OBTÍŽE PŘI PŘÍJMU POTRAVY U NOVOROZENCE S COFFIN-SIRIS SYNDROMEM – KAZUISTIKA

FEEDING DIFFICULTIES IN A NEWBORN WITH COFFIN-SIRIS SYNDROME – A CASE STUDY

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ABSTRAKT
Coffin-Siris syndrom (CSS) je velmi vzácné, geneticky podmíněné onemocnění. Má autozomálně dominantní dědičnost, většinou však vzniká de novo mutací. Jedná se o klinicky heterogenní poruchu. Přes značnou variabilitu znaků, které mohou tento syndrom doprovázet, za ty nejcharakterističtější bývá považováno opoždění psychomotorického vývoje, abnormality pátého prstu na rukou či nohou, charakteristické rysy obličeje, hypotonie centrálního původu, hirsutismus/hypertrichosis, řídké vlasy na hlavě a malý vzrůst. Novorozenci a děti s tímto syndromem mívají obtíže při příjmu potravy a poruchy polykání. Kazuistika popisuje průběh klinicko-logopedické péče o pacienta s CSS v novorozeneckém období v době hospitalizace s cílem přiblížit postup klinicko-logopedické diagnostiky i krátkodobý terapeutický plán s cílem zajistit u dítěte s CSS bezpečný orální příjem potravy.

Klíčová slova: Coffin-Siris syndrom. Dysfagie. Opoždění psychomotorického vývoje. Klinicko-logopedická péče. Novorozenecké období.

ABSTRACT
Coffin-Siris Syndrome (CSS) is a very rare genetic disorder. Although it has autosomal dominant inheritance, it is usually caused by de novo mutations. CSS is a clinically heterogeneous disorder, however, there are certain features considered to be characteristic for the disorder. These features include delayed psychomotor development, abnormalities of the fifth finger or toe, characteristic facial features, hypotonia of central origin, hirsutism/hypertrichosis, a sparse scalp, and a short stature. Individuals with the syndrome present with difficulties eating and dysphagia. The case study describes the course of Speech and language pathologist (SLP) care of a patient with CSS in the neonatal period during hospitalization. The aim of presenting the SLP diagnostic procedure and short-term therapeutic plan is to provide information in order to ensure safe oral intake of food in a child with CSS.

Key words: Coffin-Siris syndrome. Dysphagia. Delayed psychomotor development. Speech and language therapy. Neonatal period.

INTRODUCTION

Coffin-Siris syndrome (CSS) is a very rare heterogeneous genetic disorder. According to the Portal for Rare Diseases, the prevalence of CSS in the Czech Republic is <1 in 1 000 000. Children with CSS may have difficulty eating with vomiting and aversive reactions often present and causing a failure to thrive in the absence of intestinal malformations (Vergano et al., 2013).

CSS was first described by Coffin and Siris in 1970. In their study, the authors reported three cases of severely intellectually disabled females. In addition to the intellectual disabilities, certain physical features were also identified: sparse hair, bushy eyebrows, wide mouths, joint laxity, and brachydactyly/abscess of the last digit of the fifth finger, including the fingernails (Coffin et al., 1970). In 1991, Levy and Baraitser reviewed 31 cases of CSS which enabled them to identify a CSS phenotype with its typically dysmorphic facial and body features. Flat nasal root and broad nose, flat supraorbital arch, triangular and thick eyebrows, horizontal palpebral fissure, triangular philtrum, large lips, a gothic palate, and low-set ears belonged to the most frequently presented facial dysmorfias. Dysmorphic body features then included a short neck, broad chest, widely set nipples, transverse palmar crease, diffuse hypertrichosis (excessive growth of dark hairs in unusual places; formerly called wolf syndrome), hirsutism (increased growth of pigmented hair in areas atypical for the specific sex, i.e. cheeks, upper lip, chin, neck, torso, back, inner thighs; frequently found in females). Furthermore, Levy and Baraitser found that approximately one-third of the mothers of children with diagnosed CSS reported reduced foetal movements in utero. At birth, 50% of the children had low birth weight. Further in their development, feeding difficulties were found in 87 % of those children and growth retardation in 80% of the sample. In addition, intellectual disability was diagnosed in all the children. Indeed, a specific phenotype of CSS was identified. However, as in all medical and non-medical disciplines, when defining clinically unclear or overlapping syndromes, experts tended to abandon the cluster approach and

select only the major and minor symptoms significant for a clinical diagnosis of CSS. For instance, the authors' collective (Vergano et al., 2013) reviewed 80 previously reported cases of CSS and defined two main subtypes of CSS – one showing the "classic" gross facial features that have been described previously, and the other showing "variant" and less prominent or striking facial features. To this date, 334 individuals with CSS have been described in the literature (Cilberto et al., 2023). Currently, molecular/genetic testing forms the basis for a definitive CSS diagnosis. The presence of fifth finger aplasia/hypoplasia is no longer considered a prerequisite for a diagnosis.

A CASE STUDY

A male infant was born from a second pregnancy after an IVF cycle with a donor oocyte. Following a successful first trimester of gestation, polyhydramnios was revealed in the second trimester via an ultrasound examination. Due to the development of maternal hypertension, a delivery was induced at the 37th week of gestation. The second period of delivery was prolonged as shoulder dystocia occurred. Perinatal asphyxia and an early stage first degree asphyxia syndrome were identified by a neonatologist. At birth, hypotonia was observed, furthermore, stimulation and brief ventilation were provided to due inefficient breathing patterns. The birth weight was 2,900 grams, birth length 51 cm, Apgar score (7/8/8).

After admission to the intermediate care unit, an ALTE (Apparent Life-Threatening Event) developed. Repeated stimulation was provided and for two hours, the infant was placed on nCPAP (nasal Continuous Positive Airway Pressure). Minimal oxygen therapy was required for the next 20 hours, and the infant was placed in an incubator for the following three days. An ultrasound examination of the brain postdelivery revealed decreased cortical gyrification with no obvious focal pathology or signs of haemorrhage. Further examinations shall be described subsequently.

Firstly, a hearing examination during hospitalization was undertaken with the following results: TEOAE: bilaterally non-excitable, BERA: bilaterally non-excitable. Secondly, a neurological examination revealed the presence of right-sided predilection, hypotonia, and normoreflexion with poor postural and spinal mechanisms. As a result, the prof. Vojta's developmental rehabilitation was indicated. Lastly, a genetic examination indicated by the neonatologist confirmed Coffin-Siris syndrome due to the presence of dysmorphic features of the face, head and body. The infant presented with microcephaly, a wider nasal root, a gothic palate, wider thumb articles, cryptorchidism (testicular descent disorder), and sinus pilonidalis (a cyst near the coccyx and the anal region).

In addition, alimentation was problematic due to food intolerance and reoccurring vomiting, therefore, different feeding approaches were undertaken. A supportive infusion therapy was introduced at day 4 post-birth. Subsequently, a nasogastric tube provided feeding. By day 10 post birth, feeding was provided by a bottle with a teat in addition to the nasogastric tube as the mother lacked milk supply. During oral nourishment intake, saturation dropped to 75 %. As such, a Speech and Language Pathology assessment was indicated at day 12 by the neonatologist due to suspected dysphagic difficulties in food intake. At that time, the infant was hospitalized with his mother in the neonatal unit of the intermediate care unit in a rooming-in type room.

During the first clinical SLP's contact with the mother at her son's bedside (week 39 of gestation), atypical somnolence of the infant combined with sleep during feeding periods was observed. Due to high suspected risk of dysphagic difficulties, recording of the oral feeding readiness assessment according to the Infant Driven Feeding Scale IDFS I (Ludwig et al., 2007) was recommended. The assessment of alertness and vigilance, current tone distribution, and a presence of a rooting reflex takes place prior to each feeding and is recorded by the paediatric nurse on the daily discourse. Scoring is undertaken followingly: a score I or II is given to an infant who is sufficiently alert, presents with rooting reflex and an adequate body muscle tone and can therefore be exposed to oral food intake. A score of III represents only short-term alertness during handling and no apparent signs of hunger. Scores of IV and V indicate somnolence and potential changes in cardio or respiratory rate.

The subject of the case study frequently obtained a score of III or IV during the day. When an IDFS I score of III was obtained, the infant was awake only for a brief period of time (e.g., while nappies or clothes were being changed) but was not fully awake so that signs of hunger were present (e.g., oral search reflex, head turning, restlessness, placing hands in the mouth, etc.). During handling, no

increase of the body or limb tone was observed, the upper limbs remained passively lying along the body. Eyes remained closed, in response to verbal stimulation the eyes opened, however, with absent gaze, and a period of deep sleep followed. In terms of IDFS I scoring, a score of IV was obtained during the day as no awake state or signs of hunger occurred.

Ludwig et al. (2007) stated that an IDFS I score of III up to V indicates oral food intake immaturity, therefore, the infant should not be exposed to oral feeding. Instead, feeding occurs via nasogastric tube. In this case, the clinical speech therapist recommended not administering food orally until a score of I or II is achieved four times consecutively. In the following days, increased alertness was observed and a score of II was obtained more frequently supporting that for this case, the clinical speech pathology examination could be performed at the age of 39 + 2 weeks of gestation. The upcoming section provides a more detailed description of the diagnostic process and assessment by the clinical SLP.

Clinical Diagnostics and Assessment by the Speech and Language Pathologist

The present section elaborates on various examinations performed by the clinical SLP and their outcomes; furthermore, it introduces a therapeutic plan specific for the presented case and follows the additional development of the case.

Firstly, the examination of General Movements according to Professor Prechtl (2001) recognised a poor movement repertoire during the observation of spontaneous movements. The postural assessment in the pronation position identified an overload of the thoracolumbar spine transition, Th/L kyphosis, hip abduction; furthermore, in the supination position a fixed right-sided predilection occurred in combination with decreased axial muscle tone, diastasis, weakening of the oblique abdominal muscles. A tendency to head reclination in all positions was also present. Following the postural assessment, the evaluation of tactile responses after a two-point static tactile stimulation (a gentle touch with the pads of the thumb and the index finger on the forehead) detected a change in respiratory rate and facial grimacing in combination with disorganized movement and limb extensions. With a slow and gentle turn to the side, the Moro reflex was repeatedly propagated and followed by a full-body tremor. The responses were of longer duration, receding up to 45 seconds after stimulation. An increased degree of irritability of extrapyramidal nature and a prolonged response to stimulation was also observed. The evaluation of orofacial structures revealed a standard gothic palate, frenulum labii and linguae. During the assessment of orofacial motor skills, a weakly developed search and sucking reflex with a slight asymmetry of the eye slits and the mouth oval were detected. At rest, lips were partially open, the tongue was flat and reaching to the lip line. The muscles of the jaw, lips and tongue were weakened.

Building on the previous assessments, the assessment of non-nutritive suction (NNS) was undertaken. It revealed strongly uncoordinated and weak suction movements with non-rhythmical jaw movement and a flat, not optimally formed into a central groove tongue. Indeed, the test of the effectiveness of non-nutritive sucking using the five-point scale by Chantal Lau (Lau, 2015) detected stage II signs of the sucking development phase with weak and non-rhythmic positive sucking component. The negative component was absent. Continuing with the evaluation of nutritive suction (NS), the IDFS II oral intake progress score (Ludwig et al., 2007) was used. In the five-point scale, a score of I or II indicates that the infant shows signs of well-coordinated sucking, swallowing, and breathing during oral intake; alternatively, the ability to coordinate gradually deteriorates as fatigue appears. A score of III means is assigned to an infant who sucks consistently but in an uncoordinated manner. A score of IV reflects weak, inconsistent, and uncoordinated sucking, whilst a score of V marks dysfunctional sucking with significant changes in the heart/respiratory rate and saturation. In this case, swallowing is not safe. The subject of the present case study was fed from a bottle with an S.A.B. – Medical teat with a blue sleeve, which had a flow rate of 34.32ml/min (Červenková, 2022). On the IDFS II assessment, a score of V was obtained. During feeding, saturation suddenly dropped to 75% and a secondary bradycardia occurred. Therefore, sucking was assessed as dysfunctional.

Accounting for the assessment outcomes and ensuring safety during swallowing, a different bottle with lower fluid flow was chosen. It was a disposable S.A.B. – Medico teat with a red sleeve, with an average flow rate of 11.12 ml/min (Červenková, 2022). Another aim was to prevent aspirations that were suspected to occur during the food intake. The

infant remained cardiopulmonary stable (monitored by a sensor) while feeding from the teat bottle. He was alert enough to receive milk formula per os without any discoordination of sucking, swallowing and breathing, however, due to general weakness, decreased muscle strength and lower muscle tone, pauses during feeding were necessary. Feeding lasted longer overall (35-45 minutes). Due to the presence of limited stamina during feeding, the feeding schedule was changed (8 times per day instead of the previous 7 times per day). By feeding more frequently with smaller volumes, the feeding time was reduced and the overall organization of the infant during feeding was improved according to the Synactive Model of Infant Behavioral Organization by Hedelisa Als (1986). Based on the model, in order to improve the coordination of sucking, swallowing and breathing, and to ensure an adequate body posture, a side feeding position is recommended for newborns with dysphagic difficulties. Following the feeding strategy, a score of II was obtained.

In summary, the short-term therapeutic plan for the period of hospitalization included:

- Safety precautions when feeding per os with milk formula (using the IDFS I. and IDFS II. scales)
- Selection of a bottle with a slower flow teat that did not interfere with SPD coordination
- Suitable feeding positioning (side position)
- Self-regulation promotion through tactile stimulation
- Jaw rehabilitation programme
- Isometric tongue exercises

The mother received information on the signals of infant's readiness for oral intake according to the IDFS I scale. She was then instructed to monitor the individual parameters of the assessment during the day. The condition was that if the infant showed a score of I or II according to the IDFS I scale, he was fed per os, if not, feeding non per os was provided. The ability to independently decide when to offer and when not to offer food intake per os was perceived very positively by the mother.

However, additional difficulties with self-regulation occurred. The infant showed increased startle reactions when handled and touched. The mother was instructed to always speak first before initiating touch (the initial touch ritual). To increase the infant's ability to self-regulate, the principles of tactile stimulation postulated by Professor Field were explained to her (Field et al., 2006). According to those principles, tactile stimulation needs to be predictable and a larger surface area (e.g. the area of the whole palm) should be used. Touch should be static, with a medium amount of pressure. Following the principles, during the day, the mother touched the infant on the lower and upper limbs and on the large joints. This procedure reduced the degree of irritation that the infant showed in the head area. If awake during the day, the mother performed isometric exercises for the tongue to strengthen the negative component of sucking and a followed a jaw rehabilitation program increasing jaw strength. Those exercises were performed 4 times a day. The infant was discharged to home care on day 19 of hospitalization. Currently, the infant receives regular doses of 50 ml of milk formula orally.

DISCUSSION

Sucking disorders might develop early age both in immature children, and in children born at term with other risks, such as stigmatized children, children with genetic defects, or children with central muscle tone disorders (Azuma et al., 2020). For children with a history of risk, the exposition to oral feeding before their oral-motor skills reach a satisfactory level brings safety concerns. To intervene effectively and safely, certain tools reducing the risk of aspiration pneumonia and rehospitalizations were developed (Azuma et al., 2020). One of these tools is the IDFS – Infant Driven Feeding Scale (Ludwig et al., 2007). The simple scoring system ensures that the decision when to proceed or not to proceed with oral feeding is consistent across the ward. The clinical speech and language therapist then uses more detailed assessment tools that evaluate not only the presence of the above parameters, but also their quality and the quality of oral-motor skills. Based on these, a bottle with a teat of the appropriate shape, material, flow rate and variation coefficient are recommended for children who cannot be breastfed (Červenková, 2022). The suitability of the teat is not only verified objectively by monitoring the preservation of cardiopulmonary stability, but also by qualitative assessment of the presence of aversive signs of stress according to the Synactive theory.

CONCLUSION

Nursing and therapeutic procedures for a child with CSS need to be adjusted to the specific

manifestations and issues present. Ideally, the approach to the patient with CSS should be transdisciplinary, involving the collaboration of a paediatrician, cardiologist, gastroenterologist, surgeon, orthopaedic surgeon, nutritionist, clinical speech therapist, physiotherapist, occupational therapist, early intervention centre worker and a special educator. Timing of the intervention is a major factor in life participation of the persons diagnosed with CSS.

Poděkování

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REFERENCES

ALS H. A Synactive model of neonatal behavioral organization: framework for the assessment and support of the neurobehavioral development of the premature infant and his parents in the environment of the Neonatal Intensive Care Unit. *Physical & Occupational Therapy In Pediatrics*. 1986; *6* (3-4): 3-53.

AZUMA D., MARON J.L. Individualizing oral feeding assessment and therapies in the newborn. Research and Reports in Neonatology. 2020; 10: 23-30.

CILIBERTO M., SKJEJ K., VASKO A. et al. Epilepsy in Coffin-Siris syndrome: A report from the international CSS registry and review of the literature. *American journal of medical genetics. Part A.* 2023; 191 (1): 22-28.

COFFIN G.S., SIRIS E. Mental retardation with absent fifth fingernail and terminal phalanx. *American Journal of Diseases of Children*. 1970; 119 (5): 433-439.

COFFIN-SIRIS SYNDROM. Portál pro vzácná onemocnění a léčivé přípravky pro vzácná onemocnění. https://www.orpha.net/consor/cgi-bin/OC_Exp.php?lng=cs&Expert=1465

ČERVENKOVÁ B. Nejdůležitější parametry saviček aktuálně používaných u hospitalizovaných předčasně narozených kojenců. *Listy klinické logopedie.* 2022; 6 (1): 55-62.

FIELD T., DIEGO M.A., HERNANDEZ-REIF M. et al. Moderate versus light pressure massage therapy leads to greater weight gain in preterm infants. *Infant behavior & development*. 2006; 29 (4): 574-578.

LAU C. Development of suck and swallow mechanisms in infants. *Annals of nutrition & metabolism*. 2015; 66 Suppl 5: 7-14.

LEVY P., BARAITSER M. Coffin-Siris syndrome. *Journal of Medical Genetics*. 1991; 28 (5): 338-341.

LUDWIG S.M., WAITZMAN K.A. Changing feeding documentation to reflect infant-driven feeding practice. *Newborn and Infant Nursing Reviews.* 2007; 7 (3): 155-160.

PRECTL H.F.R. General movement assessment as a method of developmental neurology: new paradigms and their consequences. The 1999 Ronnie MacKeith Lecture. *Developmental medicine and child neurology*. 2001; 43 (12): 836-842.

VERGANO S.S., SANTEN G., WIECZOREK D. et al. Coffin-Siris Syndrome. Synonym: Fifth Digit Syndrome. 2013; Last updated 2021. In: Adam, M. P., Everman, D. B., Mirzaa, G. M., et al., editors. GeneReviews® Seattle (WA): University of Washington, Seattle; 1993-2023. [cit. 1.7.2023]. Dostupné z: https://www.ncbi.nlm.nih.gov/books/NBK131811/