems during primary and mixed dentition

Early loss of primary teeth

Before the age of 7, early loss of the primary first molars leads to a temporary lack of space, which can be regained, on the eruption of the first premolar. When the loss of a second molar happens before this age, often the result is the drifting of the permanent first molars as a consequence of the loss space. In this situation space maintainer is required as a passive fixed appliance that can prevent this space loss; Up to 3 mm per quadrant of space could be obtained. This appliance is not indicated for severe crowding that will require extraction later [11].

Local factors

Primary teeth present on the arch longer time are related to mispositioned permanent teeth. The immediate consequence is the delayed eruption of permanent teeth. The primary teeth should be extracted to allow spontaneous alignment. Interceptive orthodontics for the normal development of the mixed dentition is needed.

In case of the presence of supernumerary teeth extraction will be needed to allow spontaneous eruption. Severe ectopic eruption may require a fixed appliance. Delaying treatment of ectopic eruption of permanent maxillary first molars may be an option when the outcome is unclear. Increased magnitude of impaction was the most reliable predictor associated with irreversible outcome [12].

Crowding

If there is no spacing in the primary dentition there is 70% chance of crowding of the permanent teeth, if there is less than 3mm spacing there is 50% chance of crowding [7].

Ectopic eruption of maxillary canine

When the patient is 10-13 years old in Class I non-crowded for the situations where the permanent canine is impacted or accidentally is erupting buccal or palatal, the treatment is the extraction of the primary canines. Studies have shown that interceptive extraction of the primary canine completely resolves permanent canine impaction in 62% of cases; another 17% show some improvement in terms of more favorable canine positioning [13]. Ectopic eruption of maxillary canines can be associated with root resorption of adjacent teeth [14].

The success of early interceptive treatment for impacted maxillary canines is influenced by the degree of impaction and age at diagnosis [15].

Midline diastema

This stage is generally called “ugly duckling” and it corrects along with the with the complete eruption of lateral incisors and canines [16]. The other causes of midline diastema are low frenal attachment, presence of a supernumerary teeth or cyst in the midline of the upper arch, different angulation of the central incisors or the microdontia of upper central incisors. There also might be present oral habits, muscular imbalances, physical

obstructions, abnormal maxillary arch structure and various dental anomalies [17].

The pathological cause should be identified and removed early. The midline diastema can be closed with a removable appliance in the early years of mixed dentition.

Cross bite

Malocclusions on the transverse plane of the maxilla are called crossbites. If these are localized in the posterior area are defined as alterations of the correct alignment of the palatal cusps of the upper molars and premolars with the pits of the lower molars and pre-molars. Most common causes are: skeletal or dentoalveolar constriction.

Anterior crossbite is defined as an abnormal reversed relationship of a tooth or teeth to the opposing teeth in the buccolingual or labiolingual direction, and it is also known as reverse overjet. The development of anterior crossbite, can be categorised into skeletal, dental, and functional entities. Skeletal anterior crossbite arises due to either genetic or hereditary influence or discrepancy in the size of the maxilla and mandible. In the anterior crossbite of dental origin, one or two teeth are often involved, and the affected tooth/teeth are either upright or mispositioned without any significant maxilla-mandible discrepancy. In the functional-type crossbite, a premature contact between the opposing tooth/teeth could result in the deflection of the mandible to the sides or anteriorly, and this leads to the development of pseudoclass-III.

When is localized in the anterior site it must be treated at an early stage because the upper incisors may be abraded by the lower incisors and as a result of occlusal trauma the periodontal support of the incisors may be affected. If it remains untreated mandibular shift could be the result; growth pattern is rapidly changing, dental compensation leading to a true prognathic aspect and/or asymmetry at a later time. One of the consequences can be the appearance of modified functional patterns [18].

According to different studies the frequency of crossbites seen in dental clinics varies between 1% and 23%. The most frequent is single-tooth crossbite, at around 6-7%, followed by unilateral crossbites, around 4-5%, and lastly, bilateral crossbites, which make up 1.5% - 3.5% [19]. The frequency of crossbites is not influenced by either age or sex.

Vicious oral habits

The presence of vicious oral habits like finger-sucking, abnormal tongue position, tongue thrust (it refers to a swallowing pattern in which the tongue is placed in the front of the mouth to begin the swallow) are the most common factors influencing dental development and potentially facial growth in childhood. The relationship between oral habits and unfavourable dental and facial development is considered to be associational [20,21]. In order to be linked with dentoalveolar or skeletal deformations such as reduced overbite, increased overjet, anterior, posterior crossbite, increased facial height, vicious oral habits must be present in sufficient duration, frequency and intensity, duration being more important than force

magnitude; the pressure coming from the lips, cheeks, and tongue has the greatest impact on tooth position, as these forces are present most of the time [22,23]. In infants and young children non-nutritive sucking behaviours are considered normal. Prolonged non-nutritive sucking habits, have been associated with decreased maxillary arch width, increased overjet, decreased overbite, anterior open bite, and posterior crossbite [24]. Studies indicated that there are significant differences in dental arch and occlusal relationships in pacifier users at 24 and 36 months compared with those that had stopped sucking by 12 months [25]. Moreover, by age 2 to 5 years, a significant increase in overjet (>4 mm), open bite, and posterior crossbite in pacifier users was observed [26].

As a result of digit or pacifier sucking habits some changes in the dental arch perimeters and occlusal characteristics persist well beyond the cessation of the pacifier or digit habit. Parafunctional habits are influencing negatively the occlusion so they have to be corrected as early as possible, so less complex orthodontic treatment may be required later.

Treatment approaches in primary dentition

Anterior crossbite in the primary dentition must be corrected when identified to allow normal dental development and skeletal growth. A simple method such as tongue blade can be used in the early stages of anterior crossbite development as the tooth/teeth are erupting [27].

In order to intercept class III malocclusions cephalometric radiographs are needed to make the distinction between dental and skeletal problems. Removable acrylic appliances with inclined planes are a good alternative for the correction of dental anterior crossbite.

Most of the unilateral posterior crossbite in primary dentition result from a constricted maxillary arch (bilaterally) with a functional shift. Unilateral posterior crossbite could be diagnosed by observing midline discrepancy in centric occlusion. Therapeutic approach consists of selective grinding. Studies have shown that complete correction of posterior crossbite using selective grinding could only be achieved in less than 30% of children [28]. Fixed appliance (W-arch, quad-helix) or a removable appliance with an expansion screw are good alternative treatment.

For Class II malocclusions treatment is initiated in mixed and early permanent dentition. The long-term clinical effectiveness of treatment addressed to correct anterior open bite and deep bite in young children are less documented.

Several abnormal habits in primary dentition are more common: like sucking behaviors (introducing between arches different objects), mouth breathing and bruxism [29].

The most important attitude is to try to correct this behaviours as early as possible. The consequences of digit sucking could interfere with the development of maxillary growth [30].

Untreated caries in primary dentition will be followed by premature loss that could modify the arch length if space maintainers were not applied.

The deficiency in arch length can interfere with occlusion relationships generating rotations, ectopic eruption, crowding, anterior and posterior crossbite, excessive overjet or overbite and class II and III reports between canines and molars.

Therapeutic approaches in mixed dentition

In mixed dentition both dental and skeletal problems can occur (figure 1).

Most common dental problem are related to Class II and Class III malocclusions correction and tooth size-arch length correction. Skeletal problems include maxillomandibular discrepancies associated with Class II and Class III malocclusions.

In the space management it is important to start the treatment just at the end of the mixed dentition stage and to maintain leeway space. This is the gold standard treatment period [31]. It was also found that management of leeway space alone may resolve the crowding problems in more than 80% of orthodontic patients (32). As a treatment alternative: lip bumpers can be used to maintain leeway space. If the permanent first molar position is maintained during the transition to the permanent dentition an average gain of 2.5 mm of space per side in the mandibular arch and about 2 mm per side in the maxillary arch will be obtained.

Transpalatal arch can also be used, either as a passive appliance to maintain the position of the upper molars or as an active appliance that improves the molar position.

Mild-to-moderate crowding (3-4 mm) can be effectively treated with maxillary expansion (quad-helix expander, W-arch, removable appliance with expansion screw) (figure 2).

In extremely severe crowding, serial extraction can represent a treatment option, but it has to be applied with maximum care [33].

For the class II malocclusion headgear, pre-orthodontic trainer or functional appliances can be used. Headgear (GAC International Inc., Central Islip, New York, USA) produce distal force on the maxillary teeth and maxilla. The scope is to shift an end-to-end molar relationship to Class I by moving the upper molars distally (figure 3). The pre-orthodontic trainer is a functional device addressing children with aged between 4 to 10. It has the advantage direct fitting in the patient's mouth. The prefabricated appliances were claimed to be effective for class II division I management.

The appliance can also correct functional problems like interposition of the lips between dental arches or the presence of atypical swallowing pattern; it also discourages oral respiration and bruxism [34,35].

Functional appliances utilize, eliminate, or guide the forces of muscle function, tooth eruption, and growth to correct a malocclusion. They help to correct Class II malocclusion.

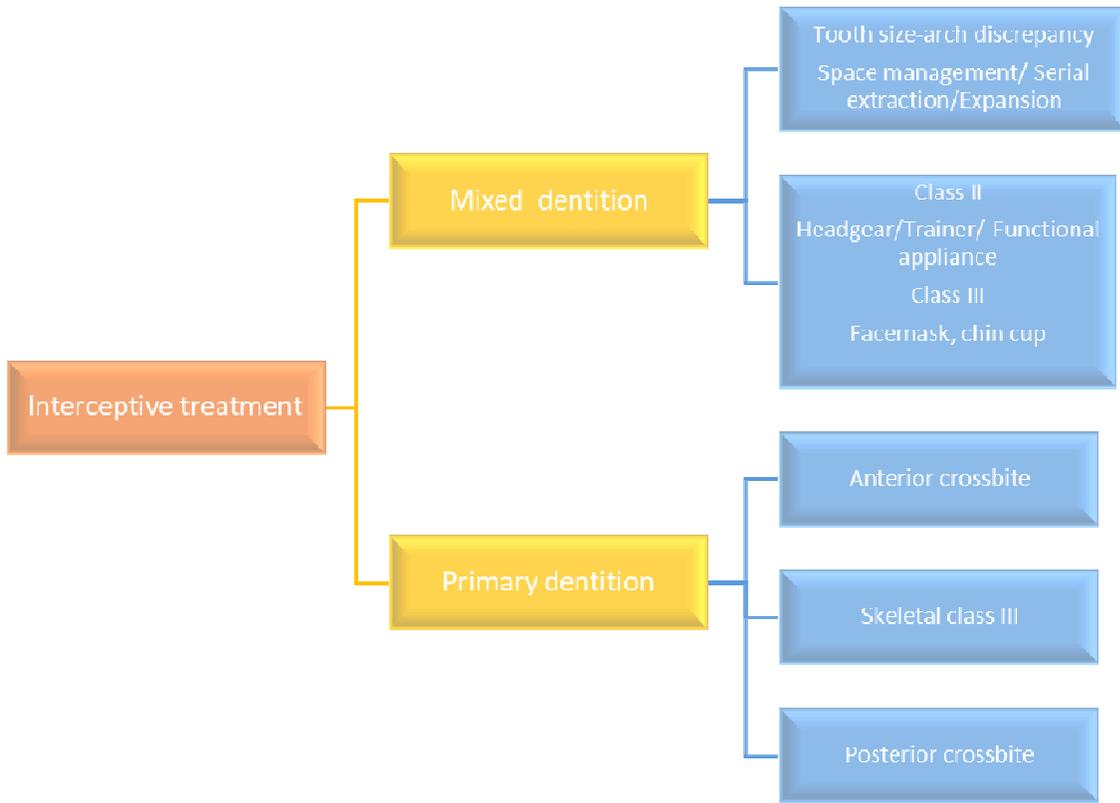


Figure 1. Interceptive approaches.

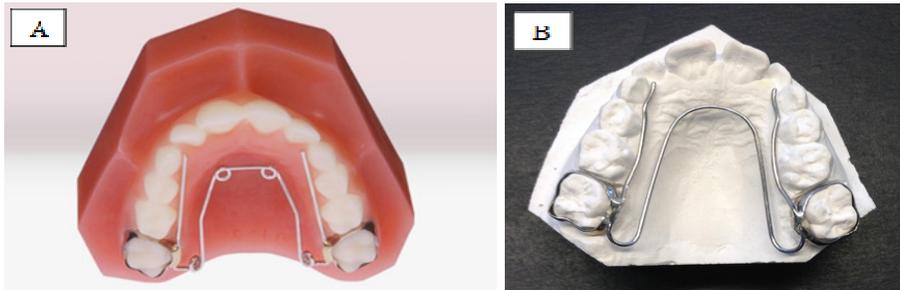


Figure 2. A. Quad-helix expander B. W-arch.



Figure 3. A. Headgear. B. Functional appliances.

Class III malocclusions are associated with maxillary retrognathia, mandibular prognathia, or a combination of both. The multifactorial aetiology is the result of interaction between genetics and environmental factors. There are also often accompanied by vertical or transversal malocclusion.

Intervention at an early stage it is highly recommended. The treatment of Class III malocclusion by means of rapid palatal expansion with facemask protraction creates favourable growth corrections both in maxilla and in the mandible [36]. In a controlled long-term study, after the

follow-up of 7 years it has been found that patients who have been treated before the pubertal growth phase showed a stable increase in the maxillary skeletal width, maxillary intermolar width, and lateral nasal width, while patients treated after the pubertal growth phase showed only dentoalveolar effects [37]. One of the most commonly used interceptive appliances to intercept developing skeletal Class III malocclusion is the protraction facemask also referred to as reverse headgear (figure 4) [38].

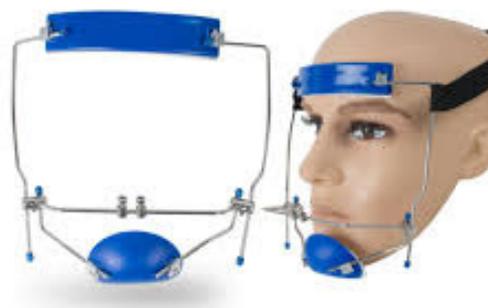


Figure 4. Reverse headgear.

The appliance is composed of two components: an extraoral framework (facemask) that fits on the forehead and chin, and an intraoral attachment to the maxillary dentition. The chin and forehead part of the extraoral framework are connected by a middle bar for the connection of the elastics to the intraoral attachment to the maxillary dentition.

Conclusion

Interceptive orthodontics has its benefits in the recognition and elimination of potential irregularities and

malposition in the developing dentofacial complex. The timing of interceptive treatment is critical. The early assessment of the child, followed by regular check-ups and treatment at the appropriate time will reduce malocclusion. The key to be able to apply prevention is awareness of the craniofacial growth and development. The positive aspect with interceptive management is that the treatment outcomes will have been achieved at a younger age and the child's social and psychological wellbeing will be enhanced before adolescence.

References

- Richardson A. "Interceptive Orthodontics" 2nd edition, London. British Dental Journal 1989. 48-50p.
- King GJ, Hall CV, Milgrom P, Grembowski DE. Early orthodontic treatment as a means to increase access for children enrolled in Medicaid in Washington state. J Am Dent Assoc 2006;137:86-94.
- Kerosuo H. The role of prevention and simple interceptive measures in reducing the need for orthodontic treatment. Med Princ Pract 2002;11 (Suppl 1):S16-21.
- Sunnak R, Johal A, Fleming PS. Is orthodontics prior to 11 years of age evidence-based? A systematic review and meta-analysis. J Dent 2015;43:477-86.
- Al Nimri K, Richardson A. Interceptive orthodontics in the real world of community dentistry. Int J Paediatr Dent 2000;10:99-108.
- Vkiparta MK, Kerosuo HM, Nyström ME, Heikinheimo KA. Orthodontic treatment need from eight to 12 years of age in an early treatment oriented public health care system: a prospective study. Angle Orthod 2005;75:344-9.
- Richmond S, Shaw WC, Roberts CT, Andrews M. The PAR Index (Peer Assessment Rating): methods to determine outcome of orthodontic treatment in terms of improvement and standards. Eur J Orthod 1992;14:180-7.

8. King GJ, Brudvik P. Effectiveness of interceptive orthodontic treatment in reducing malocclusions. *Am J Orthod Dentofacial Orthop* 2010;137:18-25.
9. Geran RG, McNamara JA Jr, Baccetti T, Franchi L, Shapiro LM. A prospective long-term study on the effects of rapid maxillary expansion in the early mixed dentition. *Am J Orthod Dentofacial Orthop* 2006;129:631-40.
10. Baccetti T, Franchi L, McNamara JA. Cephalometric variables predicting long-term success or failure of combined RPE and face mask therapy. *Am J Orthod Dentofacial Orthop* 2004;126:16-22.
11. Proffit W. R. et al. *Contemporary Orthodontics* 3rd edition, St.Louis: Mosby. 2000. 422-427p.
12. Dabbagh B, Sigal M J, Tompson BD, Titley K, Andrews P, Ectopic Eruption of the Permanent Maxillary First Molar: Predictive Factors for Irreversible Outcome. *Pediatr Dent* 2017; 39(3): 215-218(4).
13. Jacobs S. G. Reducing the incidences of palatally impacted maxillary canines by extraction of deciduous canines: a useful preventive/interceptive orthodontic procedure, Case reports. *Aust Dent J* 1992; 37: 6-11p.
14. Aileni KR, Rachala MR, Prathima CR, Naveen PK, Soujanya D. Management of an Unusual Ectopic Eruption of Maxillary Canine. *J Clin Diagn Res.* 2017;11(5):ZD03–ZD05. doi:10.7860/JCDR/2017/25637.9868.
15. Garib DG, Janson G, Baldo Tde O, dos Santos PB. Complications of misdiagnosis of maxillary canine ectopic eruption. *Am J Orthod Dentofacial Orthop.* 2012 Aug;142(2):256-63. doi: 10.1016/j.ajodo.2010.12.023.
16. Kamath M K, Arun A V. Midline diastema. *Int J Orthod Rehabil* 2016;7:101-4.
17. Huang WJ, Creath CJ. The midline diastema: A review of its etiology and treatment. *Pediatr Dent* 1995;17:171-9.
18. Pirttiniemi P. M. Associations of mandibular and facial asymmetries- a review. *Am J Orthod Dentofacial Orthop* 1994. 106. 191-200p.
19. Bravo LA. ed. *Manual de Ortodoncia*. Madrid: Síntesis; 2003. p. 617-48.
20. American Academy of Pediatric Dentistry Guideline on management of the developing dentition and occlusion in paediatric dentistry. *Clinical Guidelines.* 2014;36(6):251–261.
21. Warren JJ, Bishara SE, Steinbock KL, Yonezu T, Nowak AJ. Effects of oral habits' duration on dental characteristics in the primary dentition. *J Am Dent Assoc.* 2001;132(12):1685–1693. doi: 10.14219/jada.archive.2001.0121.
22. Proffit WR. The aetiology of orthodontic problems. In: Proffit WR, Fields HW Jr, Sarver DM, editors. *Contemporary Orthodontics*. 5. St. Louis: Mosby; 2012. pp. 114–146.
23. Bell RA, Dean JA, McDonald RE, Avery DR. Management of the developing occlusion. In: Dean JA, Avery DR, McDonald RE, editors. *McDonald and Avery's dentistry for the child and adolescent*. 9. Maryland Heights: Mosby Elsevier; 2011. pp. 550–613.
24. Canadian Paediatric Society Recommendation for the use of pacifiers. *Paediatric Child Health.* 2003;8:515–519.
25. Warren JJ, Bishara SE. Duration of nutritive and non-nutritive sucking behaviors and their effects on the dental arches in the primary dentition. *Am J Orthod Dento-facial Orthop.* 2002;121:347–356. doi: 10.1067/mod.2002.121445.
26. Adair SM, Milano M, Lorenzo I, Russell C. Effects of current and former pacifier use on the dentition of 24- to 59-month-old children. *Pediatr Dent.* 1995;17:437–444
27. Singh G. 3rd. New Delhi, India: Jaypee Publisher; 2015. Management of crossbite; pp. 655–670.
28. Kurol J, Berglund L. Longitudinal study and cost-benefit analysis of the effect of early treatment of posterior cross-bites in the primary dentition. *Eur J Orthod* 1992;14:173-9.
29. Nowak AJ, Warren JJ. Infant oral health and oral habits. *Pediatr Clin North Am* 2000;47:1034-66.
30. Ovsenik M. Incorrect orofacial functions until 5 years of age and their association with posterior crossbite. *Am J Orthod Dentofacial Orthop* 2009;136:375-81.
31. Proffit WR. The timing of early treatment: an overview. *Am J Orthod Dentofacial Orthop* 2006;129:S47-9.
32. Gianelly AA. Treatment of crowding in the mixed dentition. *Am J Orthod Dentofacial Orthop* 2002;121:S569-7127.
33. O'Shaughnessy KW, Koroluk LD, Phillips C, Kennedy DB. Efficiency of serial extraction and late premolar extraction cases treated with fixed appliances. *Am J Orthod Dentofacial Orthop* 2011;139:510-6.
34. Uysal TI, Yagci A, Kara S, Okkesim S. Influence of pre-orthodontic trainer treatment on the perioral and masticatory muscles in patients with Class II division 1 malocclusion. *Eur J Orthod* 2012; 34(1):96-101.
35. Majorana A, Bardellini E, Amadori F, Conti G, Polimeni A. Timetable for oral prevention in childhood-developing dentition and oral habits: a current opinion. *Prog Orthod* 2015;16:39. doi:10.1186/s40510-015-0107-8.
36. Westwood PV, McNamara JA, Baccetti T, Franchi L, Sarver DM. Long-term effects of Class III treatment

with rapid maxillary expansion and facemask therapy followed by fixed appliances. *Am J Orthod Dentofacial Orthop* 2003;123(3):306–320.

37. Baccetti T, Franchi L, Cameron CG, McNamara JA. Treatment timing for rapid maxillary expansion. *Angle Orthod* 2001;71(5):343–350.
38. Tortop T, Keykubat A, Yuksel S. Facemask therapy with and without expansion. *Am J Orthod Dentofacial Orthop* 2007; 132: 467-474.

Correspondence to:

Ruxandra Sfeatcu
Oral Health and Community Dentistry Department,
Faculty of Dental Medicine,
"Carol Davila" University of Medicine and Pharmacy,
Eforie Street no. 4-6, district 5, 50037,
Bucharest, Romania
E-mail: ruxandra.sfeatcu@gmail.com

UNEXPECTED CAUSE OF RECURRENT VOMITTING IN AN INFANT

A Pilsu¹, C Pienar¹, L Bota¹, V David^{1,2}, L Pop¹

Abstract

Introduction: Vomiting is one of the commonest complaints in children. Recently, a child presented to our hospital with an occult cause of vomiting and failure to thrive, for which we decided hospitalization for further investigations. This case report will follow his evolution, the differential diagnosis and therapeutic measures. **Aim:** To report a case of an infant with recurrent vomiting since early infancy. **Case report:** Teodor, a 10 months old child, presented to our gastroenterology department for chronic recurrent vomiting since he was 3 months old: At first, he presented 1 episode of vomiting per day and, after a few months, 3-4 episodes per day. We performed a complete assessment. We note 3 previous visits to our hospital during which efforts were made to diagnose the child's reason for vomiting. At 3 months GERD and Cow's milk proteins allergy was suspected, which was later excluded. After the second visit the suspicion of an obstruction on the digestive tract was raised, but the parents refused upper digestive endoscopy or barium passage. When he was hospitalized, barium swallow study was performed and it revealed a massive herniation of the stomach and duodenum. **Conclusion:** Hiatal hernia should be considered as a differential diagnosis in a patient presenting with vomiting episodes with chronic character and failure to thrive

Keywords: infant, vomiting, hiatal hernia

Introduction

In infants and children vomiting is a very common symptom, which is actually a protective reflex and can be present in a multitude of disorders that can range from mild illnesses to severe, life-threatening conditions. Although vomiting can originate from the gastrointestinal (GI) tract itself, it can also signal more generalized, systemic disorders. The diagnosis should include a focussed history (including characteristics of vomiting and associated symptoms) and physical examination. Also, investigations like serum electrolytes and blood gases, renal and liver functions and radiological studies are required. A common cause of vomiting in children is cow milk's protein allergy (CMPA), which we considered in our case, as well. Gastroesophageal reflux disease (GERD) and acute viral gastroenteritis can also be found as the cause.

Differential diagnosis of vomiting in the pediatric age group may be a result of a range of causes, including GI etiologies (obstructive and inflammatory), CNS disease, pulmonary problems, renal disease, endocrine/metabolic disorders, psychiatric disorders. Although vomiting in children is often benign and can be managed with supportive measures only, clinicians must be able to recognize life-threatening causes of vomiting and to avoid serious associated complications [1].

Case report

A 10 months old boy presented in our clinic with complaints of chronic postprandial vomiting within a few hours from the last meal, in the last 5 days acute character (3-4x episodes/ day) and failure to thrive. The child was born to healthy parents (37 years old mother and 41 years old father) and came from an urban setting. Both parents denied any chronic disease in the family or any atopy. The pregnancy was physiological. The child, GII; PI was born at 38 weeks, with a weight of 3.950 g (appropriate for gestational age) and a height of 53 cm, with an Apgar score of 9. He received breastmilk for 3 months and standard formula afterwards. Solid food was introduced correctly at 6 months. His medical history includes various visits in our department for recurrent vomiting.

The onset was at 3 months with 1 episode of vomiting/day, in the second half of the day or nocturnal, usually with food content, rarely mucus, preceded by psycho-motor agitation. After the first ambulatory presentation, we considered GERD and CMPA. We excluded cow's milk protein from the infants diet and recommended extensively hydrolyzed formula (3x120 ml/day), H2 antihistamines (Ranitidine:10 mg/kg/day), trimebutin (1ml / kgc / day). The evolution was favorable for 3 weeks, but afterwards the symptoms have reappeared. At the second ambulatory presentation, we recommended a barium swallow test and upper digestive endoscopy, but the parents refused and decided to continue the diet and the above mentioned treatment. At the third ambulatory presentation, he presented with acute symptomatology, 3-4 postprandial vomiting per day. Admission was necessary for establishing the diagnostic, monitoring and treatment.

¹2nd Pediatrics Clinic, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania

²Pediatric Surgery Clinic, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania

E-mail: pilsuandreea@yahoo.com, pienar.corina@umft.ro, zenovialoredana@gmail.com,

david.vlad@umft.ro, liviupop63@yahoo.com

Physical assessment. On examination, the anthropometric measurements revealed a weight of 7.20 kg (Percentile 2) and a height of 75 cm (percentile 75) using WHO growth standards (Figure 1). His general status was altered. He had no fever at the time of examination. He had a diminished appetite. The skin was slightly pale. The

examination of the cardiovascular and respiratory system was normal. His abdomen was soft, no tenderness on palpation. His intestinal transit for stool and gas was normal (type 3 on Bristol stool). There were no signs of meningial or peritoneal irritation.

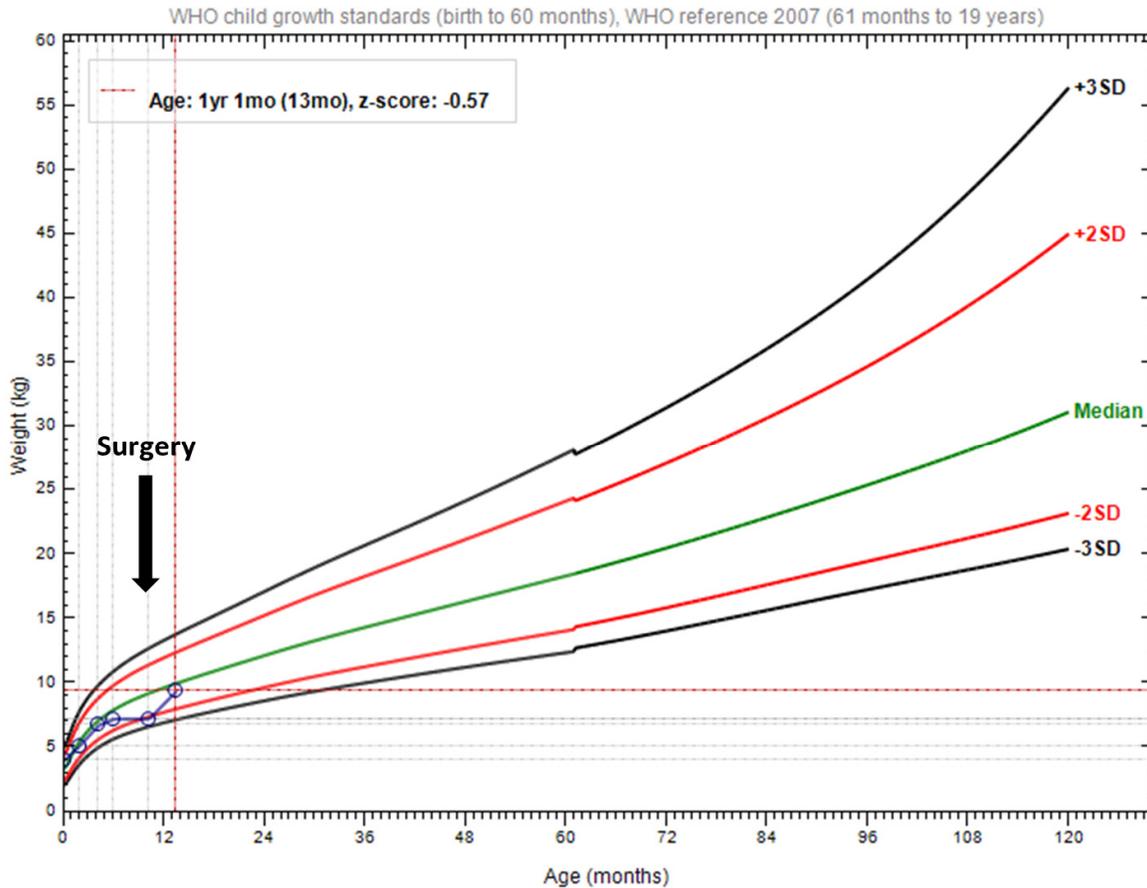


Figure 1. Growth chart showing failure to thrive. As shown by the black arrow, after surgery the child's weight normalized.

The blood work-up revealed high white blood cells (WBC) with (normal indices and CRP) and polycythemia, with low red blood cells (RBC) indices, low sideremia and a normal ferritin levels. The arterial blood gas analysis revealed a metabolic alkalosis (pH=7.47; B.E.= -10.1 mmol/L) with low chlorine (89 mmol/L). At admission an hydroelectrolytic re-balancing (calculated for his weight) was established, until normalization of the arterial blood gas analysis. At check-up, the blood-work showed normalization of WBC and RBC. Thus we concluded that the values were influenced by the dehydration status of the patient.

Consultations. Ophthalmology, pediatric neuropsychiatry and otolaryngology consultations were

normal. We decided to perform a sweat test to exclude cystic fibrosis as the cause of the failure to thrive. We also excluded a gastro-enterocolitis, an urinary tract infection and a metabolic disease (the metabolic screening showed normal ranges for ammonia, lactate and blood glucose).

Imaging studies. The ECG and the heart ultrasound were normal, as well as the abdominal ultrasound. The abdominal x-rays described digestive lumen images, located above and below the median line and right. The boy underwent a barium swallow study that completed the diagnostic, revealing a massive herniation of the stomach in the chest (type III paraesophageal hernia), with a gastric volvulus (Figure 2).

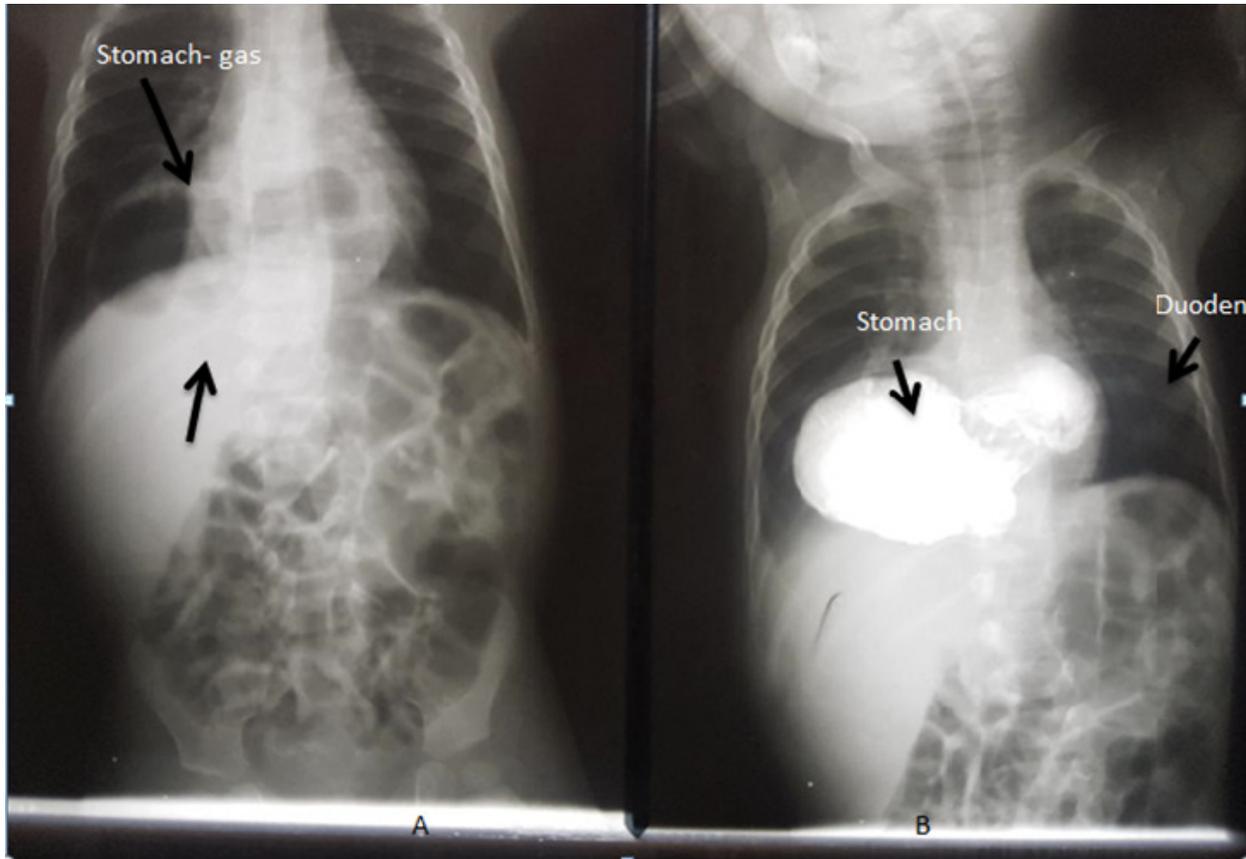


Figure 2- A. X-ray - digestive lumen images above the diaphragm; **B.** Barium swallow examination showing herniation of portion of the gastric fundus and the first part of the duodenum into the lower thoracic cavity

Management. During admission he received naso-gastric tube feeds with an elemental formula (6x120 ml/day), which he tolerated well, with no gastric residue. Six days after hospitalization, we progressively let him feed by mouth, but the vomiting reappeared. The treatment consisted of hydroelectrolytic and acid-base rebalancing and symptoms' management (proton pump inhibitors and prokinetics). He was referred to the Pediatric Surgery Clinic, where the herniation was reduced and Nissen fundoplication was performed. The evolution was favorable, with no complications. The boy is presently asymptomatic for hiatus hernia with no symptoms of heartburn, nausea, vomiting and is on a regular follow-up.

Discussions.

Back in the 16th century there were descriptions of hiatal hernia, but until the first half of the 20th century it wasn't accepted as a clinical entity [2]. The incidence in the pediatric population is low, therefore there is a lack of data concerning the diagnostic and management of hiatal hernia in children. The etiology in this population is mostly correlated with genetic factors, such as familial inheritance, Marfan syndrome, but, most of the cases are congenital [3].

In the literature there are two major types of hiatal hernia described: sliding hiatal hernia and para-esophageal

hiatal hernia. A more comprehensive classification divides the paraesophageal hernia in 3 types (II,III and IV- Figure 1). Type I (concentric or axial hiatal hernia), represents more than 95% of all hiatal hernias and is characterized by a widening of the esophageal hiatus, plus laxity of the phrenoesophageal ligament. The clinical significance of this type is in association with GERD [4,5].

Type II, classical form in which the gastroesophageal junction stays below the diaphragm and only the gastric fundus herniates. This type of hernia progressively enlarges and it can cause volvulus or incarceration, which is why it is indicated surgical repair as treatment. Type III actually represents a mixture of type I and II of hiatal hernias, meaning that both the GEJ and the gastric fundus herniated. This type was present in our patient. When type IV of hiatal hernia is described, it means that other organs (such as spleen, colon, pancreas) are found in the thoracic cavity [2].

Other types of hernia, such as congenital diaphragmatic defects, traumatic diaphragmatic hernias, iatrogenic hernias (misguided chest tubes), exist, but they are rare findings.

Hiatal hernia may be asymptomatic, discovered incidentally on routine chest x-rays or CT scans. If it is symptomatic they usually present with gastro-esophageal reflux symptoms (epigastric pain, regurgitations, heartburn), nausea, vomiting, anemia, failure to thrive, melena. They can

complicate- volvulate, strangulate, bleed, giant hernia can give mechanical complications (chest pain, respiratory distress) [4].

To confirm the diagnosis of hiatal hernia barium swallow test, upper gastro-intestinal endoscopy or CT scan need to be used. Barium swallow test is helpful to determine the size of the hernia, orientation of the stomach and to localize precisely the gastroesophageal junction in relation to the esophageal hiatus. Over the past few years, upper digestive endoscopy spread and is now used as a way to diagnose hiatal hernia, the criteria being: the proximal dislocation of GEJ of >2 cm above the diaphragmatic indentation (Z-line). CT-scan can be useful in an urgent situation, when having the suspicion of volvulized PEH, in most cases being able to distinct clearly any herniated organs in the chest cavity [3].

The presence of symptoms of gastroesophageal reflux (since GERD is the most common clinical manifestation) indicate that therapy is needed. Medical treatment consists of antacids, H2 receptor antagonists and PPIs (proton pump inhibitors) [3,6]. Drugs such as prokinetics (Metoclopramide- careful to potential extra-piramidal effects) or 5 Ht3 receptors antagonist (Ondasetron) can be used for the symptoms like vomiting. Patients who are refractory or don't answer to the treatment are considered for surgical repair. In case of a type I of hiatal hernia with no reflux disease antireflux surgery is not recommended. If

GERD is present, the indication of an antireflux procedure (fundoplication) is mandatory. In a prospective trial it was noticed that hernia and symptomatic gastroesophageal reflux managed conservative had high failure rates. Thus, they recommend surgical repair in this population. The transabdominal laparoscopic repair is preferred by most pediatric surgeons. Of course, the morbidity of an open approach being much higher than the laparoscopic approach [3].

Postoperative management consists of attention to the caloric and nutritional intake, because postoperative dysphagia is common. In patients who are asymptomatic after surgery there are no recommendations for routine contrast studies [3].

Though not so frequent in pediatric population, through this paper we hope to bring more data on hiatal hernia in pediatric population and its forms of presentation. The limitations that we, as clinicians have is the fact that the parents refuse what they consider invasive procedures, thus this kind of pathology are diagnosed late. The particularity of this case was the form of presentation with recurrent vomiting and failure to thrive.

Conclusion

Hiatal hernia should be considered as a differential diagnosis in a patient presenting with vomiting episodes with chronic character and failure to thrive..

References

<ol style="list-style-type: none"> 1. Singhi C., Shah R, Bansal A., et al. Management of a Child with Vomiting .Indian J Pediatr (April 2013) 80(4):318–325 2. Kavic S., Segan R., George I. Classification of Hiatal Hernias Using Dynamic Three-Dimensional Reconstruction Surgical Innovation, Vol 13, No 1 (March), 2006: pp 49–52. 3. Kohn GP, Price RR, DeMeester SR, et al. Guidelines for the management of hiatal hernia. Surg. Endosc.2013;27.4409. 	<ol style="list-style-type: none"> 4. Allemann P, Guarnero V, Schoepfer A. Hiatal hernia : current diagnostic and therapeutic management]. Rev Med Suisse. 2017 Jun 14;13(567):1248-1252. 5. Jong JH, Young-Tae B. Clinical Significance of Hiatal Hernia. Gut Liver. 2011Sep; 5(3): 267–277. 6. Rajesh U., Prasad AN. Hiatus Hernia in a Ten Year Old Boy.Med J Armed Forces India. 2008 Apr; 64(2): 189–190.
--	---

Correspondence to:

Corina Pienar MD, PhD
 Evlia Celebi nr 3, Timisoara
 Phone: +40727394686
 E-mail: pienar.corina@umft.ro

POSSIBILITIES AND LIMITS OF ENDOCRINE IMAGING IN CHILDREN

R Stroescu^{1,2}, T Bizerea^{1,2}, M Gafencu^{1,2}, G Doros^{1,2}, O Marginean^{1,2}

Abstract

Ultrasound scanning is non-invasive, widely available, less expensive, and does not use any ionizing radiation. Aim of the paper is to present the most updated information about the use of ultrasound in specific endocrine-related issues, such as thyroid, parathyroid, adrenal gland, and testicle in children and to share interesting cases from our experience. In children it is very important to know the normal US anatomy of the screened gland and the changing that occurs during pediatric life. US in the pediatric population is important in order to establish a complete diagnosis and subsequent monitoring. In cases of complex anomalies when US findings are incomplete or inconclusive, MRI provides precise demonstration of anatomic features in multiple planes.

Keywords: ultrasound, children, endocrine disease

Introduction

Ultrasound (US) is very useful in infants and children because of its innocuousness, simplicity, and reliability. Its value is being more and more recognized by many clinical specialists in assessing the anatomy of different anatomic parts. The endocrine system is made up of the pituitary gland, thyroid gland, parathyroid glands, adrenal glands, pancreas, ovaries (in females) and testicles (in males). Excepting the pituitary gland, all the others endocrine glands can be scan by US. Morphology and size can be evaluated by US and also the presence of lesions within these organs can be detected.

Aim of the paper is to present the most updated information about the use of ultrasound in specific endocrine-related issues, such as thyroid, parathyroid, adrenal gland, and testicle in children and to share interesting cases from our experience.

In children it is very important to know the normal US anatomy of the screened gland and the changing that occurs during pediatric life. In the following each endocrine organ will be described in terms of ultrasound imaging.

Normal US Anatomy of Genital Organs in Infants and Children:

• *The Uterus*

Uterine anatomy changes during pediatric life:

The neonatal uterus is prominent under the influence of maternal and placental hormones:

The cervix is larger than the fundus (fundus-to-cervix ratio = 1/2)

The uterine length is approximately 3.5 cm, and the maximum thickness is approximately 1.4 cm;

The endometrial lining is often echogenic

Some fluid can also be seen within the endometrial cavity (Fig.1 a.) [1,2].

The prepubertal uterus has a tubular configuration

Anteroposterior cervix equal to anteroposterior fundus or sometimes a spade shape (anteroposterior cervix larger than anteroposterior fundus)

The endometrium is normally not apparent; however, high-frequency transducers can demonstrate the central lining in some cases

The length is 2.5–4 cm; the thickness does not exceed 10 mm (Fig.1.b) [3,4].

The pubertal uterus has the adult pear configuration (fundus larger than cervix)

(fundus-to-cervix ratio = 2/1 to 3/1)

5–8 cm long, 3 cm wide, and 1.5 cm thick.

The endometrial lining is seen and varies with the phases of the menstrual cycle (Fig.1.c) [5,6].

• *Ovaries:*

Ovarian size : $V = \frac{1}{2} \text{ length} \times \text{width} \times \text{depth}$

In infants, measurements are greater than previously reported, with an average of slightly greater than 1 cm³ for the first year of life and 0.67 cm³ for the second year

The mean ovarian volume in girls less than 6 years of age is less than or equal to 1 cm³.

The increase in ovarian volume begins after 6 years of age. (Tabel 1)

In prepubertal girls (6–10 years old), ovarian volumes range from 1.2 to 2.3 cm³. In premenarchal girls (11–12 years old), ovarian volumes range from 2 to 4 cm³.

In postmenarchal girls, the ovarian volume averages 8 cm³ (range, 2.5–20 cm³). [7]

¹“Louis Turcanu” Emergency Hospital for Children Timisoara

²“V. Babes” University of Medicine and Pharmacy Timisoara, XI Pediatric Department, First Pediatric Clinic

E-mail: ramona.giurescu@gmail.com, teofanabizerea@yahoo.com, mgafencu@umft.ro, gdoros@gmail.com, omarginean@ymail.com

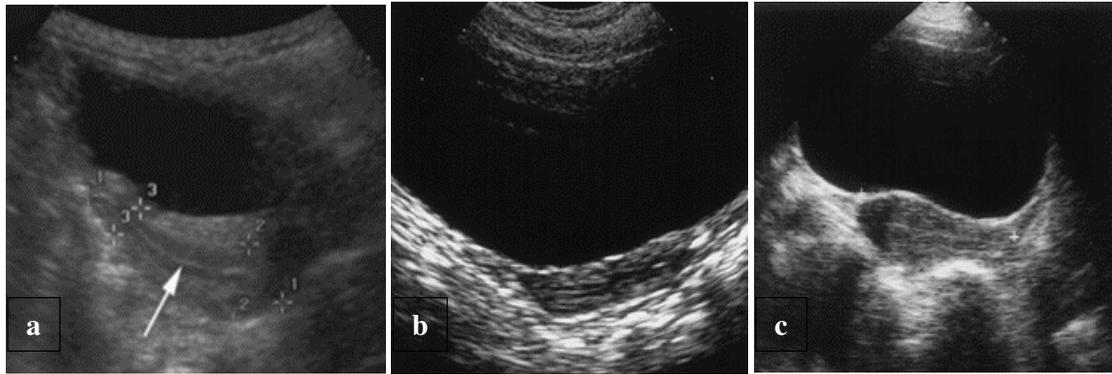


Fig 1. a. Neonatal Uterus; b. Prepubertal uterus; c. Pubertal uterus.

Table 1. Mean volume and standard deviation-ovary [7].

Age (y)	Mean Volume (cm ³)	Standard Deviation
1	1.05	0.7
2	0.67	0.35
3	0.7	0.2
4	0.8	0.4
5	0.9	0.02
6	1.2	0.4
7	1.3	0.6
8	1.1	0.5
9	2.0	0.8
10	2.2	0.7
11	2.5	1.3
12	3.8	1.4
13	4.2	2.3

Neonatal ovarian cysts (NOC) are the most common type of benign tumors found in female newborns [8]. The routine use of ultrasound allows the detection of NOC during the neonatal period. NOC with a diameter exceeding 2 cm are considered pathological. The incidence of ovarian cysts has been estimated at more than 30%. [9]. The correlation of the diameter with the clinical symptoms and ultrasound appearance allows an optimal therapeutic approach [10].

The etiology of NOC remains unknown, but hormonal stimulation, advanced gestational age and increasing placental chorionic gonadotropin levels in complicated pregnancies with large placenta such as in diabetes, pre-eclampsia and Rh incompatibility are the most frequently mentioned assumptions [11-13]. Additionally,

fetal hypothyroidism and congenital adrenal hyperplasia due to 21-hydroxylase deficiency or 11 beta-hydroxylase deficiency have also been reported to cause NOC [14]. NOC are classified according to their ultrasonographic features as “simple” or “complex”, and according to their size as “small” or “large” cysts [15,16]. Most cysts are functional in origin and histologically simple and benign (Figure 2) [17]. Complications that can occur include intracystic hemorrhage, rupture with possible intraabdominal hemorrhage, gastrointestinal or urinary tract obstruction, ovarian torsion and necrosis, incarcerated inguinal hernia, dystocia by excess of fetal abdominal part, and respiratory distress at birth from a mass effect on the diaphragm [18].



Fig. 2 Ovarian cysts in 2 months old girl.

Mnemonic:

Upper values for prepubertal girls:
 Uterine length = 4.5 cm, uterine thickness = 1 cm (the single most useful criterion), ovarian volume = 4–5 cm³.

- Testis:
 Volume of the testis (table 2) can be calculated using the formula:
 Testicular size : $V = \frac{1}{2} \text{ length} \times \text{width} \times \text{depth}$

Table 2. Normal values for right and left testis by age [19].

Age group (years)	Mean±SD							
	Right testis				Left testis			
	Length (cm)	Antero-posterior diameter (cm)	Width (cm)	Volume (cm ³)	Length (cm)	Antero-posterior diameter (cm)	Width (cm)	Volume (cm ³)
0-1	1.48±0.35	0.76±0.13	0.90±0.17	0.78±0.38	1.46±0.29	0.75±0.14	0.89±0.18	0.76±0.38
1.1-2	1.41±0.21	0.74±0.14	0.83±0.14	0.65±0.18	1.40±0.28	0.72±0.11	0.84±0.10	0.65±0.23
2.1-3	1.43±0.23	0.76±0.14	0.87±0.10	0.70±0.21	1.40±0.22	0.74±0.12	0.87±0.12	0.68±0.18
3.1-4	1.50±0.23	0.77±0.11	0.89±0.09	0.73±0.18	1.52±0.28	0.73±0.11	0.91±0.13	0.75±0.25
4.1-5	1.51±0.30	0.68±0.11	0.89±0.13	0.67±0.21	1.50±0.32	0.70±0.12	0.88±0.15	0.71±0.38
5.1-6	1.61±0.19	0.75±0.16	0.92±0.11	0.82±0.21	1.55±0.20	0.76±0.11	0.92±0.08	0.83±0.21
6.1-7	1.56±0.25	0.74±0.08	0.91±0.12	0.80±0.19	1.54±0.26	0.74±0.10	0.89±0.11	0.77±0.16
7.1-8	1.59±0.44	0.81±0.29	0.91±0.17	0.99±0.81	1.46±0.35	0.83±0.26	0.90±0.16	0.86±0.57
8.1-9	1.61±0.32	0.81±0.17	0.96±0.15	0.98±0.57	1.61±0.34	0.79±0.15	0.93±0.15	0.98±0.55
9.1-10	1.82±0.41	0.82±0.19	1.00±0.27	1.24±1.02	1.74±0.34	0.82±0.17	0.96±0.23	1.16±0.88
10.1-11	1.95±0.91	0.88±0.14	1.16±0.42	1.74±2.17	1.90±0.75	0.88±0.16	1.10±0.37	1.59±0.83
11.1-12	2.20±0.38	0.98±0.16	1.20±0.22	1.89±0.55	2.31±0.37	1.01±0.19	1.22±0.22	1.95±0.49
12.1-13	2.81±0.84	1.10±0.24	1.71±0.53	3.95±2.94	2.79±0.83	1.17±0.24	1.71±0.63	3.99±3.00
13.1-14	3.62±1.05	1.26±0.20	2.00±0.74	6.60±4.02	3.65±1.02	1.29±0.20	2.02±0.71	6.72±3.25
14.1-15	3.68±1.10	1.37±0.22	2.45±0.78	8.92±3.76	3.73±0.97	1.36±0.30	2.49±1.09	9.01±4.90

SD = Standard deviation

US investigation of genital disorders is useful in evaluating precocious puberty: central due to hamartomas causing increased testis volume (Figure 3 a. and b.) and peripheral, gonadotropin-independent due to autonomous ovarian follicular cysts. US demonstrates a stimulated uterus and an unilateral follicular ovarian cyst which is characterized by the daughter cyst sign. Spontaneous

regression of the symptoms at clinical examination and the ovarian cyst at US alternates with variable recurrences (Fig. 4) [20,21]. High estradiol level, low levels of follicle-stimulating hormone and luteinizing hormone, and no response to stimulation with luteinizing hormone-releasing hormone are seen in peripheral precocious puberty [22].

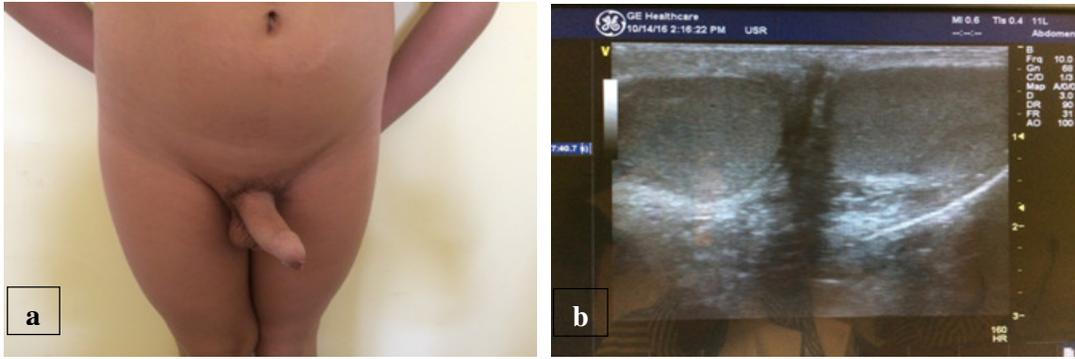


Fig. 3 a. Macrophenia in a 5 year old boy with central precocious puberty; b. Increased testis volume.

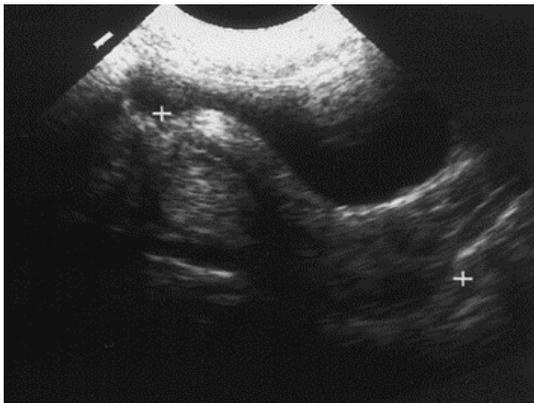


Fig. 4 A pubertal uterus in a 5 old girl with peripheral precocious puberty.

• Contribution of US in Patients with Ambiguous Genitalia:

In the male fetus, sexual differentiation is hormonally mediated by means of production of antimüllerian hormone and testosterone by the fetal testes [23]. Conversely, in the female fetus, sexual differentiation is basically an autonomous process [24].

US is very effective in demonstrating the presence or absence of a uterus in newborns with ambiguous genitalia.

Most cases of ambiguous genitalia consist of female pseudohermaphroditism due to congenital adrenal hyperplasia; in these cases, US shows a normal uterus and ovaries. Increased size of the adrenal glands has been reported in newborns and infants with congenital adrenal hyperplasia (Fig. 5 a) [25].

In the rare cases of male pseudohermaphroditism or true hermaphroditism, high-frequency transducers can also demonstrate testicular parenchyma (Fig. 5 b) [26].

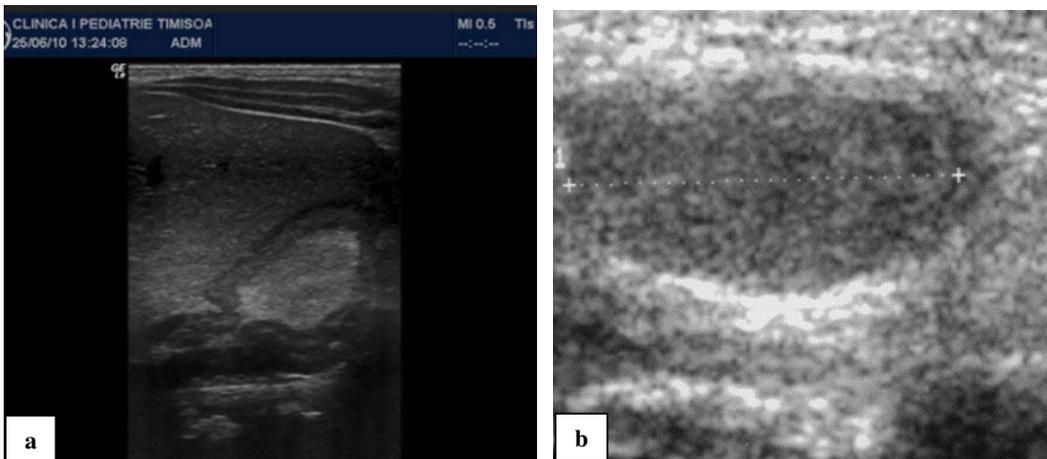


Fig. 5 a Female pseudohermaphroditism due to congenital adrenal hyperplasia; b. Male pseudohermaphroditism or true hermaphroditism, high-frequency transducers.

• Contribution of US in genetic disorders:

Patients with the 45XO karyotype, the ovaries are not visible, consistent with the classic description of absent or fibrous streak ovaries (Fig.6). US is helpful in Rokitanski syndrome, where absence of uterus and presence of normal ovaries is seen (Fig. 7a ,b) [27].

McKusick-Kaufman syndrome is an autosomal recessive disorder characterized by genitourinary

malformations, especially hydrometrocolpos, polydactyly, and, more rarely, heart or gastrointestinal malformations (Fig. 8a,b) [28].

US can be very helpful in newborns with ambiguous genitalia. In the case below uterus and scrotal testis were found in the same patient. Karyotype was 46 XY and the diagnosis of persistent Mullerian duct syndrome were established (Fig.9 a,b).

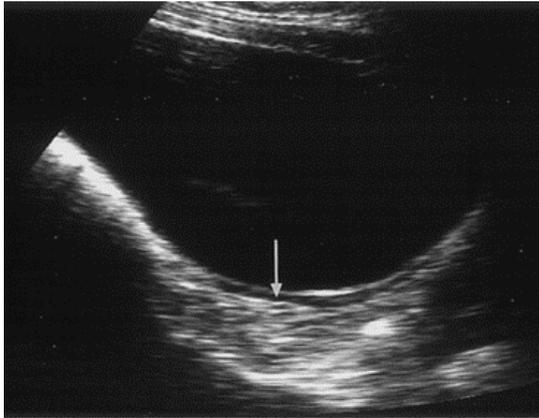


Fig. 6 Turner syndrome- prepubertal uterus and nonvisualized or streaky ovaries.

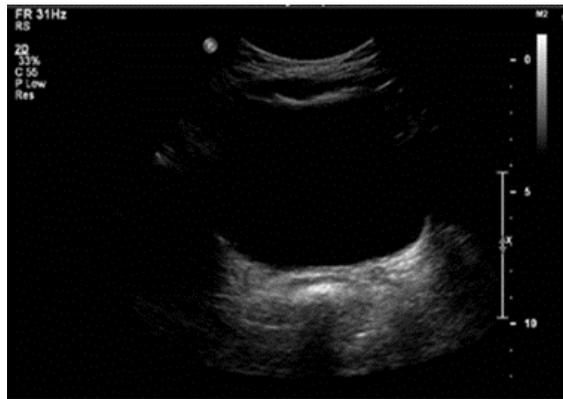


Fig. 7 Rokitanski syndrome. a. Presence; b. Absence of uterus and of normal ovaries.

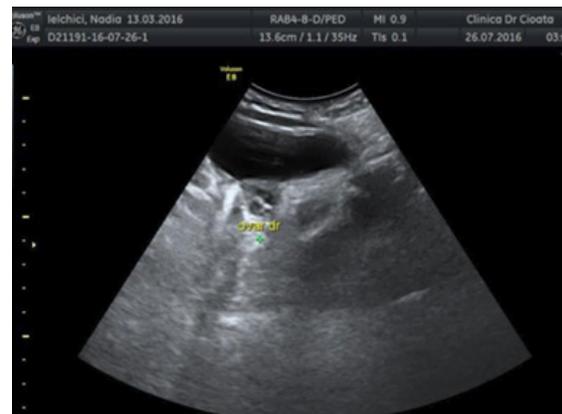
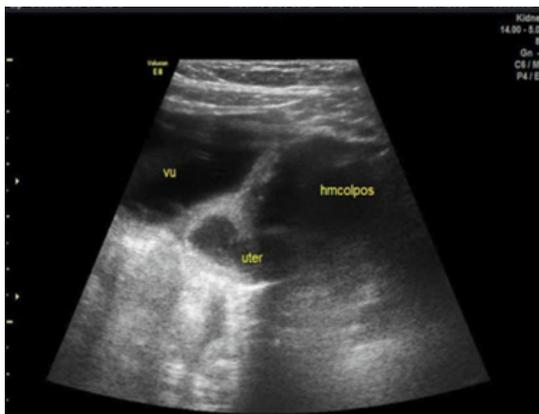


Fig. 8 a. Hydrometrocolpos in a 1 year old girl; b. Presence of the ovary with McKusick-Kaufman syndrome.

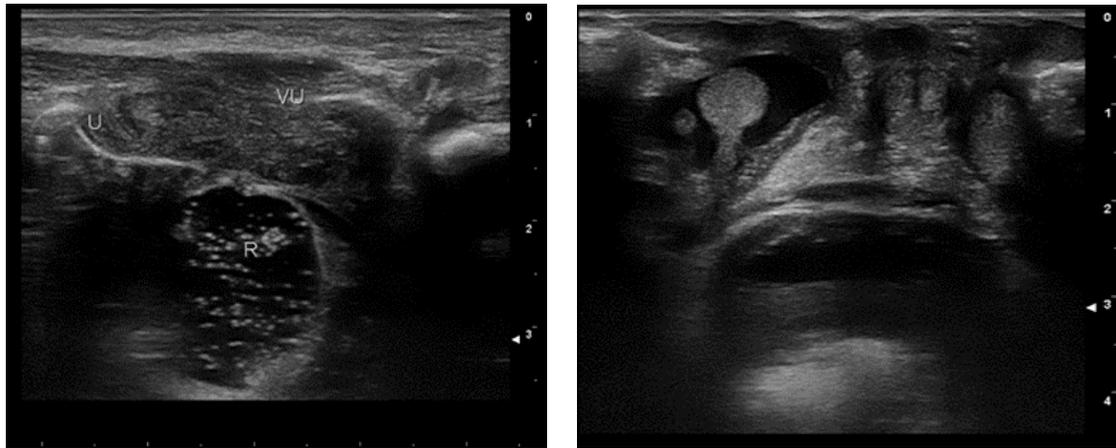


Fig. 9 a. Presence of uterus and b. testis in the scrotum in a newborn with ambiguous genitalia.

- Adrenal gland

The sonographic appearance of the normal adrenal gland in children varies with age. In newborns, the cortex is large and hypoechoic, whereas the medulla is relatively small and hyperechoic [29]. With increasing age, the cortex becomes smaller and the medulla relatively larger [30]. The cortex remains hypoechoic and the medulla hyperechoic until age 5-6 months, by which time the gland has become hyperechoic and smaller, with poor or absent sonographic differentiation between cortex and medulla. After 1 year of

age, the appearance of the gland is similar to that of the adult gland, with straight or concave borders and a hypoechoic character [31].

Normal size [30]:

- Neonates: 9–36 mm, mean 15 mm, thick 2–5 mm;
- Adults: <10 mm thick, 40-60 mm length.

Ultrasound can reveal suprarenalian hemorrhage in newborns with severe hypoxia (Fig. 10) or tumours in the adrenal gland region, neuroblastoma (Fig 11).

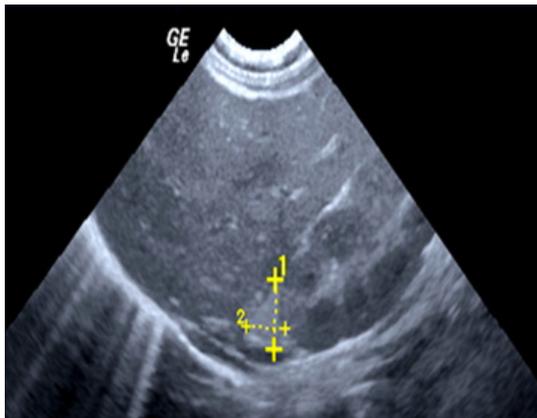


Fig. 10. Suprarenalian hemorrhage in a newborn.



Fig. 11. Neuroblastoma in 4 year old girl.

- Thyroid gland

The normal thyroid gland consists of two lobes and a bridging isthmus. Thyroid size, shape and volume varies with age and sex. There are nomograms according to age and to body surface in children (Table 3,4) [32]. Normal thyroid lobe dimensions are: 18-20 mm longitudinal and 8-9 mm antero-posterior (AP) diameter in newborn; 25 mm longitudinal and 12-15 mm AP diameter at one year age; and 40-60 mm longitudinal and 13-18 mm AP diameter in

adult population [33]. The limits of normal thyroid volume (excluding isthmus, unless its thickness is >3 mm) are 10-15 ml for females and 12-18 ml for males [34].

Indications for thyroid gland US scan are congenital hypothyroidism, absence or thyroid hypoplasia (Fig. 12).

In Graves disease thyroid Ultrasound show a diffuse swelling of the lobe, which has a rather hypo-echoic appearance and a slightly lobulated contour (Fig. 13) [35].

Table 3. Median thyroid volume normal values by age [32].

Age (years)	Median thyroid volume (cm ³)			
	Boys		Girls	
	Benin	WHO/NHD	Benin	WHO/NHD
6	1.73	1.60	1.69	1.57
7	1.54	1.80	1.54	1.81
8	1.62	2.03	1.77	2.08
9	1.61	2.30	1.94	2.40
10	1.85	2.59	1.99	2.76
11	2.58	2.92	2.51	3.17
12	2.75	3.30	2.79	3.65
13	2.92	3.07		
14	3.71	3.67		
15	4.64	4.41		
16	4.54	4.89		

Boys = $P > 0.05$; $df = 16$; $t = 0.661$ (no significant difference between present study boys and WHO/NHD boys for age). Girls = $P > 0.05$; $df = 16$; $t = 0.531$ (no significant difference between present study girls and WHO/NHD girls for age). Thyroid volume is slightly larger in girls than boys in both studies; however, this differences is statistically insignificant ($P > 0.05$).

Table 4. Normal thyroid volume values by body surface [32].

BSA	Thyroid volume (cm ³)							
	Boys				Girls			
	Range	Mean	Median	SD	Range	Mean	Median	SD
0.8	1.24-2.09	1.55	1.43	0.36	1.17-1.90	1.47	1.39	0.29
0.9	1.15-2.46	1.65	1.64	0.35	1.03-2.37	1.62	1.61	0.33
1.0	1.00-2.11	1.51	1.53	0.30	0.90-2.56	1.59	1.54	0.44
1.1	1.24-3.24	2.05	1.90	0.55	1.03-2.58	2.11	2.25	0.47
1.2	1.20-3.49	2.39	2.42	0.66	1.67-3.44	2.53	2.52	0.42
1.3	2.42-5.12	3.09	2.68	0.89	1.63-4.52	2.89	2.77	0.88
1.4	1.65-6.87	3.29	3.17	1.18	3.48-7.19	4.72	3.48	2.14
1.5	2.58-6.90	4.04	3.64	1.23	3.07-5.95	3.89	3.70	0.99
1.6	2.46-5.69	3.51	3.39	0.86	2.61-6.72	4.23	3.66	1.33
1.7	3.24-6.41	4.43	4.02	1.18	2.01-4.77	3.89	4.34	0.93
1.8	3.57-4.66	4.14	4.37	0.51	5.02-5.48	5.25	5.25	0.33
1.9	-	-	-	-	3.70-7.04	4.90	4.58	1.25

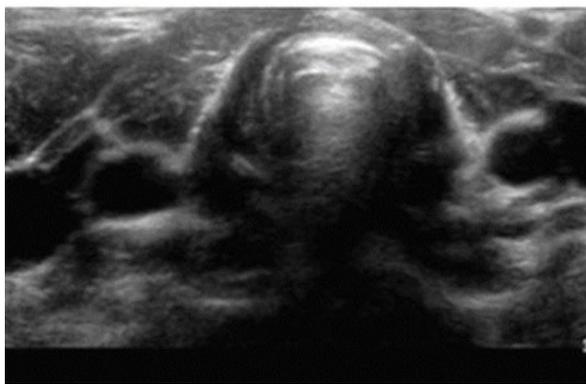


Fig. 12. Absence of the thyroid gland.

In Hashimoto the thyroid gland is seen enlarged with lobulated outline and heterogenous parenchyma showing a myriad of tiny hypoechoic nodules, separated by fibrous echogenic septa. The gland shows increased vascularity on Doppler interrogation. No otherwise sizable solid or cystic mass lesion (Fig. 14) [36].



Fig. 13. Thyroid US in Graves disease.

US is recommended as one of the first diagnostic tests in all children with thyroid nodules;

It can easily differentiate between a solid or cystic lesion. A solid nodule is being more likely susceptible to malignancy, although most solid lesions are benign, and the presence of a cystic lesion does not exclude malignancy.

A number of other US characteristics are associated with a higher risk of malignancy:

- > solitary solid lesion,
- > multifocal lesions within an otherwise clinically solitary nodule,



Fig. 14. Thyroid US in Hashimoto.

-> nodule with hypoechogenic echostructure, subcapsular localization, increased intranodular vascularity (high intranodular flow by Doppler), irregular infiltrative margins, microcalcifications, and suspicious regional lymph nodes accompanying nodule (Fig.15) [37,38].

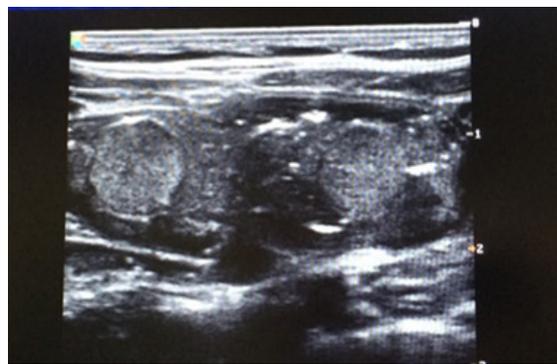


Fig. 15. Malign nodules in a 14 years old boy.

Conclusions

Ultrasound scanning is non-invasive, widely available, less expensive, and does not use any ionizing radiation. Further, real time ultrasound imaging helps to guide diagnostic and therapeutic interventional procedures. In endocrine diseases, US helps giving information about size and structure of the gland.

US in the pediatric population is important in order to establish a complete diagnosis and subsequent monitoring.

In cases of complex anomalies when US findings are incomplete or inconclusive, MRI provides precise demonstration of anatomic features in multiple planes.

References

1. Nussbaum AR, Sanders RC, Jones MD. Neonatal uterine morphology as seen on real-time US. *Radiology* 1986; 160:641-643.
2. Hata K, Nishigaki A, Makihara K, Takamiya O, Hata T, Kitao M. Ultrasonic evaluation of the normal uterus in the neonate. *J Perinat Med* 1989; 17:313-317
3. Bridges NA, Cooke A, Healy MJ, Hindmarsh PC, Brook CG. Growth of the uterus. *Arch Dis Child* 1996; 75:330-331
4. Haber HP, Mayer EI. Ultrasound evaluation of uterine and ovarian size from birth to puberty. *Pediatr Radiol* 1994; 24:11-13.
5. Holm K, Laursen EM, Brocks V, Muller J. Pubertal maturation of the internal genitalia: an ultrasound evaluation of 166 healthy girls. *Ultrasound Obstet Gynecol* 1995
6. Griffin IJ, Cole TJ, Duncan KA, Hollman AS, Donaldson MD. Pelvic ultrasound measurements in normal girls. *Acta Paediatr* 1995; 84:536-543
7. Cohen HL, Shapiro MA, Mandel FS, Shapiro ML. Normal ovaries in neonates and infants: a sonographic study of 77 patients 1 day to 24 months old. *AJR Am J Roentgenol* 1993
8. Hasiakos D, Papakonstantinou K, Bacanu AM, Argeitis J, Botsis D, Vitoratos N. Clinical experience of five fetal ovarian cysts: diagnosis and follow-up. *Arch Gynecol Obstet*. 2008;277:575–578. [PubMed]
9. Meizner I, Levy A, Katz M, Maresh AJ, Glezerman M. Fetal ovarian cysts: Prenatal ultrasonographic detection and postnatal evaluation and treatment. *Am J Obstet Gynecol*. 1991;164:874–878
10. Nguyen KT, Reid RL, Sauerbrei E. Antenatal sonographic detection of a fetal theca lutein cyst: a clue to maternal diabetes mellitus. *J Ultrasound Med*. 1986;5(11):665-7.
11. Crombleholme TM, Craigo SD, Garmel S, et al. Fetal ovarian cyst decompression to prevent torsion. *J Pediatr Surg*. 1997;32(10): 1447-9.
12. deSa DJ. Follicular ovarian cysts in stillbirths and neonates. *Arch Dis Child* 1975; 50:45.
13. Bryant AE, Laufer MR. Fetal ovarian cysts: incidence, diagnosis and management. *J Reprod Med* 2004; 49:329.
14. Dolgin SE. Ovarian masses in the newborn. *Semin Pediatr Surg* 2000;9:121-7.
15. Nussbaum AR, Sanders RC, Benator RM, Haller JA Jr, Dudgeon DL. Spontaneous resolution of neonatal ovarian cysts. *AJR Am J Roentgenol*. 1987;148:175–176. [PubMed]
16. Kuroiwa M, Hatakeyama S, Suzuki N, Murai H, Toki F, Tsuchida Y. Neonatal ovarian cysts: management with

- reference to magnetic resonance imaging. *Asian J Surg.* 2004;27:43–48. [PubMed]
17. Sakala EP , Leon ZA , Rouse GA . Management of antenatally diagnosed fetal ovarian cysts. *Obstet Gynecol Surv.* 1991 Jul;46(7):407-14.
 18. Siegel MJ. Pediatric gynecologic sonography. *Radiology* 1991; 179:593.
 19. Sotos JF, Tokar NJ. Testicular Volume revisited. *Int J Paediatr Endocr* 2012;17. Doi: 10.1186/1687-9856-2012-17
 20. Carel JC, Léger J. Clinical practice. Precocious puberty. *N Engl J Med.* 2008;358(22):2366-77
 21. Chittwar S, Shivprakash, Ammini AC. Precocious puberty in girls. *Indian J Endocrinol Metab.* 2013;16(Suppl 2):S188–S191
 22. Eugster E, A: Peripheral Precocious Puberty: Causes and Current Management. *Horm Res* 2009;71(suppl 1):64–67. doi: 10.1159/000178041
 23. Rey RA, Grinspon RP: Normal male sexual differentiation and aetiology of disorders of sex development *Best Pract Res Clin Endocrinol Metab.* 2011 Apr;25(2):221-38. doi: 10.1016/j.beem.2010.08.013.
 24. Arnold AP. A general theory of sexual differentiation. *J Neurosci Res.* 2017;95(1-2):291–300. doi:10.1002/jnr.23884
 25. Bryan PJ, Caldamone AA, Morrison SC, Yulish BS, Owens R Ultrasound findings in the adreno-genital syndrome (congenital adrenal hyperplasia). *J Ultrasound Med.* 1988 Dec;7(12):675-9.
 26. Pires CR1, De Moura Poli AH, Zanforlin Filho SM, Mattar R, Moron AF, Debs Diniz AL. True hermaphroditism-the importance of ultrasonic assessment. *Ultrasound Obstet Gynecol.* 2005 Jul;26(1):86-8.
 27. Rousset P, Raudrant D, Peyron N, Buy JN, Valette PJ, Hoeffel C: Ultrasonography and MRI features of the Mayer-Rokitansky-Küster-Hauser syndrome. *Clin Radiol.* 2013 Sep;68(9):945-52. doi: 10.1016/j.crad.2013.04.005. Epub 2013 May 31.
 28. Slavin TP, McCandless SE, Lazebnik N. McKusick-Kaufman syndrome: the difficulty of establishing a prenatal diagnosis of an uncommon disorder. *J Clin Ultrasound.* 2010 Mar-Apr;38(3):151-5. doi: 10.1002/jcu.20663.
 29. Iijima S. Sonographic evaluation of adrenal size in neonates (23 to 41 weeks of gestation). *BMC Pediatr.* 2018;18(1):60. Published 2018 Feb 14. doi:10.1186/s12887-018-1056-4
 30. Słapa RZ, Jakubowski WS, Dobruch-Sobczak K, Kasperlik-Zaluska AA. Standards of ultrasound imaging of the adrenal glands. *J Ultrason.* 2015;15(63):377–387. doi:10.15557/JoU.2015.0035
 31. Jenssen C, Dietrich CF. [Ultrasound and endoscopic ultrasound of the adrenal glands] *Ultraschall Med.* 2010;31:228–247
 32. Marchie T T, Oyobere O, Eze K C. Comparative ultrasound measurement of normal thyroid gland dimensions in school aged children in our local environment. *Niger J Clin Pract [serial online]* 2012 [cited 2019 Aug 5];15:285-92
 33. Semiz S, Senol U, Bircan O, Gümüslü S, Akcurin S, Bircan I. Thyroid gland volume and urinary iodine excretion in children 6-11 years old in an endemic area. *J Pediatr Endocrinol Metab.* 2000;13:245–251.
 34. Chaudhary V, Bano S. Thyroid ultrasound. *Indian J Endocrinol Metab.* 2013;17(2):219–227. doi:10.4103/2230-8210.109667
 35. Pishdad P, Pishdad GR, Tavanaa S, Pishdad R, Jalli R. Thyroid Ultrasonography in Differentiation between Graves' Disease and Hashimoto's Thyroiditis. *J Biomed Phys Eng.* 2017;7(1):21–26. Published 2017 Mar 1.
 36. Kapali A, Beerappa J, Raghuram P, Bangar R. Diagnostic accuracy of ultrasound imaging in Hashimoto's thyroiditis. *Thyroid Res Pract* 2017;14:28-31
 37. Lyshchik A, Drozd V, Demidchik Y, Reiners C. Diagnosis of thyroid cancer in children: value of gray-scale and power Doppler US. *Radiology* 2005;235(2):604–613.
 38. Corrias A, Mussa A, Baronio F et al. Diagnostic features of thyroid nodules in pediatrics. *Arch Pediatr Adolesc Med* 2010;164(8):714–719

Correspondence to:

Ramona Stroescu,
 University of Medicine and Pharmacy "Victor Babes"
 P-ta Eftimie Murgu no. 2, Timisoara, Romania
 Phone: 0742288868
 E-mail: ramona.giurescu@gmail.com

CONGENITAL PERINEAL LIPOMA IN A FEMALE NEWBORN – CASE REPORT

FD Enache¹, A Nicolau^{2,3}

Abstract

We report a case of an unusual congenital anomaly congenital perineal lipoma occurred in a full-term female neonate. Physical examination showed one soft perineal mass located in the right side of perineum between the vulva and the anus. No abnormalities of vulva or of anus were detected. The patient underwent ultrasound examination confirming a homogeneous fat tissue matter in its structure. The tumor was completely excised and the histological findings of the tumor revealed a perineal lipoma.

Keywords: lipoma, perineal mass, congenital, newborn

Introduction

Congenital perineal lipomas are benign tumors seen at birth in the perineal region. In boys they may be associated with accessory scrotum. In both genders they may follow an ano-rectal malformation. Antenatally these lesions may lead to misdiagnosis of ambiguous genitalia.

Purpose

Congenital perineal lipomas are rarely seen in a newborn. There are only few cases reported in the literature (about 20 cases) [1-3]. We report a neonate with this rare condition managed successfully.

Material and method

A female neonate was born at 39 weeks of gestation by normal vaginal route. The pregnancy were supervised by antenatal scans and routine blood analysis. The results were normal and no antenatal scans showed ambiguous genitalia or other genitourinary anomalies. The birth weight was 3100g. The APGAR score was 10 at one and then at five minutes. After birth the newborn was examined by a neonatologist. At examination there was an oval shaped pediculated tumor situated between the vulva and the anus on the midline, of size 4.3X2.6 cm (Figs. 1,2).



Figures 1,2 – Congenital perineal lipoma in a female newborn (anterior & lateral view).

¹Faculty of Medicine, OVIDIUS University Constanța

²Center for Research and Development of the Morphological and Genetic Studies of Malignant Pathology, OVIDIUS University Constanța

³Pathology Department, „Sf. Apostol Andrei” Constanța County Hospital

E-mail: dr.enache@chirurgiecopii.ro, craciunanca@gmail.com

There were no inflammatory signs, like redness, rised temperature or tenderness. The tumor had a pediculated base, was elastic and relatively soft in consistency. External genital organs and anus were normal. The newborn had normal intestinal transit and also normal urination. The baby was discharged from the Clinic of Neonatology with recommendation of a pediatric surgery check, for further treatment.

Results

The baby didn't come in our clinic immediately the days after discharge because of family reasons. At the age

of 3 months she came for additional investigations. Ultrasonography examination of the oval-shaped soft tumor showed a heterogeneous mass with a vascular pedicle in the center. The ultrasound examination of the abdominal cavity especially the urinary tract, showed no additional malformations. All paraclinic investigations (blood and urine analysis) were normal.

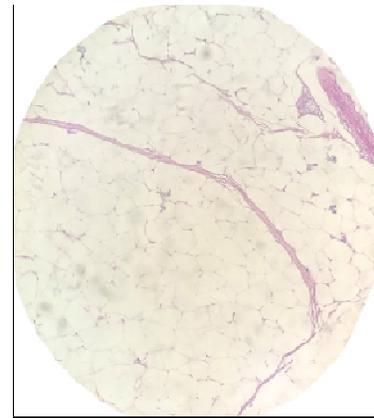
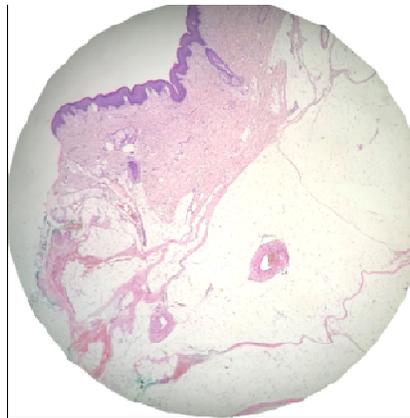
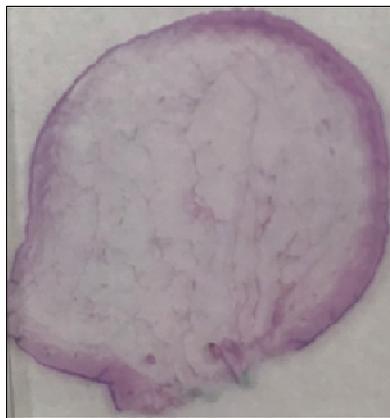
After these investigations, the child was planned for surgery - excision of the tumor. The lesion was removed completely with no complications (Figs. 3,4).



Figures 3,4 – Postoperative aspect after excision of congenital perineal lipoma.

The tumor was sent for histopathological exam. Macroscopical description shows a polypoid lesion with dimensions of 4.2/2.5/1.8 cm, with a base of surgical excision of 1/1 cm. On section there's a compact, homogeneous, yellowish-gray aspect, with low consistency (Fig. 5). The microscopic images describes a polypoid

formation consisting of a proliferation of mature adipocytes arranged in lobes separated by conjunctive septa and which on the outside is covered by a squamous keratinizing epithelium with normal structure (Figs. 6,7). As a conclusion, there was a fibrous lipoma - a mass of adipose tissue interspersed with collagen bands.



Figures 5,6,7 – Histopathological aspect of the congenital fibrous lipoma – Large subcutaneous polipoyd lesion consisting of lobules of mature adipocytes, separated by thin fibrous septa; no atypia; normal overlying epidermis.

Discussions

This type of lesion is one of the most common mesenchymal tumors. Lipomas are very rare among newborn babies [4]. Even more, a lipoma in the perineum is very rare and more than 80% of them are associated with other anomalies – accessory scrotum [5,6], abnormal labias [7] and anorectal malformations, such as anal atresia, a rectoperineal or rectovestibular fistula, or a persistent cloaca [8, 9].

The differential diagnosis can be done with an accessory scrotum in boys, fetus in fetu, haemangiomas, sacrococcygeal teratomas or lipoblastomas [10].

Although perineal lipoma is a benign tumor, it has to be excised not only for aesthetic reasons or discomfort, but also because of the fact that it can be easily confused with a lipoblastoma a borderline tumor with a high rate of recurrence and local invasion [11]. Various studies have reported the local recurrence rate of 0-25% [12].

These lipomas are evaluated antenatally by sonography and after birth the investigation may be completed with

MRI. A complete evaluation is necessary to see the structure of the lesion, the grade of invasion and also to assess other associated anomalies, such as renal agenesis, anorectal malformations, scrotum and penile anomalies [13,14].

Local excision is the treatment of choice for this type of lesions, of course, only after complete investigations.

Conclusions

Congenital perineal lipomas are very rare and can be diagnosed antenatally by sonography. The diagnosis is completed after birth by physical examination, when it is mandatory to look after associated anomalies. Then sonography and MRI may complete the diagnosis.

After complete diagnosis, surgical management with local excision is the treatment of choice. Histopathological exam is necessary to differentiate a simple lipoma from a lipoblastoma, which is a borderline tumor with a high rate of recurrence and local invasion.

References

1. Rajeev R, Swathi C, Prajakta J, Shirin J. Perineal Lipoma in a New Born Baby: It's Management. *J Pediatr Neonatal Care* 2017, 6(6): 00269.
2. Chanda MN, Jamieson MA, Peonaru D. Congenital perineal lipoma presenting as “ambiguous genitalia”: a case report. *J Pediatr Adolesc Gynecol.* 2000;13:71-4.
3. Redman JF, Ick KA, North PE. Perineal lipoma and an accessory labial fold in a female neonate. *J Urol.* 2001;166:1450.
4. Ogasawara Y, Ichimiya M, Nomura S, Muto M. Perineal lipoma in a neonate. *J Dermatol* 2001;28:165-7.
5. Baruchin AM. Human tail. *Br J Plast Surg* 1995;48:114-5.
6. Lu FL, Wang PJ, Teng RJ, Yau KI. The human tail. *Pediatr Neurol* 1998;19:230-3.
7. Redman JF, Ick KA, North PE. Perineal lipoma and an accessory labial fold in a female neonate. *J Urol* 2001;166:1450.
8. Wester T, Rintala RJ. Perineal lipomas associated with anorectal malformations. *Pediatr Surg Int* 2006;22:979-81.
9. Redman JF, Ick KA, North PE. Perineal lipoma and an accessory labial fold in a female neonate. *J Urol.* 2001;166:1450.
10. Wax JR, Pinette MG, Mallory B, Carpenter M, Winn S, Cartin A, et al. Prenatal sonographic diagnosis of a perineal lipoma. *J Ultrasound Med.* 2010;29:1257-9.
11. Ahn KH, Boo YJ, Seol HJ, Park HT, Hong SC, Oh MJ, et al. Prenatally detected congenital perineal mass using 3D ultrasound which was diagnosed as lipoblastoma combined with anorectal malformation: case report. *J Korean Med Sci* 2010;25:1093-6.
12. Kok KY, Telisinghe PU. Lipoblastoma: Clinical features, treatment, and outcome. *World Journal of Surgery.* 2010; 34(7):1517-22.
13. Wester T, Rintala R. Perineal lipomas associated with anorectal malformations. *Pediatr Surg Int.* 2006;22:979–81.
14. Wax JR, Pinette MG, Mallory B, Carpenter M, Winn S, Cartin A. Prenatal sonographic diagnosis of a perineal lipoma. *J Ultrasound Med.* 2010;29:1257–9.

Correspondence to:

Enache Florin-Daniel
 Bd. Tomis Nr. 308
 Bloc LT3, Scara D, Ap. 46
 900407 Constanța
 Tel. +4 0723012140
 Email: dr.enache@chirurgiecopii.ro

ORAL HEALTH PROFILE, KNOWLEDGE AND BEHAVIOUR IN A GROUP OF PRESCHOOLERS – A PILOT STUDY

R Sfeatcu¹, R Oancea², IM Gheorghiu³, A Totan⁴

Abstract

In the field of community dentistry, when talking about, it is aimed at translating attitudinal change into behavior, the ultimate goal being to change unhealthy habits, especially at early stages of life. The objective of the study is to assess the oral health status, the knowledge and behavior among a group of 73 preschool children from Bucharest. A questionnaire recommended by WHO was administered, an oral health education lesson was presented and a clinical examination was performed. The results are presented comparatively, before and after the oral health education lesson. After the education lesson, certain messages were understood and retained by the preschoolers, namely: the frequency of brushing, the fluoride content of the toothpaste, the fact that sticks and pastries that are not healthy for teeth. Regarding the consumption of sweets, 80% of the children (compared to 60% initially, $p < 0.05$) choose to reduce consumption as a prevention method. Conclusions: results demonstrate an unhealthy dental visits behavior and a relatively low level of knowledge regarding dental prevention. The values of the primary caries indices are increased, the presence of non cavitated lesions and the lack of sealants are also noted, which demands increased preventive and curative dental treatment needs. There is a need to implement preventive and oral health promotion programs in preschool children communities.

Keywords: oral health education, preschoolchildren, knowledge, behaviour

Introduction

The first years of life are essential for the development of the child and then for the health of the adult for a long period. The health education of the child must be carried out from the earliest age, and its beneficial effect on the state of health can last a lifetime [1]. Most oral health promotion programs have the main target group the children in kindergartens and schools [2,3]. The existence of consistent relationships between the caries risk and the level of oral hygiene measured by plaque indices, personal tooth brushing and the use of fluoridated toothpaste, has been

demonstrated [4]. In the field of oral health, when talking about attitudinal change, it is also aimed at translating it into behavior, the ultimate goal being to change unhealthy habits and to reduce the exposure to the risk factors [2,5]. In childhood, the receptivity is high, the children having the desire, but also the ability to learn new things. Moreover, World Health Organization (WHO) believes that promoting health in the environment in which individuals live, work or play is the most effective way of changing attitudes and behaviors, which is why the study was conducted among preschoolers during the activity of the daily kindergarten program [6-8]. Encouraging a favorable attitude towards visiting the dentist for regular consultation will help the child overcome their fear and prevent subsequent anxiety in adult life, and the information received in childhood will be the basis on which the behavior will be formed in adult life [9,10].

Material and methods

The study included 73 preschoolers from three kindergartens in Bucharest, with a mean age of 5.42 years ($SD=0.08$), 43.9% girls ($N = 32$).

In order to obtain information on preschoolers' knowledge and behavior towards oral health, a questionnaire recommended by WHO was administered, with closed questions and one opened question. Data were obtained regarding: oral personal hygiene habits of the child; cario-protective methods; frequency and the content of daily diet; reason and frequency of visits to the dentist; main sources of information on oral health; demographic information.

A health education lesson was realized by presenting an animated film "Journey into the Kingdom of the Tooth" (Dr. Rabbit and the Legend of the Tooth Kingdom) after obtaining the consent for using it on educational purposes. Also, it was used the demonstration of tooth brushing technique on models. After the oral health education lesson, the same questionnaire was administered again, after 2-4 weeks.

¹Oral Health and Community Dentistry Department, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

²Preventive, Community Dentistry and Oral Health Department, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, Timișoara, Romania

³Restorative Odontotherapy Department, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

⁴Biochemistry Department, Faculty of Dental Medicine "Carol Davila" University of Medicine and Medicine, Bucharest, Romania

E-mail: ruxandra.sfeatcu@gmail.com, roancea@umft.ro, igheorghiu@hotmail.com, alexandratotan99@gmail.com

Results

A. Regarding the oral health profile, the caries index values for the 73 preschoolers are:

- dmft = 3.9 (DS=0.51): d = 3.3 ((DS=0.50); m = 0.1 ((DS=0.06); f = 0.5 (DS=0.14)
- dmfs = 7.7(DS=1.27): ds = 6.8 ((DS=1.29); ms = 0; fs = 0.9 (DS=0.25).
- DMFT and DMFS = 0
- for 7 subjects (9.6%) were recorded non-cavited lesions of which 5 for male children.
- sealants were noted only in two preschool children (50% females), for permanent first molars.

B. In terms of oral hygiene, codes 0 (41.1%; N=30), 1 (39.7%; N=29) and 2 (19.2%; N=14), were registered. By gender, in equal proportion, 16 boys were assessed with code 0 and 1 and 5 girls with code 2, compared to 9 male subjects.

C. Oral health knowledge of the preschoolers. The results are presented comparatively, before and after the oral health education lesson.

- The level of knowledge about the frequency of personal dental brushing shows that half of the subjects give the right answer, but about 20% choose the once a day option and even rarer. Most of the subjects know that it is advisable to use toothpaste and toothbrush and few choose dental floss (less than 20%). After the education lesson,

more children know that it is correct to brush twice, in the morning and in the evening (Table 1).

- Children's knowledge regarding of the toothpaste components that play a role in tooth decay prevention are moderates initially, but after education lesson more subjects know the cariopreventive role of Fluoride (Table 2).

- Knowledge about cariogenic food are presented in Table 3. The majority (91.8%) correctly answered regarding the harmfulness of sweets as well as of carbonated juices.

- Methods of prevention in the opinion of children are showed in Table 4. The method of prevention in the opinion of the children remains in a large percentage the tooth brushing, but also the consumption of sweets and control are considered preventive even if in some smaller percentages.

D. Oral health behavior of the preschoolchildren. Regarding the frequency and the reasons for dental visits, the results are showed in Table 5. Almost half have never been to the dentist office and a quarter have been in pain or in emergency.

E. Sources of information related to oral health are presented in Table 6. For most children, parents or grandparents had an influence on caring for their teeth, the dentist is involved in one third of the cases. In a quarter of situations, the educational programs are also mentioned.

Table 1. Knowledge of subjects regarding the frequency and means for tooth brushing.

	Baseline		Final	
	N	%	N	%
Frequency				
After every meal	15	20.6	15	20.6
Twice a day	38	53.4	42	57.5
Once a day	15	20.6	13	17.8
At two days	2	2.7	2	2.7
Rarely	3	4.1	1	1.4
Means				
Tooth brush	72	98.6	72	98.6
Tooth paste	68	93.2	68	93.2
Dental floss	12	16.4	21	28.7

Table 2. Children's knowledge of toothpaste composition.

	Baseline		Final	
	N	%	N	%
Cariopreventive components				
I don't know	65	89.0	47	64.3
Calcium	1	1.36	1	1.36
Caramel	1	1.36	0	0
Fluor	2	2.73	24	32.87
Menthol	3	4.10	0	0
Vitamins	1	1.36	1	1.36

Table 3. Knowledge of healthy/unhealthy food for the teeth.

	Baseline		Final	
	N	%	N	%
Vegetables	8	11	4	5.5
Cereals	14	19.2	13	17.8
Cheese products	10	13.7	9	12.3
Fruits	7	9.6	6	8.2
Sweets	67	91.8	67	91.8
Sticks pastries* ($p<0.05$)	22	30.1	35	48
Beverages	49	67.1	52	71.2

Table 4. Children's opinion on the main cariopreventive methods.

	Baseline		Final	
	N	%	N	%
Tooth brushing	69	94.5	69	94.5
Eating less sweets* ($p<0.05$)	44	60.3	59	80.8
Dental check-ups	35	48	38	52

Table 5. Preschoolers' behavior regarding addressability to the dentist.

	Baseline		Final	
	N	%	N	%
Frequency of dental visits				
Never	30	41.1	29	39.7
Once	12	17.8	14	19.2
Several times	31	42.5	31	42.5
Reasons for dental visits				
Emergency/pain	19	26	18	24.7
Primary tooth extraction	17	23.3	19	26
Orthodontic treatment	0	0	1	1.4
Preventive care	3	4.1	4	5.5
Check-ups	15	20.6	14	19.2
I don't know	12	16.5	13	17.8

Table 6. Sources of information on oral health.

	Baseline		Final	
	N	%	N	%
Family (parents, grandparents)	63	86.3	62	84.9
Kindergarden teacher	10	13.7	9	12.3
Dentist	20	27.4	16	21.9
Educational programs	15	20.6	19	26
TV, mass media	7	9.6	9	12.3

Discussions

The statistically significant differences between the initial and final responses were assessed by applying the McNemar statistical test (which measures the difference

between the proportions of two variables, before and after the education lesson) and are highlighted in the tables with an asterisk. Statistical significance threshold was considered $p < 0.05$.

Thus, although there are several answers to which the children chose in a higher percentage the correct answer after being exposed to the education lesson, only in a few situations the differences were statistically significant, namely:

- regarding the consumption of sweets, the children finally chose to reduce the consumption as a method of taking care of the teeth, although it is noteworthy that the preschoolers initially knew that sugary foods are not healthy for the teeth;
- preschoolers understand that pastry products are not healthy for the teeth.

After the education lesson, certain messages were understood by the preschoolers, namely: the frequency of brushing (the proportion of those who responded once a day or less decreased; as in the 2009 study published in 2012; the use of dental floss was mentioned initially by 16% of the children, then the percentage increased to 29%; the same situation regarding the fluoride content of the toothpaste [5]. In terms of cariogenic foods, a statistically significant number of children (48% versus 30%) retained the fact that sticks and pastries that are not healthy for teeth. Regarding the consumption of sweets, 80% of the children (compared to 60% initially, $p < 0.05$) choose to reduce consumption as a prevention method.

Conclusions

The results of the study demonstrate an unhealthy dental visits behavior and a relatively low level of knowledge regarding oral health and dental prevention. As for oral status, only 33% of preschoolers are caries-free, and the value of the primary caries index is increased on untreated dental caries. The presence of non cavited lesions and the lack of sealants are also noted, which demands increased preventive treatment needs. We found it useful to use the animated film, an audiovisual method adapted to the preschooler's age, with a strong impact, which could determine the change of knowledge and behavior, rather than the oral transmission of oral health information. The study results are encouraging, showing that sanogene messages can be understood and retained by preschool children using audiovisual methods, but the message must be repeated, which would still be desirable. The oral health status of the preschoolers indicates the need to implement preventive programs along with education lessons.

Acknowledgments

The authors thank Colgate-Palmolive company in Romania for the support in conducting this study..

References

1. Peres MA, Lattore MR, Sheiham A, Peres KGA, Barros FC, Hernandez PG, Maas AM, Romano AR, Victoria CG. Social and biological early life influences on severity of dental caries in children aged 6 years. *Community Dent Oral Epidemiol* 2005;33:53-6
2. Dumitrache MA, Sfeatcu IR, Buzea CM, Dumitrascu LC, Lambescu D. Concepte și tendințe în sănătatea orală. "Carol Davila" Publishing House, Bucharest, 2009
3. Sheiham A, Watt RG. The common risk factor approach: a rational basis for promoting oral health. *Community Dent Oral Epidemiol* 2000;28:399-406
4. Gibson S, Williams S. Dental caries in pre-schoolchildren: association with social class, toothbrushing habit and consumption of sugars and sugar-containing foods. *Caries Res* 1999;33:101-113
5. Dumitrașcu L. Schimbarea atitudinilor și comportamentelor față de sănătatea orală. „Carol Davila” Publishing House, Bucharest, 2012
6. World Health Organization. World health report 2002. Reducing risks, promoting healthy life. Copenhagen. WHO Regional Office for Europe, 2002
7. Gluck GM, Morgenstein WM. Jong's community dental health. Mosby, 2003
8. Kumar JV, Wadhawan S. Targeting dental sealants in school-based programs: evaluation of an approach. *Community Dent Oral Epidemiol* 2002;30:210-5
9. Sheiham A, Watt RG. The common risk factor approach: a rational basis for promoting oral health. *Community Dent Oral Epidemiol* 2000;28:399-406
10. Hobdell M, Petersen PE, Clarkson J, Johnson N. Global goals for oral health 2020. *Int Dent J* 2003;53:285-288.

Correspondence to:

Roxana Oancea
Preventive, Community Dentistry
and Oral Health Department,
Splaiul Tudor Vladimirescu no. 14A,
Timișoara, Romania
E-mail: roancea@umft.ro

VARIATIONS OF THE REX BYPASS FOR EXTRAHEPATIC PORTAL VEIN OBSTRUCTION. REVIEW OF THE LITERATURE

IA Dumitru^{1,2}, V Zembrod², ER Iacob^{1,2}, VL David^{1,2}, ES Boia^{1,2}

Abstract

Introduction. Portal vein thrombosis is the main cause of Portal Hypertension among children. Its etiology is heterogeneous and not completely understood and many cases of portal vein thrombosis are called idiopathic. With the introduction of Meso-Rex bypass 27 years ago, the outcome changed drastically as this shunt surgery restore portal blood to the liver. Since then, more and more surgeons use it to treat Portal Hypertension and they report variants of the original shunt operation in an effort to develop the best approach. **Objective.** This review paper aim to present the rex bypass and its variants reported so far, highlighting the best and the worst outcome. **Methods.** We have reviewed the English literature for articles presenting Extrahepatic Portal Vein Obstruction treated with Rex shunt surgery. Articles were reviewed systematically. For limitation of bias we have excluded Case Report articles and Review articles in which the authors or their affiliation institution have published more than one article using same patient population or collected data from articles used in this study.

Keywords: Rex shunt, extrahepatic portal vein obstruction, graft, variant Rex shunt

Introduction

Portal vein thrombosis (PVT) is the main cause of portal hypertension (PHT) in pediatric population [1]. The term PVT refers to obstruction (complete or incomplete) of the portal venous flow due to an intraluminal thrombus. When the obstruction is limited to extrahepatic segment of the porta hepatica is referred to as Extrahepatic Portal Vein Obstruction (EHPVO), although many authors use PVT and EHPVO terms interchangeably [2]. Incriminated factors that lead to thrombosis of the portal vein are numerous (see Table 1) [3] and the treatment is constantly evolving as the underlying disease is better studied and understood. Patients with PVT without a intrinsic liver disease (e.g. cirrhosis) have a normal liver function but display growth retardation, coagulopathy, alteration of neurocognitive function and other symptoms related with liver deprivation of normal portal venous flow. As collateral circulation develops rapidly, bleeding form esophageal and gastric varices may be the first symptom of PHT which can be fatal. The role of

shunt surgery is well established in the treatment of PHT and among many shunt alternatives the Rex shunt created in 1992 by Jean de Ville de Goyet and his team became the preferred option for selected patients as it reestablish portal flow to the liver with the potential of cure. Although Rex bypass is not clearly stated in the treatment guidelines is it highly indicated for selected patients as the best option for shunt surgery [2].

Table 1. Etiological factors encountered in PVT in pediatric population.

Etiological factor
Portal vein injury Umbilical vein catheterization Trauma, splenectomy, pancreatic surgery, colectomy, etc
Post liver transplantation
Local inflammatory conditions Pancreatitis Abdominal sepsis Liver abscesses
Coagulation disorders Factor V Leiden mutations (rs6025) Prothrombin gene mutation (G20201A) MTHFR gene mutation (C677T) Hyperhomocysteinemia Protein C deficiency Protein S deficiency Antithrombin III deficiency Antiphospholipid syndrome/Anticardiolipin antibodies
Post biliary atresia operation (portoenterostomy)
Idiopathic

Objective

At the end of this review, the reader will be familiar with physiologic and pathologic anatomy of the portal vein system as in Extrahepatic Portal Vein Obstruction.

¹Victor Babeş” University of Medicine and Pharmacy Timișoara, Department of Pediatric Surgery

²Louis Țurcanu” Clinical Emergency Hospital for Children Timișoara

E-mail: dumitruionutadrian@gmail.com, zembrodvlad@yahoo.com, radueiacob@umft.ro, david.vlad@yahoo.com, boiaeugen@yahoo.com

Will know the Rex shunt and its variations available in the literature for performing this type of shunt surgery which is, currently, the preferred surgical treatment option for selected patients. We aim to highlight the Rex Shunt techniques with best results in short and long-term outcome.

Methods

We have reviewed the English literature for articles presenting Extrahepatic Portal Vein Obstruction treated with Rex shunt surgery. For finding relevant articles we have searched for “Rex Shunt”, “Rex Bypass”, “Meso – Rex” and “Mesenterico Left” and the results – more than 100 articles were reviewed systematically. For limitation of bias we have excluded Case Report articles and Review articles in which the authors or their affiliation institution have published more than one article using same patient population or collected data from articles used in this study. While reviewing the relevant articles we have focused on the operative technique, the type of graft used as a conduit and short and long-term outcome of the operation highlighting complications.

Normal and pathologic anatomy.

In brief, during the 4th to 6th embryonic life the omphalomesenteric veins transport blood from the gut and the umbilical veins transport blood from the placenta to the embryo. Blood is transported through the hepatic sinusoids in the liver, then through the hepatic veins in the heart. Some blood bypass the liver through the ductus venosus. The left omphalomesenteric vein will become the portal vein as the right one will involute by the end of 6th week. Also the right umbilical vein will disappear and the left umbilical vein will be patent until after birth when it thromboses and become round ligament of the liver. Portal vein forms at the confluence of the superior mesenteric and splenic veins just posterior to the head of the pancreas. In the splenic vein drains the Inferior mesenteric vein anywhere along its course. In the portal vein drains the coronary (left gastric) vein which communicates with distal esophageal veins (will become esophageal varices in PHT). Portal vein divides into the right and left portal branches. In the right portal branch drains the cystic vein (which will

contribute to cavernous transformation of the portal vein). The portal vein will collect blood from the intestines, stomach, pancreas, spleen and gall bladder [4]. The normal blood flow through the portal vein is approximately 18% of systemic blood flow [5]. When the thrombosis occur, the liver blood supply is diminished by up to half, but the hepatic arterial buffer rapidly compensate perfusion and so, the acute thrombosis can take place without displaying any symptoms especially if there is an acute disease at this time (e.g. sepsis) which masks the symptoms, if any, of acute PVT. Collateral circulation to bypass obstruction rapidly develop, usually within a 3-5 weeks period. Most important collateral pathways are depicted below:

- (1) left gastric (coronary) vein and short gastric veins to esophageal veins and thenceforth to azygous and hemiazygous veins,
- (2) superior hemorrhoidal veins to the middle and inferior hemorrhoidal veins into the inferior cava vein (IVC),
- (3) umbilical vein to epigastric veins trough superficial veins of the abdominal wall,
- (4) in the retroperitoneum, intestinal veins to branches of IVC,
- (5) veins (Sappey) around the falciform ligament to epigastric or intrathoracic veins.

These collaterals dilate and become varicose. Anyhow, of most interest are the esophageal and gastric varices because these can rupture due to lumen dilatation, increased wall tension, thin wall and ulceration. Acute EHPVO is considered to be if the symptoms appear within the first 2 months from the thrombosis event in the absence of PHT or Portal Cavernoma (PC). Chronic EHPVO is when there is a PHT (with or without PC) or its complications like variceal bleeding, hypersplenism, ascites. Cavernous transformation of the Portal vein is a sequel of acute thrombosis and usually, but not always, define chronicity. PCs are reported as early as few days from the thrombosis and there are also patients without a PC even after 2 months. For better understanding of this heterogeneous pathological transformations at the Sixth Baveno Consensus (April 2015) for PHT, experts presented a classification for portal vein obstruction (see Table 2).

Table 2. Classification of portal vein obstruction.

Site of PVT	Type 1: Only trunk Type 2: Only branch: 2a- One, 2b – both Type 3: Trunk and branches
Presentation	R: Recent Ch: Chronic
Underlying liver disease	C: Cirrhotic N: Non-Cirrhotic liver disease H: HCC and other local malignancies L: Post liver transplant A: Absence of underlying liver disease
Degree of portal venous system occlusion	I: Incomplete T: Total/ Complete
Extent of PV occlusion	Splenic vein, Mesenteric vein, Both

Using this classification could help deciding on treatment, diagnostic modalities, prognostication and assess the outcome of shunt surgery on short and long term [2].

Classic Meso-Rex bypass. Mesenterico-to-left-portal vein bypass was initially designed to cure portal vein thrombosis after liver transplantation in children, but soon after it began to be used with success for EHPVO in children with a healthy liver. In current practice, all children with PVT are candidates for a Rex bypass. Careful and complete preoperative assessment must be performed. Must be excluded intrinsic liver disease (e.g. cirrhosis) and thrombophilia. Also, the Rex recessus must be patent otherwise the shunt will not be possible to perform. The Rex recessus is that short part of the left portal vein located within the umbilical scissure (between hepatic segments II, III, IV) in a sagittal orientation. If you follow the round ligament into the liver, one will find and open the Rex recessus as its anterior part is related to the ligament. In brief, the operation as designed by de Ville de Goyet is as follow: usually the liver is addressed through a bilateral subcostal incision, followed by its luxation anteriorly and medially. Round and falciform ligaments are divided to access the Rex recessus. A portion of the liver parenchyma is resected on each side of the umbilical scissure with great attention not to damage portal branches of the II and III segments. Dissecting the round ligament of the liver in the umbilical scissure will reveal the rex recessus. Preparation of the recessus is performed close to the vein wall until all the collateral branches and the origin of left portal vein are identified. At this point an angiography can be performed to confirm patency of the Rex recessus. After the preparation of Rex recessus, the superior mesenteric vein and the route for the bypass conduct preparation is performed. Next step is to harvest internal jugular vein to be used as a conduit. The Rex recessus and its collaterals are clamped with suture ties and a Satinsky clamp and a longitudinal venotomy is made. The subclavian end of the graft is anastomosed to the Rex recessus in an end to side manner followed by removal of the clamps. The bypass is completed with the end to side anastomosis at the superior mesenteric part. This is type 1 of Meso-Rex bypass. De Ville de Goyet also described a type 2 bypass when he use right gastroepiploic vein to anastomose it in the Rex recessus without the need of a harvested graft [1,6]. For very detailed and step-by-step description of the operation we suggest reading “Meso-Rex Bypass – A procedure to Cure Prehepatic Portal Hypertension: The Insight and the Inside” by di Francesco, Grimaldi and de Ville de Goyet.

We analysed data and operative details on a total of 494 patients operated using different Rex shunt techniques (see Table 3 [5,7–25]) and the most used technique (59%) is the “classic” Jean de Ville de Goyet’s Meso-Rex bypass using internal jugular vein as a conduit. It seems to give the best outcome on short and long term follow-up. Most frequent complications reported are the shunt thrombosis and stenosis. While some thrombosis events were resolved by thrombolysis, especially if it was an early event, some were permanent and required portosystemic shunt surgery. Stenosis of the shunt was usually corrected with

percutaneous dilatation or stent placement. Overall shunt patency approaches 90% in the literature. Most complications were diagnosed by close follow up. Some clinical aspects that suggested a possible complication was recurrence of variceal bleeding episodes, persistent or recurrent splenomegaly and poor weight gain.

Variant Rex Shunt surgery

Recent literature articles present experiences with variants of the original Meso-Rex bypass. Most notable results are reviewed in this paper.

Transposition of gastric coronary vein, splenic vein, recanalized umbilical vein or inferior mesenteric vein to complete the bypass without the need to harvest a graft was observed in 18% of studied cases. In the largest study, Zhang et al [8,26] performed a gastro-portal bypass on 48 cases. They mobilized the coronary vein and anastomosed it to the left portal vein. When suitable (diameter of the coronary vein > 0,5 cm) they concluded is the preferred method. This type of Rex bypass has some significant advantages, like less vascular anastomoses, less scaring and preservation of the jugular veins. The results are comparable with classic meso-rax bypass, except for the variant when recanalized umbilical vein is used, as this has a higher complication rate. Although the preliminary results are very good, more and detailed data is necessary to conclude.

More of an ad-on to the Rex bypass than a variant of the bypass, is the paraesophageal and paracardial devascularisation to alleviate esophageal and gastric varices. Wang et al propose that, at the time of the bypass, first step is to perform excision of parasophagogastric veins. This include coronary vein, short gastric veins, posterior gastric vein, left inferior phrenic veins and ectopic high esophageal branches. They also recommend splenectomy or partial splenectomy if the patient is over 6 years of age and in the presence of hypersplenism. They concluded that this procedure is effective for preventing variceal bleeding and portal gastropathy. Also they consider it reduces the risk of bypass thrombosis because of increased portal flux and pressure [18].

In some cases the jugular vein is not available or is not long enough. Alternative grafts that can be used include, cadaveric cryopreserved iliac vein, great saphenous vein, splenic vein, inferior mesenteric vein, recanalized umbilical vein, gastroepiploic vein, jejunal or ileal vein, polytetrafluoroethylene (PTFE or Gore-Tex®) synthetic grafts and coronary vein. It appears to be of great significance the type of graft used, as in one series, Krebs-Schmitt et al reported that all cryopreserved iliac veins and umbilical vein got thrombosed at a median time of 21 months (ranging between one day and 69 months). Even after recanalization of the shunt, these got rethrombosed. They concluded that best outcome is observed when jugular vein is used [19]. Regarding the use of saphenous vein, Louto et al presented a thnique where the graft consists of both great saphenous veins longitudinally cuted and sutured together around a Hegar to create a tubular graft of large diameter after the valves were excised. The outcome reported is that 7 out of 21 cases developed thrombosis. One

on 8th postoperative day and the remaining 6 developed late thrombosis (median range 20 months). Their thrombosis rate seems to be above 30% compared to the 10% rate when using jugular vein. Theoretical factors that predispose to thrombosis are the many cuts in the graft (longitudinal cuts

and valve excision cuts) [16]. The information available about the use of synthetic grafts like PTFE are sparse and insufficient. In our reviewed papers we only encountered 3 cases in which was used PTFE without mentioning any complications.

Table 3. No. – number of Rex shunts studied/performed by the author.

Author / year	No.	Type of graft used to complete the bypass									
		JV	ePTFE	Al.	Sph. V	SV	IMV	GV	UV	None	NS / Others
Timothy B Lutz/ 2013	70	70									
Ruo-Yi Wang/2017	42	10			8	2		2		20	
D. Krebs-Schmitt/2009	25	17		5					3		
Wei Chen/2011	5	5									
Daniel A. Bambini/2000	5	4		1							
Nelson E. M. Gibelli /2011	11	11									
Mark D. Stringer/ 2007	11	11									
Tae-Yong Ha/2015	12									12	
Caroline Rochon/2012	6									6	
Jin-Shan Zhang/2017	79									53	26
Sukru Emre/2009	3	2	1								
Li Long/2017	5						4				1
Gloria Chocarro/2016	18	16		2							
Rukhmi Bhat/2013	65	56									9
Zhang Wei/2014	22					22					
Paloma Triana Junco/2018	19	19									
Jorg Fuchs/2003	7	7									
Topi Luoto/2012	21				21						
F. Gúerin/2013	43	40	2					1			
Heather A. Stefek/2018	25	22					3				
TOTAL	494	29		8	29	24	7	3	3	91	36
	100%	5.9%	<1%	1.6%	6%	5%	1.4%	<1%	<1%	18%	7%

JV – jugular vein internal or external (autograft); ePTFE – expanded polytetrafluoroethylene / Gore-Tex® (synthetic graft); Al. – allograft (cryopreserved iliac vein); Sph.V. – saphenous vein; SV – splenic vein; IMV – Inferior mesenteric vein; GV – gastroepiploic vein or coronary vein; UV – umbilical vein; None – no graft was used to complete the shunt, but the transposition of specified vessels; NS/ Others – not specified or other type of graft.

Conclusion

Overall conclusion is that classic meso-rax bypass is the best option so is indicated whenever possible. The outcome compared to the other variant rex bypasses is better and the diameter of the graft might have a role which is yet to be demonstrated. The diameter of the graft influences the blood velocity and at least theoretical, a higher velocity could reduce the thrombosis risk. Further research on

determining the optimal diameter of the graft in order to properly release portal hypertension and yet to maintain a high velocity of the blood in the graft need to be conducted. At last, synthetic graft like PTFE needs to be studied as they may play an important role as they are available on-demand, but using a synthetic graft that will not grow or expand over time when a child grows might limit its use to the adult patient.

References

1. Di Francesco F, Grimaldi C, De Ville De Goyet J. Meso-Rex bypass - A procedure to cure prehepatic portal hypertension: The insight and the inside. *J Am Coll Surg* [Internet]. Elsevier Inc; 2014;218(2). Available from: <http://dx.doi.org/10.1016/j.jamcollsurg.2013.10.024>
2. Baveno S, Risk S, Care I, Franchis R De. Portal Hypertension VI.
3. Khanna R, Sarin SK. Non-cirrhotic portal hypertension - Diagnosis and management. *J Hepatol* [Internet]. European Association for the Study of the Liver; 2014;60(2):421–41. Available from: <http://dx.doi.org/10.1016/j.jhep.2013.08.013>
4. Azarow KS, Cusick RA. Pediatric surgery. [Internet]. Vol. 92, The Surgical clinics of North America. 2012. xvii-xix. Available from: <http://www.sciencedirect.com/science/article/pii/S0039610912000680>
5. Stefek HA, Rigsby CK, Berhane H, Popescu AR, Rajeswaran S, Superina RA. MR angiography and 2-D phase-contrast imaging for evaluation of meso-rax bypass function. *Pediatric Radiology*; 2018;2–8.
6. De Ville De Goyet J, Alberti D, Clapuyt P, Falchetti D, Rigamonti V, Bax NMA, et al. Direct bypassing of extrahepatic portal venous obstruction in children: A new technique for combined hepatic portal revascularization and treatment of extrahepatic portal hypertension. *J Pediatr Surg*. 1998;33(4):597–601.
7. Lautz TB, Keys LA, Melvin JC, Ito J, Superina RA. Advantages of the meso-Rex bypass compared with portosystemic shunts in the management of extrahepatic portal vein obstruction in children. *J Am Coll Surg* [Internet]. American College of Surgeons; 2013;216(1):83–9. Available from: <http://dx.doi.org/10.1016/j.jamcollsurg.2012.09.013>
8. Zhang JS, Li L, Cheng W. The optimal procedure of modified Rex shunt for the treatment of extrahepatic portal hypertension in children. *J Vasc Surg Venous Lymphat Disord* [Internet]. Society for Vascular Surgery; 2017;5(6):805–9. Available from: <http://dx.doi.org/10.1016/j.jvsv.2017.02.011>
9. Emre S, Dugan C, Frankenberg T, Hudgins LC, Gagliardi R, Artis AT, et al. Surgical portosystemic shunts and the Rex bypass in children: A single-centre experience. *Hpb*. 2009;11(3):252–7.
10. Long L, Jinshan Z, Zhen C, Qi L, Ning D, Mei D, et al. Portal-to-right portal vein bypass for extrahepatic portal vein obstruction. *J Pediatr Surg*. 2018;53(7):1403–7.
11. Chocarro G, Triana P, Eva J, María D, Amesty V, Nuñez V, et al. Portal Cavernoma in the Era of Mesoportal Shunt (Rex) and Liver Transplant in Children. *Eur J Pediatr Surg*. 2016;26(1):1–6.
12. Bhat R, Lautz TB, Superina RA, Liem R. Perioperative Strategies and Thrombophilia in Children with Extrahepatic Portal Vein Obstruction Undergoing the Meso-Rex Bypass. *J Gastrointest Surg*. 2013;17(5):949–55.
13. Wei LS. Partial Splenectomy and Use of Splenic Vein as an Autograft for Meso-Rex Bypass: A Clinical Observational Study. *Med Sci Monit* [Internet]. 2014;20:2235–42. Available from: <http://www.medscimonit.com/abstract/index/idArt/892482>
14. Triana P, Ana J, Mariela A, Javier D, Gomez J, Sánchez A, et al. Long-Term Results after Diversion Surgery in Extrahepatic Portal Vein Obstruction. 2018;1–5.
15. Fuchs J, Warmann S, Kardorff R, Rosenthal H, Rodeck B, Ure B, et al. Mesenterico-left portal vein bypass in children with congenital extrahepatic portal vein thrombosis: A unique curative approach. *J Pediatr Gastroenterol Nutr*. 2003;36(2):213–6.
16. Luoto T, Pakarinen M, Mattila I, Rintala R. Mesoportal bypass using a constructed saphenous vein graft for extrahepatic portal vein obstruction-technique, feasibility, and outcomes. *J Pediatr Surg* [Internet]. Elsevier Inc.; 2012;47(4):688–93. Available from: <http://dx.doi.org/10.1016/j.jpedsurg.2011.10.065>
17. Guérin F, Bidault V, Gonzales E, Franchi-Abella S, De Lambert G, Branchereau S. Meso-Rex bypass for extrahepatic portal vein obstruction in children. *Br J Surg*. 2013;100(12):1606–13.
18. Wang RY, Wang JF, Liu Q, Ma N, Chen WX, Li JL. Combined Rex-bypass shunt with pericardial

- devascularization alleviated prehepatic portal hypertension caused by cavernomatous transformation of portal vein. *Postgrad Med [Internet]. Taylor & Francis*; 2017;129(7):768–76. Available from: <https://doi.org/10.1080/00325481.2017.1343646>
19. Krebs-Schmitt D, Briem-Richter A, Grabhorn E, Burdelski M, Helmke K, Broering DC, et al. Effectiveness of Rex shunt in children with portal hypertension following liver transplantation or with primary portal hypertension. *Pediatr Transplant.* 2009;13(5):540–4.
 20. Chen W, Rodriguez-Davalos MI, Facciuto ME, Rachlin S. Experience with duplex sonographic evaluation of meso-Rex bypass in extrahepatic portal vein obstruction. *J Ultrasound Med.* 2011;30(3):403–9.
 21. Bambini DA, Superina R, Almond PS, Whittington PF, Alonso E. Experience with the rex shunt (mesenterico-left portal bypass) in children with extrahepatic portal hypertension. *J Pediatr Surg.* 2000;35(1):13–9.
 22. Gibelli NEM, Tannuri ACA, Pinho-Apezato ML, Maksoud-Filho JG, Tannuri U. Extrahepatic portal vein thrombosis after umbilical catheterization: Is it a good choice for Rex shunt? *J Pediatr Surg [Internet]. Elsevier Inc.*; 2011;46(1):214–6. Available from: <http://dx.doi.org/10.1016/j.jpedsurg.2010.09.091>
 23. Stringer MD. Improved body mass index after mesenterico-portal bypass. *Pediatr Surg Int.* 2007;23(6):539–43.
 24. Ha TY, Kim KM, Ko GY, Oh SH, Kwon TW, Cho YP, et al. Variant meso-Rex bypass with transposition of abdominal autogenous vein for the management of idiopathic extrahepatic portal vein obstruction: A retrospective observational study Visceral and general surgery. *BMC Surg [Internet]. BMC Surgery*; 2015;15(1):1–5. Available from: <http://dx.doi.org/10.1186/s12893-015-0101-6>
 25. Rochon C, Sheiner PA, Sharma J, Rodriguez-Davalos MI, Savino J, Facciuto ME. The utility of recanalized umbilical vein graft to the hepato-pancreato-biliary surgeon. *Surg Innov.* 2013;20(2):126–33.
 26. Zhang JS, Li L, Cheng W. Surgical treatment for rebleeding caused by bypass failure after Rex shunt: re-Rex shunt or Warren shunt? *Pediatr Surg Int [Internet]. Springer Berlin Heidelberg*; 2018;34(5):521–7. Available from: <http://dx.doi.org/10.1007/s00383-018-4246-0>.

Correspondence to:

Emil Radu Iacob
 "Victor Babes" University of Medicine and Pharmacy,
 P-ta E. Murgu no. 2, 300041,
 Timisoara, Romania
 E-mail: radueiacob@umft.ro

NEONATAL ISCHEMIA OF THE LOWER LIMB – CASE REPORT

S Cerbu¹, F Bîrsășteanu¹, ER Heredea², D Iacob³, ER Iacob⁴,
MC Stănculescu⁴, CE Timofte⁵, DM Timofte⁶, ES Boia⁴

Abstract

We present a case with acute ischemia of lower limb seven hours after delivery. He was admitted in the Surgery department of Emergency Pediatric Hospital, on 30rd of April 2016. Angiography computed tomography was performed as an emergency measure that found vascular obstructions at the level of the left common femoral artery and the popliteal artery. An arteriotomy was immediately performed in order to extract the thrombi from the common femoral and popliteal vessels with clinical improvement immediately post-surgery. The histopathological examination found that the thrombi originated from the placenta.

Keywords: vascular anomalies, arterial ischemia, limb, neonate, placental emboli

Introduction

The acute limb ischemia is a rare phenomenon in the newborn. The most frequent causes are arterial or venous catheterization, neonatal infections and dehydration. Other causes that are less commonly found are metabolic disorders (gestational diabetes) and congenital hypercoagulability disorders (e.g. thrombophilia) [1-3]. The first case ever reported was described by Martini et al. Since then, more than one hundred cases have been reported in the literature [1].

Aim

The purpose of this article is to present the management of a very rare case of neonatal acute ischemia of the lower limb caused by placental emboli without a specific explanation (an idiopathic thrombosis).

Case

A male newborn, 4020 g, naturally delivered (cephalic presentation) after a 38 weeks gestation in the hospital without any complications, was transferred from maternity

at 17:42, on 30rd of April 2016. The mother was under 30 years old, with no health problems reported and no drugs or other toxic substances taken during the pregnancy. Two hours after the delivery, the lower left limb (below the knee) was cyanotic. Also, the absence of posterior tibial artery pulse and a temperature difference between the legs were found (Figure 1).

The symptoms did not improve after heparin administration. The medical staff from neonatology department decided the transfer into the surgery department, 6 hours after birth. The emergency CT scan arteriography detects two obstructions on the common femoral artery (10 mm diameter) and the popliteal artery (6 mm) on the left lower limb. No causes of extrinsic compression were found in order to explain the complete stop of contrast agents. No infection or malformations of the arterial or venous system were detected (Figure 2).

Three hours after the admittance in the pediatric surgery department, an arteriotomy of the left common femoral artery and popliteal artery was performed. Two thrombi from each level were extracted. The intervention was followed by the subsequent heparinization of the arteries. The macroscopic appearance of thrombus from the common femoral artery was yellow-gray color and its consistency was hard. The thrombus extracted from the popliteal artery was red and had a soft consistency.

Shortly after the surgical intervention, the clinical symptomatology improved: the color of the shank returned to normal and the skin temperature started rising. Postoperatively, the patient was transferred into the Intensive Care Unit in order to adjust and monitor the anticoagulant therapy. In the 14th post-operative day, the Enoxaparin therapy was suppressed, but the antiplatelet therapy was continued. The blood testing showed no coagulation abnormalities, no deficiencies of protein C, S or antithrombin III.

¹Department of Radiology, “Victor Babeș” University of Medicine and Pharmacy, Timișoara, Romania

²Department of Pathology, “Louis Țurcanu” Emergency Children Hospital, Timișoara, Romania

³Department of Neonatology, “Victor Babeș” University of Medicine and Pharmacy, Timișoara, Romania

⁴Department of Pediatric Surgery, “Victor Babeș” University of Medicine and Pharmacy, Timișoara, Romania

⁵Department of Radiology, “Pius Brînzeu” Emergency County Hospital, Timișoara, Romania

⁶Department of Cardiology, Institute of Cardiovascular Diseases, Timișoara, Romania

E-mail: cerbusimona@yahoo.com, fbirsasteanu@yahoo.com, heredea.rodica@yahoo.com, danielariacob@yahoo.com, radueiacob@umft.ro, corinastanculescu@yahoo.com, cristian.timofte@icloud.com, cristian.timofte@icloud.com, boiaeugen@yahoo.com



Figure 1. The clinical aspect of the lower limb ischemia.



Figure 2. CT arteriography aspect – Contrast cessation at the level of femoral artery with distal reinfusion at the level of the thigh and occlusion at the level of popliteal artery.

The samples extracted from the thrombi were examined in hematoxylin-eosin (HE) coloration. The fragments were irregular masses consisting of fibrin and platelet-type nuclear detritus, mixed cell groups including lymphocytes and granulocytes interspersed with hematic - properly thrombus recently. No cholesterol crystals or hemosiderin pigment were found. The Masson's trichrome coloration did not show collagen deposition or muscle tissue. The Giemsa coloration identified no microorganisms and the Perl coloration did not

show deposits of iron at the level of histiocytes. The final histologic diagnostic was arterial thrombi with rolling macrophage inclusions arterial (Figure 3).

Fourteen months after the surgery a discrete asymmetry between the left and right lower limb could be observed, but without any consequences on the walking abilities. The Doppler ultrasound showed patent arteries without any visualized thrombi.

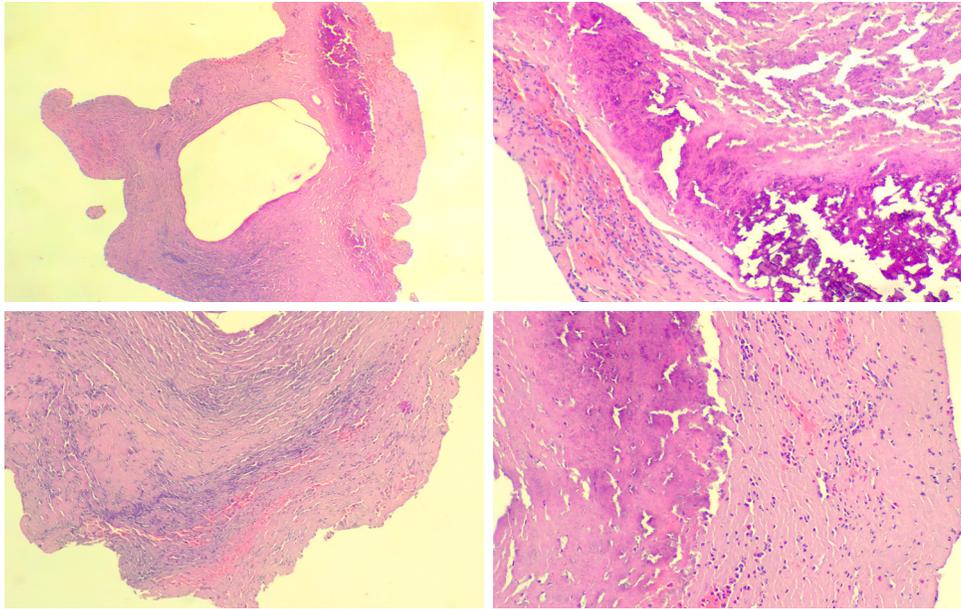


Figure 3. Microscopic aspects in HE coloration: the fibrin mass that includes lymphocytes, granulocytes, histiocytes and nuclear detritus. (ob. 4x,10x,20x).

Discussions

This is the first presented Romanian case of neonatal ischemia of the lower limb. The incidence of neonatal acute limb ischemia due to the thrombosis is increasing [4].

The diagnosis of thrombosis was established using an emergency CT scan after the exclusion of any vascular malformations or compressive tumors [5].

There are three major factors presented by Virchow that contribute to the formation of thrombus: abnormalities of the vessel wall, changes in blood coagulation and disturbances of the blood flow [6].

In our case, the mother was diagnosed with a low profile of thrombophilia with Factor V H1299R (R2) mutant heterozygote and MTHFR A1298C mutant heterozygote, without any depicted symptoms. In this case, the maternal thrombophilia profile could be considered the cause of the embolus from the maternal artery system to the neonatal lower limb. The cause of thrombosis in the neonatal period is often difficult to depict.

Hyperviscosity of the blood is reported in 1-5% of the newborns [7-9]. The delayed cord clamping can increase the risk of the hyperviscosity which can affect the blood flow, leading to local hypoxia and acidosis and that may be the trigger of the coagulation system [10,11].

Arterial puncture is also known to increase the arterial thrombosis; the infused substances can irritate the vessels [12, 13]. Our patient suffered no femoral arterial puncture and no catheterization.

Inherited deficiencies of antithrombin III and protein C can be a cause of fetal thrombosis [14,15]. In our case, the patient had no deficiency of antithrombin or protein C.

The early recognition of ischemia, the thrombolytic treatment and the thrombectomy are very important in order

to obtain a good outcome. The thrombolysis is successful in 85% of cases of heparin resistant femoral thrombosis, [16-18]. In case of arterial thrombosis, the thrombolysis has been recommended as the first line treatment while the thrombectomy is reserved for the cases that do not respond to this treatment [19].

In very young infants, the risk of re clotting after thrombectomy is known to be considerable [20]. An explanation for this could be that a Fogarty catheter inserted into a small vessel could fissure the intima and mobilizing a vessel has been reported to cause thrombosis in this age of group [21,22]. In one case, it is presented that the limb of an infant was salvaged using postoperative thrombolytic treatment [23]. Fortunately, our patient did not suffer any clots formation after the surgical intervention. The thrombectomy was successful and the post-operative ultrasound examination revealed an appropriate blood flow on Doppler arterial examination, with a peak difference between the two legs. Fourteen months after the surgery, a discrete asymmetry between the left and right lower limb (1 cm) could be observed, but without any consequences on the walking abilities.

Conclusions

The early clinical recognition of limb ischemia is very important. Furthermore, a diagnostic algorithm of the possible causes must be performed as soon as possible. In children, vascular malformations must be also ruled out.

The thrombolytic treatment has become the mainstay treatment strategy, but thrombectomy is also associated with good outcome. There is a risk of thrombosis after the intervention. In order to avoid this, the surgery should be combined with anticoagulant treatment.

References

1. Blank JE, Dormnas JP, Davidson RS. Perinatal limb ischemia: Orthopedic implications. *J Pediatr Orthop*, 1996,16:90-96.
2. Coombs CJ, Richardson PW, Dowling GJ, Johnstone BR, Monagle P. Brachial artery thrombosis in infants: an algorithm for limb salvage. *Plas Reconstr Surg*, 2006,117:1481-1488.
3. Nagai MK, Littleton AG, Gabos PG. Intrauterine gangrene of the lower extremity in the newborn a report of two cases. *J Pediatr Orthop*, 2007, 27:499-503.
4. Oski FA, Naiman JL. Hematologic problems in the newborn. Third edition, WB Saunders, Philadelphia, 1982, 1-360.
5. Cerbu S, Arghirescu TS, Stănculescu MC, Timofte CE, Mussuto E, Heredea ER, Horhat ID, Iacob ER, Bîrsăşteanu F, Boia ES. Role of imagistic techniques in diagnosing soft-tissue vascular anomalies in pediatric population – a 5-year experience. *Rom J Morphol Embryol* 2019, 60(2), 495-500.
6. Virchow R. Phlogose und Thrombose im Gefasssystem. In: Virchow, ed. *Gesammelte Abhandlungen zur Wissenschaftlichen Medizin*, Frankfurt a/m: Meidinger Sohn, 1856:458.
7. Linderkamp O. Blood rheology in the newborn infant. *Bailliere’s Clinical Haematology*, 1987, 1:801-826.
8. Brooks GI, Backes CR. Hyperviscosity secondary to polycythaemia in appropriate for gestational age neonate. *Journal of the American Obstretic Association*, 1981, 80:415-418.
9. Black VD, Lubchenco LO. Neonatal polycythaemia and hyperviscosity. *Pediatr Clin North Am*, 1982, 29:1137-1148.
10. Peters M, ten Cate JW, Koo LH, Breederveld C. Persistent antithrombin III deficiency: risk factor for thromboembolic complications in neonates small for gestational age. *J Pediatr*, 1984, 105:310-314.
11. Cerbu S, Bîrsăşteanu F, Heredea ER, Iacob D, Iacob ER, Stănculescu MC, Boia ES. Acute limb ischemia in neonates: etiology and morphological findings – short literature review. *Rom J Morphol Embryol* 2018, 59(4),1041-1044.
12. Perry MO. Iatrogenic injuries of arteries in infants. *Surg Gynecol Obstet*, 1983, 157:415-418
13. Wehbe MA, Moore JH. Digital ischemia in the neonate following intravenous therapy. *Pediatrics*, 1985, 76:99-103.
14. Bjarke B, Herin P, Blomback M. Neonatal aortic thrombosis. A possible clinical manifestation of congenital antithrombin III deficiency. *Acta Paediatr Scand*, 1974, 63:297-301.
15. Seligsohn U, Berger A, Abend M, Rubin L, Attias D, Zivelin A, Rapaport SI. Homozygous protein C deficiency manifested by massive venous thrombosis in the newborn. *N Engl J Med*, 1984, 310:559-562.
16. Wessel DL, Keane JF, Fellows KE, Robichaud H, Lock JE. Fibrinolytic therapy for femoral arterial thrombosis after cardiac catheterization in infants and children. *Am J Cardiol*, 1986, 58:347-351.
17. Ino T, Benson LN, Freedom RM, Barker GA, Aipursky A, Rowe RD. Thrombolytic therapy for femoral artery thrombosis after pediatric cardiac catheterization. *Am Heart J*, 1988, 115:633-639.
18. Brus F, Witsenberg M, Hofhuis WJD, Hazelzet JA, Hess J. Streptokinase treatment for femoral artery thrombosis after arterial cardiac catheterization in infants and children. *Br Heart J*, 1990, 63:291-294.
19. Davison PM, Sully L. Microvascular surgery to preserve a preterm infant’s ischemic arm. *BMJ*, 1988, 297(6651):788.
20. Smith C, Green RM. Pediatric vascular injuries. *Surgery*, 1981, 90:20-31.
21. Stavorovsky M, Iellin A, Spirir Z. Acute ischemia of the limb in a newborn treated successfully by thrombectomy. *Am J Surg*, 1975, 129:337-340.
22. Cahill JL, Talbert JL, Ottesen OE, Rowe RD, Haller Jr JA. Arterial complications following cardiac catheterization in infants and children. *J Pediatr Surg*, 1967, 2:134-143.
23. Kay S, Gilpin DJ. Combined microsurgical and thrombolytic salvage of an ischaemia lower limb in a 1079 gram preterm neonate. *Br J Plast Surg*, 1991, 44:310-311.

Correspondence to:

Emil Radu Iacob
 "Victor Babes" University of Medicine and Pharmacy,
 P-ta E. Murgu no. 2, 300041,
 Timisoara, Romania
 E-mail: radueiacob@umft.ro

DARIER-WHITE DISEASE: GENETIC DETERMINISM FOR VESICULOBULLOUS REACTIONS

RZ Ionescu¹

Abstract

Darier disease is an autosomal dominant disease, with severe symptoms and an early onset, during childhood, with a relatively rare incidence, of one reported case in 55 000 healthy individuals. The clinical aspect implies the presence of a symmetrical eritematous eruption, in the upper trunk, face and lateral cervical aspects, consisting in the presence of yellow brownish skin scales and keratotic papules. We present the case of a 12 years old boy diagnosed for the first time with Darier-White disease showing an eruption on the forehead, perioral and lateral cervical skin, with onset at 7 years old, remaining untreated since – while the mother and his step-brother, undiagnosed, suffered from the same condition with identical distribution. Histopathological examination reveals dis cohesive dyskeratocytes, the presence of corps ronds and suprabasal clefts. The inheritance pattern in our case suggests etiological ATP2A2 typical mutation involvement along with the action of stress cutaneous factors as ultraviolet B radiation.

Keywords: Darier Disease, forehead, inheritance pattern, mutation, skin

Introduction

Darier-White disease (DWD), also known as kerosis follicularis, is a rare and severe inheritable disease, with an autosomal dominant pattern, having an estimated prevalence of 1 in 55 000 normal individuals, accompanied by a considerable handicap. The disease was first reported

independently by Darier and White in 1889, being the first to recognize the genetic nature of keratosis follicularis, also noticing that a mother and her daughter were both afflicted. Clinically, the disease is characterized by the existence of keratotic papules in seborrheic skin areas, located, especially, in trunk face and skin foldings. Furthermore, infections occur frequently in affected regions, thus, being considered a major discomfort for the patients. The disease typically presents with puberty onset, a chronic relapse, and exacerbations favored by UV irradiation, heat, friction and infections [1].

Materials and methods

A 12 years old boy presented to the dermatologist in our hospital with the presence of cohesive, keratotic papules on the forehead, having a brownish color, non-homogeneously spread involving the surrounding skin, condition that initially manifested at the age of 7 years old. The mother, aged 46 years old, stated that she also suffered from a similar condition, which she left untreated, started from the age of 10 years old following an apparent remissive pattern with the same distribution. The boy has a normal syster born, while his mother during her previous marriage gave birth to another male now aged 27 years old that is afflicted by the same condition. The latter has another stepsister (figure 1) from the mother’s first husband that showed no signs of the disease.

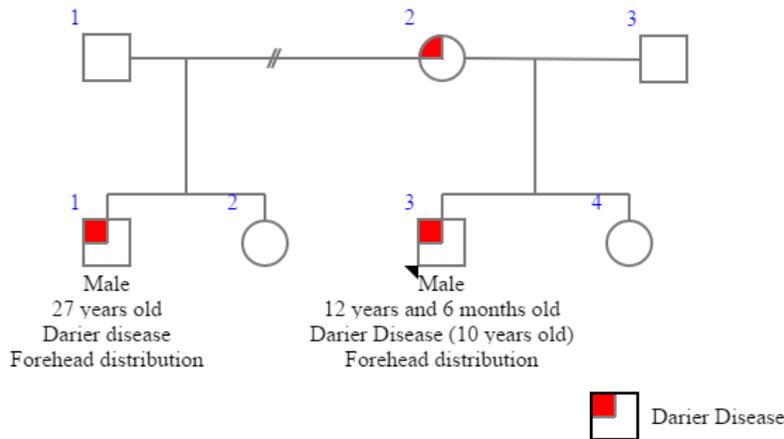


Figure 1. Pedigree chart for the presented case – with arrow, is the proband; 1-2 is the mothers first relationship, now divorced, while 2-3 depicts actual marriage.

¹PhD, M.D., Pathology and Prosector Medicine, The Pediatric Hospital, Pitești, Romania.
E-mail: dr.raduionescu@gmail.com

Results

At close inspection, on the forehead, bilateral cervical, around the mouth and nose skin, it was observable a rugged eruption with eritematous and papular appearance covered in yellowish to brown scales. In our case, a representative lesion was sampled, consisting in a cutaneous biopsy (0.4/0.4 cm) with emergent hair shafts and brownish areas (figure 2). The fragment was processed via automated standard haematoxylin and eosin stains, consisting in successive and progressive concentrated ethylic alcohol baths of 70%, 80%, 96%, 99% with isopropyl intermediaries. Following paraffin embedding and chemical

processing, microtome histological sections with 2.5µm in thickness were made. The optical microscopic examination revealed an acantholytic, dyskeratotic epidermis, with basophilic discohesive dyskeratocytes, conspicuous nuclei and nucleolus, frequently surrounded by a perikarional halo. Suprabasal clefts filled by haematic infiltrates were visible (figure 3 and 4), a conspicuous lymphocytic inflammation with admixed neutrophils and oedema, probably, due to an over-added infectious process in the biopsy region of interest. The dermis revealed actinic elastosis, thus, proving the existence of repeated, prolonged, ultraviolet irradiation (figure 5).



Figure 2. Macroscopic appearance of cutaneous biopsy for the case in matter (0,4/0,4 cm, buffered formalin 0,4%).

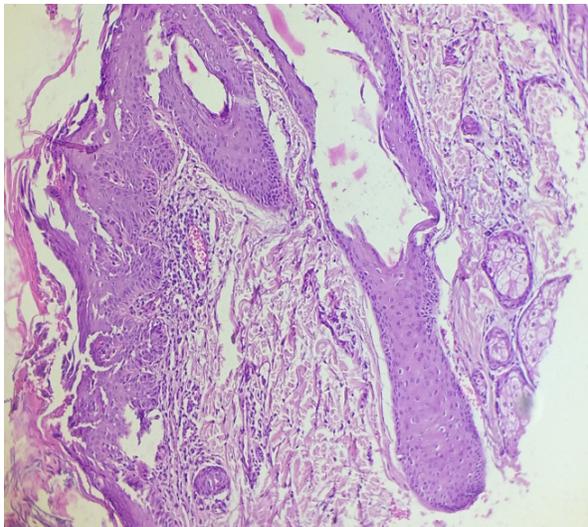


Figure 3. Blistering-like suprabasal clefts, acantholysis and frequent dyskeratocytes are visible; brisk upper dermis inflammatory infiltrate (HE, 4x10).

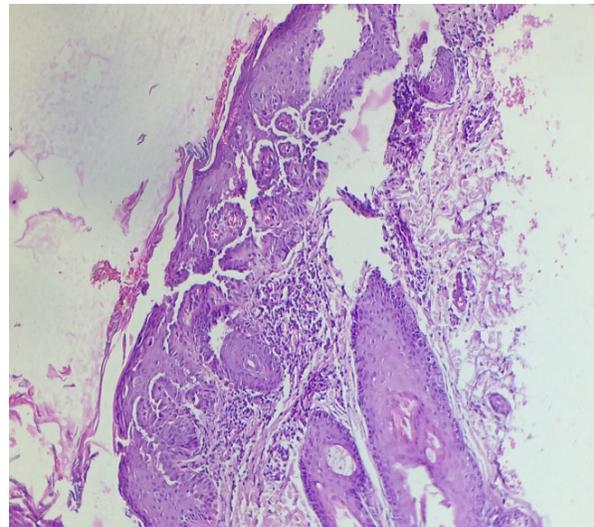


Figure 4. Suprabasal clefts in parakeratotic epidermis, disruption of rete ridges and pearl-like structures with frequent dyskeratocytes - corps ronds - surrounded by inflammatory infiltrate (HE, 4x10).

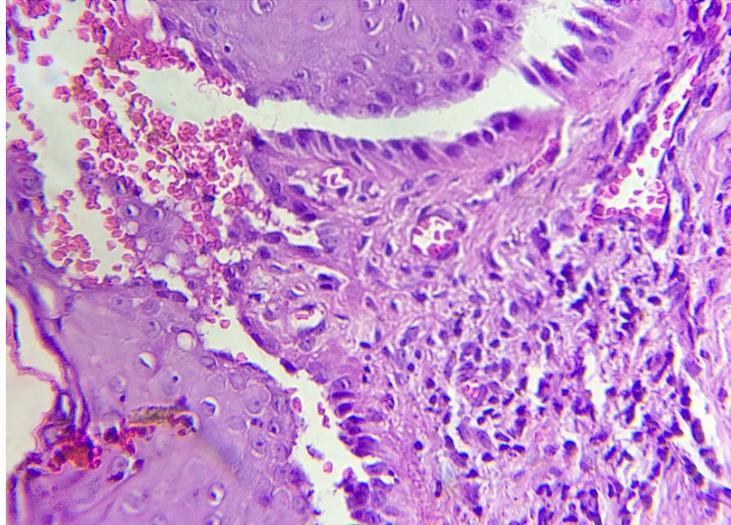


Figure 5. Structural details of corps ronds in the neighbourhood of a suprabasal cleft: basophilic cytoplasm, discohesiveness, nuclei with halo; notably lymphocytic inflammation with rare neutrophils – infection – hyperemia and oedema in upper dermis (HE, 40x10).

Discussion

The genetic inheritance of DWD is conditioned by a heterozygous mutation in the ATP2A2 gene, which encodes the sarcoplasmic reticulum Ca^{2+} -ATPase-2 (SERCA2), located in the 12th chromosome, region 12q24.11, with an autosomal dominant pattern and high penetrance that exceeds 95%. Because the disease is causing mutations in ATP2A2 that afflicts functional domains of the gene, the mechanism of autosomal dominant transmission is believed to be haploinsufficiency, thus, one wild-type functioning isoform of ATP2A2 gene remaining insufficient to compensate DWD specific injuries. The expression of isoforms ATP2A2a and ATP2A2b, evidenced by hybridizing northern blots containing specific probes for 3' un-translated ends of both genes, have strong intensity signal in keratinocytes for a 4.5-kb length, but also in heart and skeletal muscles [2]. More than 130 mutations were identified, including frameshift and in-frame deletions, insertions, splice-site mutations, and non-conservative missense in functional domains, thus, disclosing the role for SERCA2 in Ca^{2+} signaling pathways for cell-to-cell adhesion regulation and differentiation of the epidermis layers [3]. However, some cases present mutations located in exon 21 which is specific for SERCA2b resulting in a loss of expression sufficient enough to cause a DWD pathological phenotype. The fact that SERCA2b, encoded by ATP2A2b, cannot be compensated by SERCA2a expressions allows us to conclude that SERCA2b remains the main epidermal isoform [4]. As a result of the loss SERCA2 Ca^{2+} transport on Ca^{2+} homeostasis, DWD specific keratinocytes display lower endoplasmic reticulum (ER) Ca^{2+} concentrations [5]. Thus, compensatory mechanisms are activated consisting in the up-regulation of transient receptor potential canonical channel 1 (TRPC1) resulting in restricting apoptosis together with the up-

regulation of ATP2C genes that encodes $\text{Ca}^{2+}/\text{Mn}^{2+}$ -ATPase, a Ca^{2+} pump for the Golgi apparatus, that have similar effects of TRPC1 [6]. It seems that Ca^{2+} depletion of ER stores has the potential to impair post-translational modification in protein secretion triggering a ER stress response, easily augmented by external stressors like ultraviolet B irradiation, heat, infection and frictions. Meanwhile, inflammation and cytokines down-regulate ATP2A2 activity, therefore, DWD keratinocytes being unable to overcome the ER stress because of defective up-regulation of SERCA2 expressivity resulting in premature induced apoptosis. The cumulative and final result of these molecular impairments is the histological appearance of apoptotic keratinocytes observed in DWD, known also as "corps ronds" [7]. Nonetheless, impairment of SERCA2 pumps affects the molecular assembly of the desmosomes complex, the trafficking of desmoplakins, desmogleins and desmocollin represented by their significantly inhibition in DWD keratinocytes. The summative result of this inhibitions marks the microscopic acantolysis, suprabasal clefts, abnormal keratinization or dyskeratosis [4]. Pharmacologically, the α -glucosidase inhibitor miglustat restores mature adherens junctions and desmosomes in DWD keratinocytes, thus, increasing adhesion strength. It has been suggested that restoration of nonmutated proteins due to miglustat favorable response in DWD might imply a misfolding mechanism in the ER [8]. In order to have a competent diagnosis, the clinician should rely on the macroscopic appearance of DWD rely that consists in symmetrical distribution of red-brown keratotic papules, unilateral or localized, that turn almost verrucoid if sufficiently close together. On seborrheic areas and in flexures, greasy, malodorous papules and plaques may be also observed. Sometimes, oral mucosa may become involved in the lesions, while nails may show subungual

hyperkeratosis, fragility and splintering, with alternating white and red longitudinal bands. Microscopic examination on standard hematoxylin and eosin stains reveals acantholytic dyskeratosis, with prominent irregular acanthosis and papillomatosis, suprabasal clefts and dyskeratotic, basophilic cells with large nuclei, sometimes with a perinuclear halo. If present in the granular layer, these basophilic cells define the presence of corps ronds. During infections of interested areas a brisk upper dermis infiltrates of lymphocytes becomes visible with haemorrhage that may spill inside the suprabasal clefts. Differential diagnosis includes the variant Hailey-hailey disease, in which the full thickness of epidermis becomes subject to acantholysis with scant dyskeratocytes, and transient acantholytic dermatosis as well as all other blistering dermatoses, in which rete ridges are sometimes spared with predominant spongiosis [1].

Conclusions

As in many situations, DWD seems to be a clear example of a genetic determinant in pathologic cutaneous lesions. Mutations found in ATP2A2 isoforms, even in a

heterozygous trait, seem to predict the appearance of DWD in future children. Early onset, high cutaneous sensitivity to external stress factors, and superimposed infections reveals DWD as a disease accompanied by a high distress for the young patients regarding self-esteem and cosmetic features. The fact that treatment is available, at least partially effective, for these patients is an important reason for further research in SARC2 and ATP2A2 genes relationship in tissue development and homeostasis.

Acknowledgements

The author wishes to thank to the Pediatric Hospital in Pitești, Argeș, Romania and their staff for full support in publishing this case.

Conflict of interests

The author declares no conflict of interests.

We undersign, certificate that the procedures and the experiments we have done respect the ethical standards depicted in the Helsinki Declaration, as revised in 2000, as well as the national law regarding medical publications and tissue manipulation.

References

1. Savignac M, Edir A, Simon M, Hovnanian A. Darier disease: A disease model of impaired calcium homeostasis in the skin. *Biochim Biophys Acta - Mol Cell Res*, 2011, 1813(5):1111–7.
2. Sakuntabhai A, Ruiz-Perez V, Carter S, Jacobsen N, Burge S, Monk S, et al. Mutations in ATP2A2, encoding a Ca²⁺ pump, cause Darier disease. *Nat Genet*, 1999, 21(3):271–7.
3. Ruiz-Perez VL, Carter SA, Healy E, Todd C, Rees JL, Steijlen PM, et al. ATP2A2 mutations in Darier's disease: variant cutaneous phenotypes are associated with missense mutations, but neuropsychiatric features are independent of mutation class. *Hum Mol Genet*, 1999, 8(9):1621–30.
4. Dhitavat J, Dode L, Leslie N, Sakuntabhai A, Macfarlane S, MacSween R, et al. Acrokeratosis Verruciformis of Hopf is Caused by Mutation in ATP2A2: Evidence That it is Allelic to Darier's Disease. *J Invest Dermatol*, 2003, 120(2):229–32.
5. Foggia L, Aronchik I, Aberg K, Brown B, Hovnanian A, Mauro TM. Activity of the hSPCA1 Golgi Ca²⁺ pump is essential for Ca²⁺-mediated Ca²⁺ response and cell viability in Darier disease. *J Cell Sci*, 2006, 119(4):671–9.
6. Pani B, Cornatzer E, Cornatzer W, Shin D-M, Pittelkow MR, Hovnanian A, et al. Up-regulation of transient receptor potential canonical 1 (TRPC1) following Sarcoendoplasmic Reticulum Ca²⁺ ATPase 2 gene silencing promotes cell survival: A potential role for TRPC1 in Darier's disease. *Mol Biol Cell*, 2006, 17(10):4446–58.
7. Onozuka T, Sawamura D, Goto M, Yokota K, Shimizu H. Possible role of endoplasmic reticulum stress in the pathogenesis of Darier's disease. *J Dermatol Sci*, 2006, 41(3):217–20.
8. Savignac M, Simon M, Edir A, Guibbal L, Hovnanian A. SERCA2 Dysfunction in Darier Disease Causes Endoplasmic Reticulum Stress and Impaired Cell-to-Cell Adhesion Strength: Rescue by Miglustat. *J Invest Dermatol*, 2014, 134(7):1961–70.

Correspondence to:

Radu Zamfir Ionescu
 Department of Pathology, Pediatric Hospital of Pitești,
 Str. Dacia, Nr 1, Pitești, Argeș,
 Romania, Zip Code 110414,
 Tel 040248 220 800, Fax: 040248 213 850,
 E-mail: dr.raduionescu@gmail.com

SYSTEMIC DISEASES AND DISORDERS INVOLVED IN ORAL MUCOSA AND PERIODONTIUM PATHOLOGY IN CHILDREN: A CROSS-SECTIONAL CLINICAL SURVEY IN BUCHAREST

C Funieru¹, R Oancea², M Cărămidă³, E Funieru⁴, RI Sfeatcu³

Abstract

Background and aims: The purpose of this study is to find prevalence of systemic diseases and disorders which can cause pathological changes in periodontal tissues or in oral mucosa. **Material and methods:** This study is a cross-sectional epidemiological survey made on a 1595 sample of schoolchildren from Bucharest, Romania. The dental clinical examinations were performed in order to find any changes in oral mucosa. Data about general condition were obtained using a questionnaire especially developed for this study. **Results:** 7% of children investigated said that have different allergies. Other general diseases or disorders were found less than 1%. **Conclusions:** General diseases are very important elements for an accurate periodontal or oral mucosa pathology diagnosis.

Keywords: systemic diseases, disorders, periodontium, children

Introduction

There are many systemic diseases and disorders which may be involved in the gingiva and/or in oral mucosa pathology in children or adolescents such as: nutritional deficiencies (vitamins A, D, E, C, B – complex, niacin, folic acid), endocrine disorders (diabetes mellitus, hyperparathyroidism, sex hormones disorders), hematologic disorders (leukemia, anemia, thrombocytopenia, leukocyte disorders), cardiovascular diseases (congenital heart diseases), liver diseases (hepatitis), renal failure, gingival and oral mucosa changes in pemphigus vulgaris, erythema multiforme, Wegener's granulomatosis, psoriasis or allergic reactions to some restorative materials, oral hygiene items and food additives [1-3]. Except the acute diseases such as measles virus [4] very common in children, there are some rare syndromes which can cause disturbances in oral or gingival tissues: Chédiak-Higashi, leukocyte adhesion

deficiency, Papillon-Lefèvre, histiocytosis, Ehlers-Danlos, congenital neutropenia (Kostmann syndrome), juvenile hyaline fibromatosis of gingiva or Down syndrome [5,6]. Even some adult-specific diseases such as oral lichen planus can be found in children or adolescents [7].

In Romania were developed very few studies about the relation between gingivitis and some systemic disorders like diabetes or infection with human immunodeficiency virus [8-11]. However, it is obvious that is a gap in the literature regarding gingival and oral disturbances caused by the systemic diseases and disorders in Romanian children population. This study had as main objective to find the oral health condition of Bucharest schoolchildren population, as well the prevalence of systemic disorders which may cause changes in gingiva or oral mucosa.

Materials and Methods

The data shown in this paper are part of the PAROGIM study, an epidemiological cross-sectional clinical survey developed in a sample of schoolchildren from 85 schools in Bucharest. However, the methodological line of this study, as well the epidemiological data about caries and gingivitis was previously published (12,13). Summarily, we can say the study was conducted from 2008 to 2009 on a sample of 1595 children aged 10 – 17 years. The sample size (n = 1600) was established for a population of 58,000 schoolchildren (total number of children from gymnasium schools in Bucharest in 2008), 50% assumed gingivitis prevalence, 95% confidence interval and a 2.4% estimation error, using EPIINFO statistical software for epidemiology, version 3.2.2 (Centers for Disease Control and Prevention, Atlanta, GA, USA). A single-stage cluster sampling method was used followed by a stratification processed by grades, city regions the presence of dental offices in schools criteria.

¹Preventive Dentistry Department, Faculty of Dental Medicine, “Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania

²Preventive Dentistry, Community and Oral Health Department, Faculty of Dental Medicine, “Victor Babes” University of Medicine and Pharmacy, Timișoara, Romania

³Oral Health and Community Dentistry Department, Faculty of Dental Medicine, “Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania

⁴SCM Dr. Voinoiu

E-mail: thycristi@yahoo.com, roancea@umft.ro, mariana.caramida@gmail.com, thycristi@yahoo.com, ruxandra.sfeatcu@gmail.com

The cluster size was established to be 25 (the number of schoolchildren per class recommended by the Romanian Ministry of Education at that time). All information about the general health were obtained following a short interview with the children. We have collected lot of data including information about the systemic diseases and disorders which can cause changes in gingiva or oral mucosa. Afterward, the data were picked-up in a special paper form especially designed for this study.

This study had the approvals of the “Carol Davila” University Ethical Committee, Bucharest Public Health Department and of the Bucharest School Inspectorate. An

invitation for participation was sent to each selected school. At least one parent for each child was asked to read and sign an inform consent form.

Results

The proportions of systemic diseases and disorders among children from the study sample were analyzed. Allergies were found in the top of the list (see figure no.1).

Causes of allergies are graphically shown in figure no.2.

The association between systemic diseases and gingivitis is presented in table no. 1.

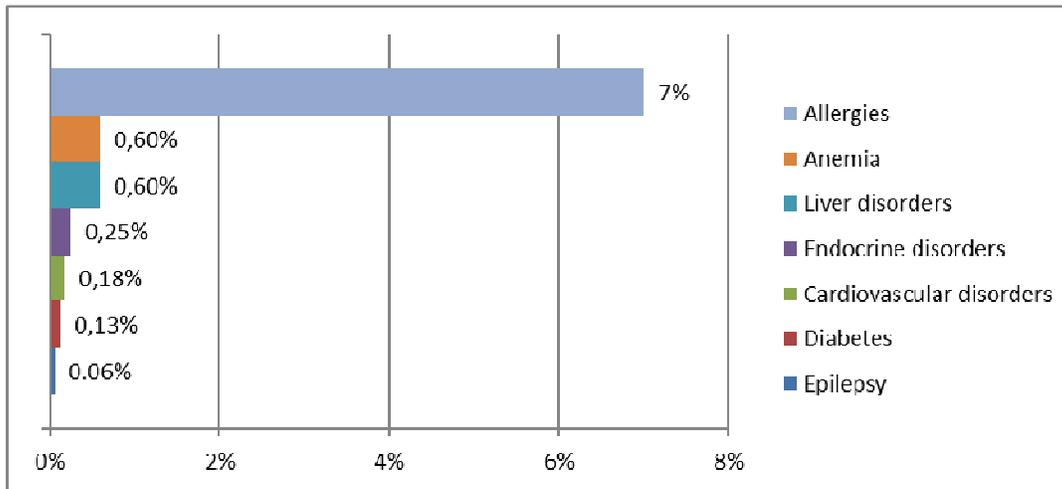


Figure no. 1: Prevalence of systemic diseases and disorders among schoolchildren in Bucharest (aged 10 – 17 years).

Causes of allergies

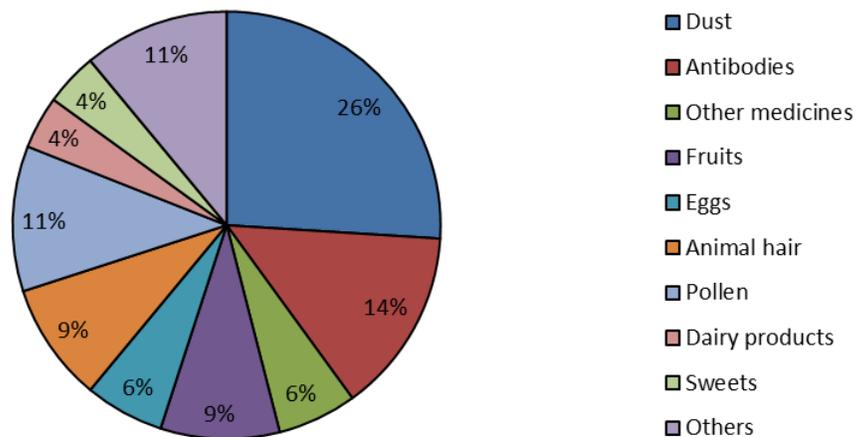


Figure no. 2: Causes of allergies for schoolchildren included in the sample.

Table no. 1: Data about gingival inflammation (GI) for children with and without systemic disease/disorders.

GI for children without systemic disease/disorders	GI for children with systemic disease/disorders
0.186*	0.189*
0.13 (± 0.22)†	0.14 (± 0.18)†

*Mean value; †Median value ± interquartile range

Discussion

A lot of systemic diseases and disorders can lead to some changes in periodontal tissues and oral mucosa condition. The data presented in this study show the proportions of some diseases responsible for periodontal pathological changes among children in Bucharest. However, even gingival inflammation is higher in children with systemic diseases, there is no statistical link in order to sustain this hypothesis in our study. The most prevalent general disease found in this study is allergy, but very few children showed any local gingival allergic reactions because a general allergen is not necessary a local (periodontal tissues or oral mucosa) allergen. General allergens such as antibodies or other medicines, fruits, eggs, milk or sweets found in this research are responsible for

some local allergic reactions [12]. However, none of these can be put in relation with gingival or oral mucosa lesions. Oral allergies reactions can be caused also by local allergens such as medicines, chewing gum, dental restoration materials, and some components from toothpaste or mouthwash [12, 13].

Conclusions

General diseases and disorders are important factors in periodontal and oral mucosa pathology. The general allergic reactions were found most prevalent, but they not showed any link with local periodontal condition in this study. The relation between systemic diseases and local condition is a very important issue for an accurate diagnosis.

References

- Newman MG, Takei HH, Carranza FA. Carranza's Clinical Periodontology 9th Edition, Saunder, Philadelphia, Pennsylvania, 2003, 204-228.
- Armitage GC. Periodontal diagnoses and classification of periodontal diseases. *Periodontol* 2000, 2004, 34:9-21.
- Davidovich E, Schwarz Z, Davidovitch M, Eidelman E, Bimstein E. Oral findings and periodontal status in children, adolescents and young adults suffering from renal failure. *J Clin Periodontol*, 2005, 32:1076-1082.
- Katz J, Guelmann M, Stavropolous F, Heft M. Gingival and other oral manifestations in measles virus infection. *J Clin Periodontol*, 2003, 30:665-668.
- Deas DE, Mackey SA, McDonnell HT. Systemic disease and periodontitis: manifestations of neutrophil dysfunction. *Periodontol* 2000, 2003, 32:82-104.
- Meyle J, Gonzáles JR. Influences of systemic diseases on periodontitis in children and adolescents. *Periodontol* 2000, 2001, 26:92-112.
- Alam F, Hamburger J. Oral mucosal lichen planus in children. *Int J Paediatr Dent*, 2001, 11(3):209-14.
- Matei M, Nechita A. Histomorphometric study regarding the evolution under treatment of the changes appearing at the level of the gingival mucosa in diabetic children. *Rom J Morphol Embryol*, 2012, 53(3):569-572.
- Vaseliu N, Carter AB, Kline NE, Kozinetz C, Cron SG, Matusa R, Kline MW. Longitudinal study of the prevalence and prognostic implications of oral manifestations in romanian children infected with human immunodeficiency virus type 1. *Pediatr Infect Dis J*, 2005, 24(12):1067-1071.
- Chen JW, Flaitz CM, Wullbrandt B, Sexton J. Association of dental health parameters with oral lesion prevalence in human immunodeficiency virus-infected Romanian children. *Pediatr Dent*, 2003, 25(5):479-484.
- Flaitz C, Wullbrandt B, Sexton J, Bourdon T, Hicks J. Prevalence of orodontal findings in HIV-infected Romanian children. *Pediatr Dent*, 2001, 23(1):44-50.
- Țovaru Ș. *Patologie Medicală Stomatologică*, Editura Cerma, București 1999, 162-170.
- Dumitriu HT, Dumitriu S, Dumitriu AS. *Parodontologie* 5th edition, Editura Viața Medicală, 2009, 246-247.

Correspondence to:

Roxana Oancea
Preventive, Community Dentistry
and Oral Health Department,
Splaiul Tudor Vladimirescu no. 14A,
Timișoara, Romania
E-mail: roancea@umft.ro

HYDATID CYST IN CHILDREN-15 YEARS OF EXPERIENCE

P Fuicu^{1,2}, CM Popoiu^{1,2}, N Babeu², ER Iacob^{1,2}, ES Boia^{1,2}

Abstract

Hydatid cyst is the most prevalent disease with potential transmission from animal to humans. Its prevalence is estimated at 3.1/100,000 children in the western part of our country. We present the results of a retrospective study over a period of 15 years (2000-2014) which includes 69 patients. The aim is to present our experience in the diagnosis and treatment of hydatid disease. The peak of incidence is in the 12-15 years old age group (46.6%) with a mean age of 10.4 years, the sex ratio girls / boys was 1.5. All the patients received classic surgical treatment. Lagrot procedure was used in of 81.6% of cases and followed, by oral Albendazole 10 mg / kg for 2 weeks - 3 months.

Results: In accordance with the GHARBI classification we met:

- 30 patients (56.6%) – type I cyst
- 12 patients (22,6%) – type II cyst
- 8 patients (15%) – type III cyst
- 3 patients (5,6%) – type IV cyst

Age ranges from 4 to 18 years, 36 patients (60%) were female, 24 (40%) male, with a sex ratio girls/boy of 1.5 and an average age of 10.4 years.

Patients from rural areas represented a proportion of 63.3% (38 cases) respectively patients from urban areas, the rest of 36.6% (22 cases).

Conclusions: Although it is a condition whose etiology is known and for which prevention methods could be applied so as to decrease its prevalence, hydatid cyst remains a disease that shows a constant rate of illness. Cystotomy accompanied by partial Lagrot pericystectomy remains the most used surgical procedure, being a relatively simple intervention, accessible to all surgeons.

Keywords: hydatid cyst, hydatid disease, Lagrot process, Taenia Echinococcus, child

Introduction

Hydatid cyst or hydatid disease is a zoonosis caused by Taenia Echinococcus, especially by the granulosus and multilocularis forms. The disease is prevalent in endemic areas of the Mediterranean, Eastern Europe, Australia, New Zealand, North Africa respectively South America [1,2].

The hepatic location of the disease is ascertained in 55-75% of patients, the lung location in 10 - 30% and in 15% of cases, the location is possible in other organs [3].

The suspicion of disease is raised in patients with positive epidemiological and clinical data, accompanied by the growth of the eosinophils in the leukocyte formula [4,5].

Imaging tests (Ultrasound, RX, CT, MRI), supplemented with serological techniques (enzyme - linked immunosorbent assay) (ELISA), indirect hemagglutination (IHA), and (Western Blot) are used to confirm a positive diagnosis [6].

The treatment is complex: medical and surgical, aiming the evacuation of the proligere membrane with its contents, and the treatment of the remaining cavity. The postoperative treatment consists of oral antiparasitic medication (Albendazol).

In the cases without complicated forms, multiloculated locations or relapses, the classic technique tends to be replaced by minimally invasive thoracic or laparoscopic techniques or PAIR (puncture cyst, percutaneous aspiration, injection of chemicals, and reaspiration) [5]. Besides the direct mechanical action exerted on the affected organ, which causes local pathological changes, the hydatid cyst has a negative impact on the entire organism through its toxic-allergic action [7].

The prevalence of the disease in the western part of Romania is estimated at 3.1/100.000 children, having a higher rate in rural areas (4.4/100,000 children) when compared to urban areas (2.3/100.000 children). A peak is described in children aged 5-15 years (4.4/100,000) [3,8].

Aim

The paper aim is to present our approach for the diagnosis and treatment of hydatid cyst with the lowest risk for the patient, in order to obtain the fast and favorable evolution.

Patients and method

We performed a retrospective study, between January 2000 - December 2014, on 69 patients diagnosed and treated for hydatid cyst in Pediatric Surgery Timisoara.

¹Department of Pediatric Surgery, „Victor Babes” University of Medicine and Pharmacy, Timisoara

²“Louis Turcanu” Emergency Hospital for Children Timisoara

E-mail: dr.fuicupaun@yahoo.com, mcpopoiu@yahoo.com, alinababeu@yahoo.com, radueiacob@umft.ro, boiaeugen@yahoo.com

In the cohort, we included 60 patients (87%) who had a confirmed the diagnosis of hydatid cyst, regardless of its location and received surgical treatment. We excluded from the cohort 6 patients (8.7%) with hydatid cyst size less than 3cm, and 3 patients (4.3%) who had small calcified hydatid cysts, all receiving medical treatment as outpatient. The datas were collected from the medical charts, surgical protocols and were statistically processed. We evaluated the demographic data (age, sex) clinical data (symptoms at the beginning and the period of state, the affected organ), laboratory investigations, imaging (Ultrasound, RX, CT, MRI), the treatment and surgical techniques, postoperative complications, recurrences and surgical re-intervention, duration of hospitalization and mortality.

Data were collected and analyzed using SPSS v.17 (SPSS, Chicago, IL, USA). The results are presented as number of cases and percentage from the total of the subgroup analyzed. To evaluate the statistical significance of the differences in proportions between two subgroups,

Fisher’s exact test was used, respectively for the differences in proportions between more than two groups we used chi-square for trend test.

A p-value <0.05 was considered to be statistically significant.

Results

Patients from rural areas represented a proportion of 63.3% (38 cases) respectively patients from urban areas, the rest of 36.6% (22 cases).

Age ranges from 4 to 18 years, 36 patients (60%) were female, 24 (40%) male, with a sex ratio girls/boys of 1.5 and an average age of 10.4 years.

No significant differences was noticed regarding the age group neither between rural vs. urban inhabitants (p=0.566) nor between boys vs. girls (p=0.818) (Table 1).

The age distribution showed increase with age, most cases, 28 (46.6%), belonging to the age group of 12-15 years (Figure 1).

Table 1. Children cystic echinococcosis – Timisoara 2000-2014.

AGE GROUP (YEARS)	URBAN INHABITANTS			RURAL INHABITANTS			P (urban vs. rural)	TOTAL CASES			P (male vs. female)
	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL		MALE	FEMALE	TOTAL	
4 – 7	1	1	2	1	3	4	0.566	2	4	6	0.818
8 – 11	1	3	4	3	4	7		4	7	11	
12 – 15	4	5	9	9	10	19		13	15	28	
16 – 18	2	5	7	3	5	8		5	10	15	
TOTAL	8	14	22	16	22	38		24	36	60	

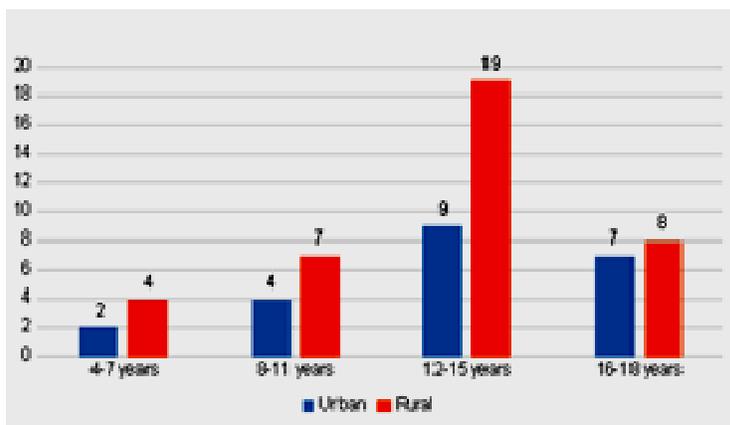


Figure 1. Cases distribution according to age group.

The liver was affected in 46 patients (76.6%), followed by lung, 7 patients (11.6%) and 1 case each (1.6%) for the location of spleene, pancreatic, common bile duct and uterus. Three cases (5%) had multiorgan location: liver and lung 2 cases (3.3%), liver and spleen 1 case (1.6%).

Right hepatic lobe was interested in 29 patients (63%), left lobe in 9 patients (19.5%) (Table 2), and multiple hepatic localization was reported in 8 patients (17.4%). The distribution of hepatic cysts (n=46), according their localization is presented in Figure 2.

Table 2. Localization of the unique hepatic cysts based on the liver’s segmentation.

No. of CASES	MEDIAN				LATERAL			
	RIGHT		LEFT		RIGHT		LEFT	
	V	VIII	I	IV	VI	VII	II	III
38	6	6	5	1	7	10	1	2

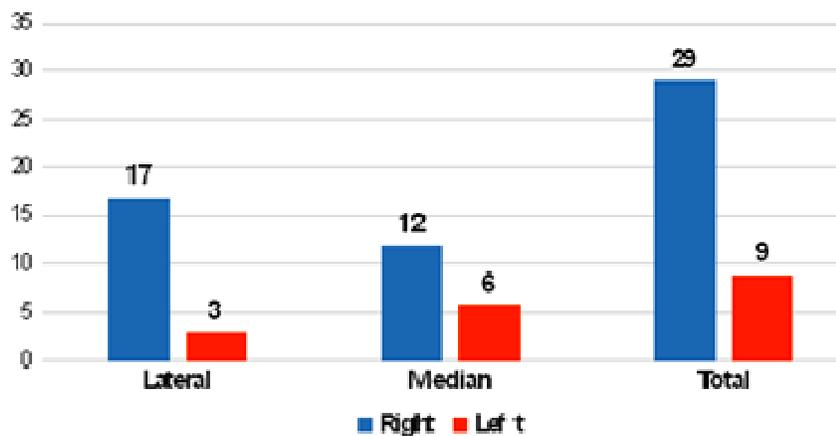


Figure 2. Location of the hepatic hydatid cysts.

From the cases which affected the lung (n=7), three (42.8%) were located in the right lower lobe and 4 (57.1%) in the left inferior lobe.

According to the dimensions, 20 cysts (33%) were between 4 and 7cm, 28 (46.6%) had between 8 and 12cm respectively in 12 cases (20%) their size was larger than 12cm (Figure 3).

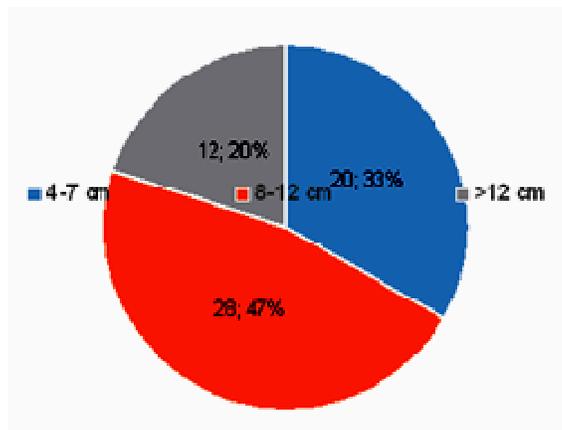


Figure 3. Dimensions of the hepatic hydatid cysts.

Hydatid cyst was discovered incidentally in 32 patients (53.3%), when the patients presented nonspecific symptoms at admission: weight loss, loss of appetite, fatigue, low grade fever, diffuse abdominal pain on exertion.

Pain and tenderness at palpation in the right upper quadrant, with muscular defense reflex, accompanied by hepatomegaly, fever, jaundice, and the existence of an irritating cough accompanied by shortness of breath on exertion, chest pain with generalized pruritus, represented the onset of the disease in 23 patients (38.3%).

The debut of this symptomatology was insidious, being described in period ranging from one week up to 4 months prior their presentation at the medical office and/or admission in hospital. The complicated forms had an acute debut in 5 cases (8.3%): 2 cases with hydatid cysts ruptured post-traumatic, with the evacuation of the content into the peritoneal cavity, one with gallbladder hydrops and mechanical jaundice, a punctured lung hydatid cyst with anaphylaxis, a pancreatic hydatid cyst with debut of acute pancreatitis. The rigorous anamnesis on these cases indicated a worsening of general condition with at least one week prior to admission, without a acknowledged etiology. Hyper-eosinophilia was present in 25 patients (41.6%), 28 patients (46.6%) had values at the upper limit or slightly

elevated in the pathological ranges, and a total of 7 patients (11.6%) presented values within normal limits.

Leukocytosis was present in 20 patients (33.3%) and leucopenia in 3 patients (5%).

ESR was increased in most cases, 36 (60%) and in 13 cases (28.2%) of hepatic hydatid cyst elevated levels of bilirubin were observed, with altered liver function and increased ALT and AST.

ELISA tests and indirect hemagglutination were performed in 45 patients (75%), with a rate of 88.8% of positive results for ELISA test and 71.1% for hemagglutination.

The ultrasound examination was performed in all patients and, in accordance with the classification in the international class GHARBI, WHO-IWGE, the following ultrasound images were met :

- 30 patients (56.6%) – type I cyst
- 12 patients (22,6%) – type II cyst
- 8 patients (15%) – type III cyst
- 3 patients (5,6%) – type IV cys

All patients received a mandatory pulmonary XR, 7 patients (11.6%) presenting positive images for the cystic formation (Figure 4).

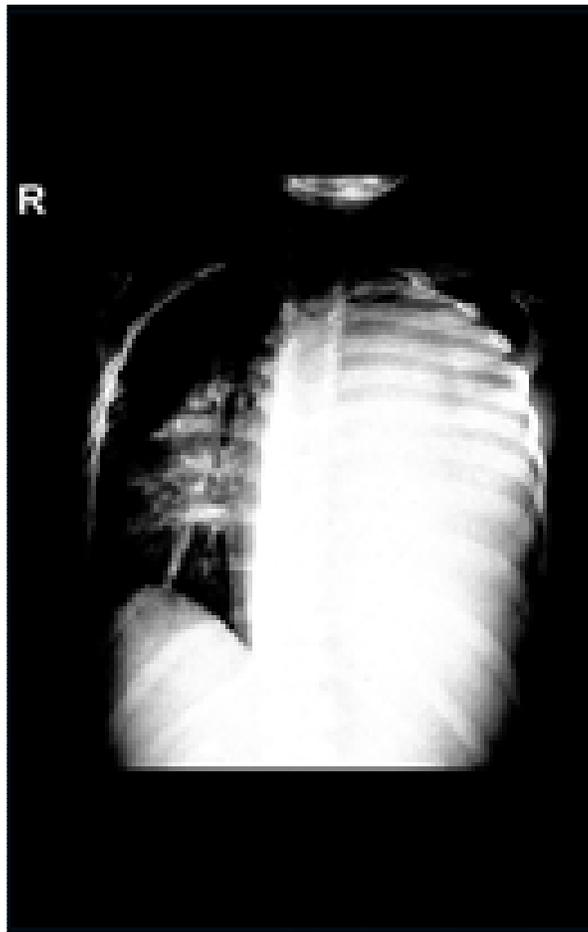


Figure 4. Gyant left pulmonary hydatid cyst.

In 24 patients (41.6%) CT with contrast was performed, which confirmed the lesions detected by ultrasound and radiology. By this method there were diagnosed 2 cases (3.3%) of ruptured hydatid cyst and evacuated into the peritoneal cavity with secondary echinococcosis.

The pharmacological therapy treatment with oral Albendazole, in doses of 10 to 15 mg/ kg before surgery was received by a total of 34 patients (56.6%). Postoperatively, all 60 patients (100%) followed this treatment between two weeks and three months.

Surgery was performed using the classical, conservative method.

To inactivate the parasite in hydatid fluid we used the hypertonic saline solution 20% for 10 min. We applied the Lagrot process in 49 patients (81.6%) with cystotomy with partial pericystectomy and the evacuation of the fluid leaks and of the entire proligere membrane (Figure 5), external remaining cavity drainage on silicone tube, in a closed system.



Figure 5. Extraction of the proligere membrane.

In 9 cases (18.3%), the Lagrot process was completed also with external drainage of the Douglas space. For 9 patients (18.3%) the residual cavity was capitonnaged which put the cyst walls in contact. The omentoplasty of the residual cavity, after the removal of the proligere membrane, was used in 2 cases (3.3%), one with spleen location and one with liver location, post-traumatically ruptured and evacuated into the peritoneal cavity. For the last one, we paid special attention to the removal of the vesicula ficae of the peritoneal cavity and those fixed in the omentum were removed in block by their resection. Peritoneal fluid was

taken for culture, the peritoneal cavity was washed with hypertonic saline solution 20% and externally was drained separately the Douglas pouch bottom with silicone tube. In the pulmonary hydatid cysts, after the evacuation of the fluid content and extraction of the proligere membrane, after cystotomy, all the bronchial fistulas were sutured with nonabsorbable threads, the cystic cavity was externally drained and, separately, the pleural cavity on silicone tubes in closed suction system, under the liquid column for the treatment of the post-surgical pneumothorax.

Early surgical reintervention was performed in 3 cases (5%) of internal biliary fistula and consisted in fistula suturing (Table 3), the capitonnage of the residual cavity through a tunneling by fitting a silicone tube into the cavity and its externalization in a closed drainage system.

Biliary fistulas with draining extended over 10 days were spontaneously closed over a period of time between 15 and 28 days, averaging 19 days.

Hospitalization was between 7 and 41 days, with a mean of 14 days. Postoperatively, 48 patients (80%) were followed for a period between 3 months and 2 years.

Medium and long-term prognosis was favorable, with restitutio ad integrum, no relapses and no mortality.

Table 3. Complications.

During the surgery	Peritoneal contamination	2 (3.3%)
	Respiratory arrest	1 (1.7%)
Post-surgery	Wound infection	2 (3.3%)
	Biliary fistula	3 (5.0%)
	Prolonged biliary drainage	6 (10.0%)

Discussions

The hidatid cyst is far from being eradicated in Romania, currently representing a real hazard to the infant's health, with a prevalence rate of 3,1 per 100,000 children, in the western part of the country [2]. The maximum incidence of the disease is common around the age of 12-15 years, at the female patients coming from rural areas and families with low social-economic environment, dealing with livestock in the household.

The mean age is similar to that reported by a study performed in Serbia (10,1 years old) (Djuricici et al. 2010), a country that borders Romania to the southwest [9].

Female predominance was also reported in other studies performed in children (Inan et al. 2007; Al-Shibani et al 2012) [10,11]. Patients from urban areas usually live in remote, unsanitary conditions, without running water or sewerage network, where the presence of community tramp dogs represents a very serious problem in the present for local authorities. The positive diagnosis of hydatid disease is an imagistic diagnosis; the abdominal ultrasound, chest radiography and the thoracic-abdominal CT being paraclinical methods with high accessibility and high specificity.

The Elisa test for determining the antibodies against echinococcus seems to have the highest specificity and sensitivity in establishing the diagnosis.

The elective treatment of the hydatid disease is surgical, the classical conservative techniques intending the evacuation of the fluid content, extracting the entire proligere membrane and the management of the remaining cavity. The medical treatment is mandatory, both preoperative and especially postoperative, currently the Albendazole is elective in dose of 10-15mg dose / kg body for 3 month.

Special attention should be paid to insulation of the cyst from the adjacent organs (with tables soaked in hypertonic saline 20% solution) during the extraction of the

fluid and of the proligere membrane, avoiding the secondary contamination.

The hydatid cyst, ruptured and emptied of its the contents into the peritoneal cavity, is an immediate medical emergency, with the patient possibly in anaphylactic shock and the acute abdomen labeled as appendicitis, peritonitis or abdominal tumor.

Pulmonary cases require selective intubation in order to prevent the invasion of the tracheobronchial tree with the fluid content, during the maneuvers of cyst draining or cyst inactivation with saline 20% solution.

The essential problem in the surgical treatment of the hydatid cyst is represented by the approach of the pericystic residual cavity. Its thorough exploration to detect biliary fistulas or bronchial entail their suture and drainage cavity with external silicone tube.

The capitonnage of the residual cavity should be used where there is no certainty of a good macroscopic exploration for viewing the biliary fistulas existence.

Lagrot partial pericystectomy, practiced in cases with hepatic localization, is a method characterized by the technique's simplicity, with the urge preservation of the affected tissues and the absence of the retentional accidents. Omentoplasty is a method used to stimulate migration of macrophages in both septic focus, as well as to favor the resorption of the fluid in the remained cavity.

According to Dziri and collaborators, in a study on 115 patients, it was proved that omentoplasty decreased the rate of profound abdominal complication compared to the simple drainage [12]. Postoperative complications of hydatid disease must be recognized and treated in a timely manner, otherwise could endanger the patient's life.

Hydatid disease recurrences usually occur due to improper disposal of cystic content, intraoperative cystic fluid leaks, undetected cysts, satellite lesions or reinfections.

Average length of hospitalization in our study is one consistent with that found in the literature. Compared with reported data, the low relapse cases in our study is due to a

competent team of surgeons involved in resolving this pathology in our clinic.

Conclusions

Although it is a condition whose etiology is known and for which prevention methods could be applied so as to decrease its prevalence, hydatid cyst remains a disease that shows a constant rate of illness. In order to eradicate the disease, measures are needed against the infection reservoir. It is necessary to enhance the health-related education, dissemination of the basic medical knowledge, to create hygienic habits, starting from the family, kindergarten and to be continued in schools.

Although the incidence of the disease is higher in rural areas in our country, there is an urbanization of the disease

in recent years, probably due to the large number of tramp dogs. Abdominal ultrasound and chest radiography remain the main imaging methods both for disease screening and for the follow. Cystotomy accompanied by partial Lagrot pericystectomy remains the most used surgical procedure, being a relatively simple intervention, accessible to all surgeons. Our experience is proving that the surgical method chosen, accompanied by medical therapy (Albendazole 10-15 mg/kg body) should be adapted to the general condition of the patient, the evolutionary phase of the parasitary infection, the position and extension of the hydatid cyst and, not least, the experience of the therapist surgeon. No major complications and no death were recorded in our seria.

References

1. Cummings H, Rodriguez-Sosa M, Satoskar AR. Hydatid Disease. In: Satoskar AR, Simon GL, Hotez PJ, Tsuji M (eds) Medical Parasitology Austin, TX: Landes Bioscience, 2009, pages 146-152.
2. Moldovan R, Neghina AM, Calma CL, Marincu I, Negina R. Human Cystic echinococcosis in two south-western and central western Roumanian counties: A 7-year epidemiological and clinical overview. Acta Tropica vol 121, Issue 1, January 2012; pages 26-29.
3. Schantz PM, Kern P, Brunetti E, Echinococcosis In: Tropical Infectious Diseases: Principles, Pathogens & Practice, 3 ed. Guerrant RL, Walker DH, Weller PF (eds.). Philadelphia: Saunders Elsevier, 2011, pages 824-838.
4. Muller R, Wakelin D, Worms and Human Disease, 2nd ed. Wallingford, Oxon, UK: CABI Publishing, 2002.
5. Tantawy IM, Hydatid Cystic in Children. Ann Pediatr Surg 2010; 6 (2); 98-104
6. Popescu I, Ciuce C, Sabetay C. Tratat de chirurgie, vol. III, 2 ed., Chirurgie Pediatrica. Editura Academia Romane Bucuresti 2014 ISBN 978-973-27-2185-8 pages 253-362.
7. Negina R, Neghina AM, Marincu I, Iacobiciu I, Epidemiology and epizootology of cystic echinococcosis in Roumania 1862-2007, Foodborne Pathologens and Disease, 2010a; 7:613-618.
8. Vlad DC, Neghina AM, Dumitrascu V, Marincu I, Neghina R, Calma CL. Cystic echinococcosis in Children and Adults: A 7-year Comparative Study in Western Romania, Foodborne Pathologens and Disease, volume 10, number 2, 2013, pages 189-195.
9. Djuricic SM, Grebeldinger S, Kafka DI, Djan I, Vukadin M, Vasilievic ZV, Cystic echinococcosis in children – The seventeen year experience of two large medical centers in Serbia. Parasitol Int. 2010; 59:257-261.
10. Inan M, Ayvaz B, Baser M, Karoayvaz M, Ciftici A, Hatipoglu AR, Gul H, Hepatic hydatid disease in children ans adults living in different areas in Turkey. Saudi Med J 2007; 28:555-558.
11. Al-Shibai LA, Al-Eryani SM, Azazy AA, Al-Mekhlafi AM, Cases of hydatidosis in patients referred to Governmental hospitals for cyst removal in Sana’a City, Republic of Yemen. Trop Biomed 2012; 29:18-23.
12. Dziri C, Haonet K, Fingerhut A, Treatment of hydatid cyst of the liver: where is the evidence? World J Surg 2004; 28 (8):731-736.

Correspondence to:

Calin Marius Popoiu,
 Department of Pediatric Surgery
 Victor Babes University of Medicine and Pharmacy
 Piata Eftimie Murgu nr. 2
 300041 Timisoara
 Romania
 E-mail: mcpopoiu@yahoo.com

MANUSCRIPT REQUIREMENTS

The manuscript must be in English, typed single space, one column on A4 paper, with margins: top – 3 cm, bottom – 2, 26 cm, left – 1, 5 cm, right – 1,7cm. A 10-point font Times New Roman is required.

The article should be organized in the following format: Title, Names of all authors (first name initial, surname), Names of institutions in which work was done (use the Arabic numerals, superscript), Abstract, Keywords, Text (Introduction, Purpose, Materials and Methods, Results, Discussions and/or Conclusions), References, and first author's correspondence address.