Clinical and morphological characteristics and diagnosis of external haemangiomas in children


Abstract. Background. The relevance lies in the increasing occurrence of haemangiomas in children under 1 year old when diagnosis confirmation through morphological methods is necessary. The purpose of the research is to characterise the histological initial and final changes of cutaneous haemangiomas and to present the main clinical manifestations of haemangiomas in children. Materials and methods. Several clinical (for detailed diagnosis of the disease), morphological (histological examination of the material) and statistical methods were used in the work. The object of the research was 98 children with haemangiomas of the facial skin aged 6 months to 16 years. Results. The morphological study demonstrated that in 49 cases (50 %), the typical simple capillary structure of haemangioma was identified, in 35 cases (35.7 %) — cavernous type of neoplasm. Only 18.3 % of the children had combined haemangiomas. Capillary-type haemangiomas contain many small capillaries with a narrow lumen, covered by adhering fleshy epithelium. Conclusions. During the phase of the active growth of haemangiomas, there is a predominance of massive endothelial cells, suggesting that the vascular component, particularly proliferating epithelium-lined capillaries, makes up the main and largest part of the hyperplasia.

Keywords: skin; neoplasm; vascular component; congenital pathology; cryodestruction

Introduction

A tumour is a development in the form of an overgrowth consisting of tissue of any origin and can be localised in any part of the body. Even though haemangioma is mostly a benign development, the relevance of the presented subject is to disclose the problem of complications of haemangiomas. For example, in addition to a cosmetic defect of the face, haemangiomas interfere with the work of facial mimic muscles, lead to impaired vision, hearing loss, deformations of the auricles, impede the process of breathing, and even can deform the small bones of the face (depending on the depth of its growth). Each of the first existing methods of treatment is not favourable for any morphological type of haemangioma and any defined localisation. Surgical treatment of superficial haemangiomas is not successful due to serious cosmetic complications and functional disorders of the body. In turn, sclerotherapy is characterised by a significant duration of haemangioma treatment, often leading to the development of new haemangiomas. The latest new and relevant method for the safe elimination of skin haemangiomas is cryodestruction.

As stated by A. Leung et al. [1] and A. Rodríguez Bandera et al. [2], vascular malformations range from simple “moles” to life-threatening defects. Incorrect pathological definition and misdiagnosis of vascular malformations are not uncommon. There is no exact clear concept, which is the cause of haemangiomas of superficial body coverings. But it can be stated unequivocally that a significant role is played by environmental factors. Of particular relevance is a high index of atmospheric pollution, periods of high humidity, changes in radiation background or emissions of pesticides into the air. D. Sebaratnam et al. [3] note that the problem of examination and treatment of haemangiomas is important for modern diagnosis and a further choice of therapy since even any benign mass under specific conditions can acquire signs of malignization. In addition, there is a high risk that the edges of such haemangiomas may necrotise and further wound infection may occur. To improve the quality of treatment for paediatric haemangiomas, it is necessary to pay attention to qualified morphological diagnosis of these neoplasms.

Infantile haemangiomas are the most common tumours of early childhood (4–10 % of cases) [4, 5]. External hae-
Haemangiomas are most common in childhood and account for 50 to 80% in children and about 20–22% in the adult population. They are specific vascular overgrowths that have a benign course and are congenital. C. Li et al. [6] and H. Kim et al. [7] in their works indicate that usually such neoplasms are not harmful to the child’s body and do not cause complications but cause considerable cosmetic discomfort. Infantile haemangiomas, characterised by a high level of endothelial cell proliferation and rapid angiogenesis, cannot be detected immediately after birth but their development begins in the first few weeks of life [8]. The rapid growth of such infantile haemangiomas may result in ulceration, distortion, distortion of the edges of the neoplasm or obstruction of vital structures (e.g., airways). Although regression of paediatric haemangiomas mostly begins in adolescence, it can begin even as late as 6 months of age, sometimes sooner or much later.

According to J. Jiang et al. [9] and H. He et al. [10], endothelial cells, which are part of infantile haemangiomas, synthesise unique immunohistochemical markers such as glucose transporter 1, as well as Lewis Y antigen, FC, II receptor and merosin, which are present in blood vessels of the common vascular-tissue barrier, in particular the retina and brain. The most frequent localisations of haemangiomas in the adult population are the head and neck area (70%), the chest and body (25%), and the upper or lower extremity (5%). As for superficial haemangiomas in children, they are most frequently localised in the lower and upper extremities, back, and abdomen and very rarely on the buttocks, genitals and perineal area [11]. Infantile haemangiomas can be focal, multifocal, segmental or those that cannot be classified (indeterminate masses), depending on their morphological features, length, width, diameter and distribution, and according to their localisation on the skin and/or within the subcutaneous tissue or various surfaces.

P. Fan et al. [12] and B. Bancalari et al. [13] in separate independent studies indicate that congenital haemangiomas consist of small capillary particles in which endothelial cells are unable to secrete glucose transporter 1, accompanied by a number of large extralobular vessels, arteries and lymphatic vessels. The ultrasound findings of infantile haemangioma can clearly identify the vessels in or around the pathological focus, and solid calcinates or their fragments. H. Zheng et al. [14] and C. Mazzini et al. [15] note that classical haemangiomas proceed without degenerative changes. Rapid regression of congenital haemangiomas may be accompanied by transient thrombocytopenia and manifestations of coagulopathy.

The purpose: to give a morphological assessment of superficial haemangiomas of childhood. The objective of the research is to indicate the frequency of haemangiomas and gender of detection; to describe the main histological features of haemangiomas and stages of development, involution of neoplasm; to characterise the clinical course of superficial haemangiomas.

Materials and methods

The material and the object of the research are 98 children aged from 6 months to 16 years with different clinical forms of haemangiomas and their localisation. Haemangiomas of the skin, particularly of the maxillofacial region, are of the greatest interest. During the presented research, the analysis of clinical and morphological parameters of haemangiomas of the maxillofacial region in children was conducted according to the presented histological characteristics. The staff of the National Centre for Maternity and Childhood of the Kyrgyz Republic, Department of Paediatric Surgery and Paediatric Maxillofacial Surgery, thoroughly examined 1,163 case histories of inpatients who were treated in Bishkek in 2009–2020. All further studies of histological samples of superficial haemangiomas were conducted at the Pathological and Anatomical Bureau under the Ministry of Health. All patients were treated according to the existing nosological forms of the disease and the accepted protocols: 1) without cryo-sclerosing treatment — 74 cases; 2) after cryo-sclerosing therapy — 24 cases. The morphological characteristics of various forms of haemangiomas of soft tissues of the maxillofacial region in children were studied on 16 preparations made from postoperative material. The presented work on morphological specimens was conducted at the Republican Pathological and Anatomical Bureau of the Ministry of Health of the Kyrgyz Republic.

Several scientific methods of research were used to achieve the set purposes. A list of clinical, instrumental, ecological, morphological and medico-statistical methods of research was used during the investigation and treatment of haemangiomas. Clinical and instrumental methods included anamnesis, examination, palpation, auscultation, thermometry of patients, ultrasound, surgical and combined treatment, cryotherapy, electrocoagulation, and sclerosing therapy of the affected area. For microscopic examination of haemangiomas, neoplasms from different skin areas with localisation both in the dermis and subcutaneous tissue, singly in deeper skin layers, were taken. For histological examination, fragments of 1 x 1 cm were removed from the surgical material. The material taken postoperatively was fixed in 10% neutral formalin, which was dehydrated in alcohols of increasing concentration and filled with paraffin-celloidin. Then sections with a thickness of 5–7 microns were made and stained with haematoxylin and eosin according to the Van Gieson method. Histological preparations were studied using Nikon-50S microscope (Japan). The ruler was calibrated with ocular and object micrometres.

The statistical method was used in two interrelated areas: as one of the methods of analysing and processing research data and as a general representation of the breadth and variation of the prevalence of the presented disease in the population. Statistical data among the world population regarding the prevalence of haemangiomas were considered, with special attention paid to those of the Kyrgyz Republic. The highlighted statistical information allows analysing the causes for a sharp increase in the incidence of cutaneous haemangioma among the child population, the probable theories of the origin of congenital haemangiomas as defects in the development of the vascular bed and reflecting the sexual component among the spread of neoplasm. Meta-analysis as a type of statistical research method was used to evaluate the presented set of sources.
on this subject by probable error of thought. Despite it, this method provides a foundation for the development of an average assessment or opinion on the purpose put forward and the unexplained problem of the prerequisites for the occurrence of haemangiomas of the maxillofacial region in children. In addition, the data on the percentage distribution of simple capillary haemangiomas, cavernous, combined and mixed haemangiomas are statistically outlined. Parametric (Student’s test) and non-parametric (χ² and Fisher’s criterions) statistical methods were used for further statistical processing of the results of clinical studies. The indicated detected patterns and correlations between the examined parameters were significant between populations and traits with a probability of false prediction of p = 0.05 and higher.

Results
The morphological research demonstrated that out of the examined 98 patients, in 49 cases (50 %) the tumour was found to have the structure of a classical simple capillary haemangioma, in 35 (35.7 %) observations, the presence of a cavernous type of haemangiomas was confirmed (Table 1). In turn, only in 18 objects of the research, making 18.3 %, the morphological structure of haemangioma close to the combined one was identified.

### Table 1. Distribution of patients by histological structure of haemangiomas

<table>
<thead>
<tr>
<th>Type of haemangioma</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary</td>
<td>85.1</td>
<td>90.1</td>
<td>85.2</td>
</tr>
<tr>
<td>Cavernous</td>
<td>49.3</td>
<td>50</td>
<td>33</td>
</tr>
<tr>
<td>Combined</td>
<td>31.8</td>
<td>26</td>
<td>25.2</td>
</tr>
<tr>
<td>False</td>
<td>18.8</td>
<td>24</td>
<td>41.8</td>
</tr>
</tbody>
</table>

Of the cohort of submitted subjects, there were only 24 cases after cryo-sclerosing therapy as indicated. Considering the highest frequency of diagnosis of haemangioma of capillary morphology, this type should be carefully described. The obtained data of the study indicate that in 12 cases (63.2 %), the clinical diagnosis did not coincide with the results of histological examination of the postoperative material. In 9 of these patients (63.7 %), the clinical diagnosis of cavernous haemangioma was not confirmed by morphologists and is classified as the morphological type of capillary haemangioma. All groups of patients were comparable in terms of the main baseline parameters. Among the patients of group I, male patients accounted for 35.9 %, and female patients — 64.1 %; in group II, 24.6 and 75.4 %, and in the group III, 40 and 60 %, respectively. The difference between the groups is statistically significant (χ² = 9.78, p < 0.05). An increase in the number of children and adolescents in groups II and III is notable.

It relates to the high rate of haemangiomas diagnosed at an early age and with the positive results of the cryogenic method of treatment. Both true and false haemangiomas were detected in the patients included in the study. Among the patients of group I, true haemangioma was diagnosed in 85.1 % of patients, false — in 14.9 %. In group II, these indicators were 90.1 and in 9.9 %, and in group III, 85.2 and 14.8 %, respectively (Table 2). The difference between the groups is statistically insignificant (χ² = 3.51, p < 0.05). The analysis on the frequency and distribution of various forms of true haemangioma identified statistically significant differences between some groups (χ² = 79.52, p < 0.05). Combined forms of haemangioma were diagnosed more often in groups II and III. Thus, patients with more severe manifestations of the disease and complications undergo cryogenic treatment.

### Table 2. Distribution of patients depending on the types of superficial haemangiomas, %

Some scientific sources provide information that histologically most haemangiomas in childhood are not mature capillary neoplasms, and later they mature and transform into cavernous tumours [16]. The essence of the sclerosing method (without cryodestruction) in 74 patients of group I consisted in using alcohol of 70% concentration by intrathecal injection. Considering the significant painfulness of sclerosing therapy, particularly in significant areas of haemangiomas, preliminary anaesthesia using 2% novocaine solution with infiltration of the site of the intended effect was performed. The amount of 70% alcohol was from 1 to 5 ml per injection. The cryogenic method (cryodestruction) of treatment was applied to 24 patients of group II. Liquid nitrogen was used as a cryoagent, which due to its low boiling point (−196 °C) can remove heat flows at a high speed and perform deep freezing. Cryotherapy sessions were carried out using new porous self-contained titanium nickelide TiNi applicators.

Capillary haemangiomas consist of numerous capillaries with a narrow lumen lined with fleshy epithelium. A greater number of endotheliocytes predominate at the stage of active growth and proliferation. Hence the opinion that the vascular component, and mainly capillaries lined with proliferating epithelium, constitute the largest part of the hyperplasia (Fig. 1). Endotheliocytes are hyperplastic, and fleshy, with eosinophilic cytoplasm and hyperchromatic nuclei in their structure and characteristics. Large fields of fibrous and adipose tissue smoothly replace capillaries in some areas. The vessels of the same name are lined with atrophied endothelium.

Capillary haemangiomas can vary in colour from scarlet to blue. They range in diameter from a few millimetres to several centimetres. A capillary haemangioma is approximately at the level of the skin surface or may rise slightly. Such haemangioma is usually covered by intact epithelium (human external haemangioma) (Fig. 2). The borders of a capillary haemangioma are clear, red or red-blue. Visually, capillary haemangioma of the outer skin has the appearance of red spots due to the presence of red or purple papules, nodules rising slightly above the skin sur-
face [17]. Pathognomologically, such spots have a port wine-coloured appearance or are called wine-like nevus.

When pressure is applied to the haemangioma, the area becomes pale and dull, then returns to its original colour. On histological examination, haemangiomas are unencapsulated specific aggregates closely adhering to thin capillary walls, almost filled with blood and lined with squamous endothelium. Blood vessels are separated from each other by stromal tissue consisting of a small amount of connective tissue. The lumen of such vessels is partially or completely thrombosed and is combined with characteristic vascular sclerosis. As a result of such haemorrhage following the rupture of a blood vessel, haemosiderin rapidly begins to accumulate in the tumour tissue and thereafter forms a scar. Particles of vascular channels of capillary size are lined with a single layer of squamous endothelial cells. A large branching of vessels can be found at the depth of the haemangioma [18, 19]. Along with this, an associated lymphocytic infiltrate is microscopically visualised. Infantile haemangioma of capillary type is characterised by a sequence of development. First, capillary proliferation occurs and this process is divided into three stages: early proliferative stage (lobules of immature dendritic-type cells with intermediate specific stroma, with numerous large feeding vessels); early regression (capillaries dilate and then gradually begin to disappear; debris due to apoptosis in the basal membrane with an increase in pericapillary mast cells are noted); late regression or end-stage (characterised by capillary remnants — so-called ghost capillaries, in addition, rings of the basal membrane with rare endothelial cells with specific immunophenotype of placental capillaries are observed).

Pyogenic granuloma or partial capillaroma (granulomatous telangiectasia) is one of the types of capillary haemangiomas and has the appearance of red nodules that tend to grow rapidly on a stalk. Described telangiectasias are most common in adults, children and adolescents [20, 21]. The so-called pyogenic granulomas are located on the skin or mucous membranes of the oral cavity or gums. The nodules of this haemangioma are easily traumatised, frequently bleed and are covered first by erosions and then by ulcers. Approximately 35 % of lesions occur after trauma and can reach sizes of up to 2–4 cm within a few weeks. Capillary haemangioma in the form of hyperplasia is often accompanied by the presence of a large-sized oedema and along with this, there is a focus of chronic inflammatory infiltrate, very reminiscent of hyperplastic granulation tissue. Lobular capillary haemangiomas can be considered the result of a general inflammatory proliferative response to local stimuli, and mechanical traumatisation or the administration of some drugs, particularly in the treatment of processes with a malignant course [22, 23]. For this neoplasm, the site of spread is the upper extremities and lips. In some cases, such haemangioma may be localised on the head, neck or atypical sites. Lobular haemangiomas are more frequently localised on the penis, external female genitalia, in the gastrointestinal tract, and respiratory system organs. Lobular capillary haemangiomas have the appearance of small or large, smooth or exophytic vascular nodules with a lobular structure, which can grow rapidly, develop, and increase in size, and there is a tendency to ulceration and haemorrhage. When these haemangiomas reach a large size, their structure resembles lobules, sometimes they have a mushroom shape.

Histologically, a capillary haemangioma of lobular structure consists of a series of capillaries and venules with loose endothelial cells, which in turn are divided into parts by a specific fibromyxoid matrix. Fascicular haemangiomas are rare benign neoplasms of vascular origin, defined as progressive capillary haemangiomas, and are diagnosed within the first 5 years of a child’s life (50 % are children under 1 year of age) [24]. Congenital fascial haemangiomas are seen in up to 78 % of all fascial haemangiomas. The described haemangioma and Kaposiform haemangioendothelioma should be considered different manifestations of the same pathology. Furthermore, fascial haemangioma is characterised by a mild course and is frequently clinically combined with the superficial form of Kaposiform hae-

Figure 1. Microscopic picture of capillary vascular hyperplasia of the skin, haematoxylin-eosin staining: EC — extensive cavity; PP — proliferation phase; DZ — demarcation zone; E — endothelium

Figure 2. Microscopic picture of vascular hyperplasia (capillary), haematoxylin-eosin staining: EC — extensive cavity; PP — proliferation phase
Cavernous haemangioma. This statement is based on similar and common symptoms, and most importantly, this fact is proved by histological specimens. Congenital paediatric haemangioma has a smooth surface and rigid consistency precisely in the phase of rapid growth with poorly canalised vessels and mitotically active endothelium. In addition, a layer of pericytes is histologically defined, which is located at the periphery of the haemangioma. With the subsequent maturation and development of this neoplasm, blood flow begins to develop. During the microscopical examination, it is possible to see chaotically arranged components of solid matter and vascular areas, but in different proportions.

Later, the development of a massive capillary plexus with a powerful blood supply is noted. As a result of the onset of the involution process, there is a thickening of the basal plates and fibrosis. The specific feature is that the considered haemangiomas are combined with Kasabach-Merritt syndrome [25]. According to the clinical course, fascial haemangiomas can be classified into 3 types: uncomplicated fascial haemangiomas, Kasabach-Merritt syndrome without signs of thrombocytopenia, and haemangiomas with chronic coagulopathy. In clinical practice, in children younger than 1 year of age, both fascial haemangiomas and Kasabach-Merritt syndrome can be observed simultaneously.

Cavernous haemangioma has a hilly hard surface and consists of developed arteries and veins. Therefore, such neoplasms often look like birthmarks. On histological examination, endothelial cells are found to demonstrate multiple mitoses. No mitoses with pathological elements are found. Tissues in the pathological cell (in the area of haemangioma) penetrate deeper into the subcutaneous fatty tissue and sometimes with progressive development — into the skeletal muscles, which are below the layers. Later on, the tissue of cavernous haemangioma destroys their fibres [26]. At the involution stage, the presented vascular haemangioma tissue loses its lobular structure. The total number of stained endothelial cells becomes much less, which indicates a significant reduction of the vascular component. There is a decrease in both the number of capillaries and the quality of their endothelial cells. The blood supply by arterioles of vascular hyperplasia in most of this area
is diffuse and minimal (Fig. 3A). The cavernous form of haemangioma is characterised by a spongy structure and massive subcutaneous nodular masses. The specific feature is a soft elastic consistency, since there are cavities filled with blood.

Cavernous haemangiomas consist of abnormally dilated and connected blood vessels (capillaries, venules, arterioles). These haemangiomas are less well-defined than fully capillary ones, and they more frequently involve deep structures in their tissue. Since cavernous haemangiomas are associated with local destruction and are not capable of regressing on their own, it is sometimes necessary to involve surgery for treatment. As a rule, the mentioned haemangiomas are not clinically significant, but more frequently disturb the child’s usual life with their cosmetic appearance and skin traumatisation. In addition, visceral cavernous haemangiomas detected visually need to be differentiated from more dangerous conditions such as malignant lesions [27]. The most problematic cavernous haemangiomas are those of the brain and skin areas that come into contact with underwear and cause traumatisation.

A cavernous haemangioma has a soft and hollow surface that is developed from arteries or veins. Morphologically, it consists of vascular lumen (cavities) of different shapes and sizes, filled with blood and connected (Fig. 3B). When localised in the subcutaneous tissue, this haemangioma protrudes above the skin surface and has a bluish-blackish colour. When pressed, the haemangioma shrinks and changes its colour to pale. When a child coughs, screams or cries, blood from this haemangioma may flow deep under the skin, causing the haemangioma to grow faster and change its colour [28]. In addition, a neoplasm of this structure may originate from the vascular epithelium of vascularised internal organs such as the liver, spleen, brain or spinal cord, kidneys and lungs. In this case, it is a haemangioma of internal location.

A separate variety is combined haemangiomas, their structure has features of both cavernous and simple capillary haemangiomas. Symptomatology depends on the predominance of the capillary or cavernous part. This type of haemangiomas includes angioneuromas and angiofibromas. The cytoplasm of endothelial cells of combined haemangioma is impoverished and pale, histologically oval nuclei and hyperchromatosis are noted. They contain neither mitotic elements nor fragments of nuclei and are not associated with erythrocytes. In the residual phase of its development, the main part of the hyperplastic focus of haemangioma is occupied by mesenchymal cells consisting of fibroblasts and stromal tissue (Fig. 4).

The latter contains collagen and reticular fibres surrounded by interstitial fibroblasts [29]. The mixed type may consist of elements of capillary or cavernous tumours, but has subcutaneous and external parts and includes other tissues besides the vascular component.

Discussion

More frequently, haemangiomas appear in children as congenital birthmarks. Such neoplasms on the skin change as a result of vascular malformation. The worldwide incidence of neonatal haemangioma is about 3%. But about 10–12% of children are diagnosed with this problem in the first year of life. Statistics confirm that it is the most common benign soft tissue tumour in paediatrics, neonatology and paediatric surgery [30]. The diagnosis rate with the correct therapy reaches 50%. The presented disease is 3–5 times more common in girls. Capillary haemangiomas of the external skin in adults occur in exceptional cases if inappropriate medical care was provided in childhood and the defect was not eliminated.

According to M. Xie et al. [31] and S. Chang et al. [32], superficial haemangioma of newborns is a frequent phenomenon, and it is the most common among benign neoplasms in children under 1 year of age. Due to rapid growth, development and cell proliferation, such haemangiomas can cause serious impairment of vision and orbital eye function (Fig. 5). The earlier this disease is diagnosed in a child, the better parents should understand and recognise the main manifestations of haemangioma, and there will be no defect or even impairment of a particular organ in adulthood.

The described disease justifies its name in 30–40% of cases, as tumours of this type begin to develop in the foetus and manifest themselves immediately after birth. However, haemangiomas are not always detected in the first few hours of a newborn’s life. More than 65% are diagnosed only between 2–8 weeks after birth. Moreover, in terms of the prevalence of benign paediatric tumours, haemangioma ranks first. Girls with this skin neoplasm predominate over boys with a ratio of 3 : 1 [33]. The early symptoms of superficial haemangiomas appear in the first 2–3 weeks of a newborn’s life. In rare cases, especially for cavernous haemangiomas, symptoms may appear much later, usually between 4–8 weeks of age. From this point onwards, over 5–6 months, the tumour undergoes several phases of development, the main one being the proliferative phase, characterised by dense progressive growth [34]. For this reason, it can be seen on clinical examination that cutaneous and subcutaneous manifestations are most pronounced during this period.

After that, when the child has reached 6–8 months of age, the tumour enters a regression phase. It refers only to the simple superficial haemangiomas (e.g., capillary haemangiomas of children), as cavernous and mixed haemangiomas cannot regress on their own. Significant regression of such tumour occurs within 1–2 years, but complete self-treatment and elimination of almost all elements of haemangioma is possible within 7–12 years. According to the statements of J. Mashiah et al. [35] and J. Cheng et al. [36], later the haemangioma that has passed the previous stages gradually shrinks and is covered with healthy skin. In about half of the cases of haemangiomas, residual lesions (atrophy, scarring, hyperpigmentation or telangiectasia) are found on the child’s skin.

Benign tumours such as childhood haemangiomas are rapidly progressive. They grow rapidly in the superficial and deep layers of the skin. As the defect grows and spreads, the surrounding tissues may undergo destruction, resulting in impairment of the child’s vision, hearing or breathing. Researchers state that if a haemangioma is traumatised, there is a high risk of infection and ulcerative deformities deve-
laping on the surface of the neoplasm [37–39]. In appearance, the initial form of simple capillary haemangioma is a red spot with an uneven surface, rounded in shape, with inconspicuous edges, protruding and rising above the skin surface. If pressure is applied to the area where healthy skin meets the haemangioma, the spot will turn pale, but if the finger is removed, it will return to its original colour. When the child screams or cries, the mass fills with blood and becomes scarlet, sometimes fiery, and purple. In addition, there are large capillary haemangiomas that can spread over a significant area of the body. Such spot of indeterminate shape with irregular edges is usually located on the back, upper or lower extremities. Cavernous haemangiomas are located in the subcutaneous fatty tissue, are characterised by a mostly soft consistency and palpated as lobular hilly structures with unchanged upper skin. They are essentially communicating cavities filled with blood or blood clots. The mass is usually flesh-coloured or blue, and sometimes small or larger blood vessels can be seen in it. Tumours may be surrounded by a thin capsule or they may grow into the surrounding tissue and have no clear limit. Therefore, the size of such masses can vary from a few millimetres to tens of centimetres.

According to A. Diociaiuti et al. [40], infantile haemangioma develops when a significant group of blood vessels sprout in or under the child’s skin and such a process can be defined as abnormal vascular development. It is usually noticed within the first few days or months of a child’s life. In most children, haemangiomas first enlarge and then slowly disappear without intervention. But some may leave scarring loose skin or other defect. There are two main types of infantile haemangiomas: superficial (skin) and deep (internal) haemangiomas, which are located in the lower layers of the skin and under the skin. In addition, they are known as strawberry haemangiomas or strawberry marks because of their wavy red appearance, which is very similar to the surface of a strawberry. Deep haemangiomas grow under the skin, giving them the shape of a bulge, usually a blue or purple-coloured mass. Deep haemangiomas are called subcutaneous haemangiomas.

K. Jicha et al. [41] and K. Rezende et al. [42] describe that infantile haemangioma of segmental structure can be associated with other vascular and extravascular anomalies, including the so-called PHACE/PHACES syndrome. This disorder includes anomalies of the posterior cranial fossa (P), the presence of haemangioma (H), arterial malformations (A), cardiovascular pathology (C), anomalies of the eye or its orbit (E), and sometimes the presence of a sternal defect (S) is added. PHACE syndrome is most commonly associated with haemangiomas of the face, whereas LUMBAR syndrome is associated with haemangiomas of the lumbosacral region, and areas of the perineum, lower or upper extremities. Congenital paediatric haemangiomas are rare, their variation is infantile superficial haemangioma. It is already fully developed at birth and in most cases does not tend to further progressive growth. Such congenital haemangiomas are characterised by vascular components protruding above the skin surface, possibly with the presence of telangiectasias at the apex of the tumour and a peripheral pale margin.

Haemangiomas may regress rapidly during the first year of life and partially reduce in size or remain unchanged. According to the clinical course, such congenital haemangiomas are divided into rapidly regressing masses, superficial haemangiomas with partial regression and haemangiomas without regression. Sometimes these benign masses are of two types [43]. Haemangiomas may appear in internal organs such as kidneys, lungs, liver or brain. Children may be born with no signs of haemangioma or with flat blue or red patches that are hardly noticeable or there is a negligible number of elements with vascularity. Infantile haemangioma may grow and develop over several months. Later, during the first year of life, it begins to shrink (or degenerate) until few or no vascular tufts remain. This involution of haemangioma elements can last up to 7 years and more. In many children, haemangiomas disappear completely, with no trace behind. Sometimes, however, haemangiomas leave areas of discoloured or stretched skin surface. Haemangiomas can cause several problems: obstruction of vision or movement of the eyeballs, reduced airflow through the nose and mouth, bleeding, and lesions (erosions and ulcers) on the surface of the skin [44, 45].

Cavernous haemangioma frequently causes complications, particularly if it is located on the head, face or inside an organ. For example, facial haemangioma can reach very large sizes and is considered a serious cosmetic defect. Haemorrhages often complicate the disease and are particularly dangerous when such a tumour is located within the liver, spleen or brain membranes [46]. Haemangioma on the skin surface of the neck can cause compression of the large veins and arteries of the neck, larynx and trachea, which can lead to upper airway obstruction. If not treated properly and effectively, the development of Kasabach-Merritt syndrome is one of the most serious and often fatal complications of haemangioma. The disease is characterised by the destruction of platelets and increased growth of vascular tissue. It results in very frequent haemorrhages, bleedings under the skin, subcutaneous tissue or into hollow organs, congestive heart failure and the development of other diseases.

Despite technological advances in medicine, doctors of the 21st century do not know the reliable causes of haemangiomas. The development of these masses may be associated with changes in the intracellular level of oxygen when the foetus is developing and the probable influence of teratogenic factors on the child or mother [47]. Haemangiomas are more common in children born prematurely, marked by weight deficiency or multiple pregnancies in the mother. These children may have more than one haemangioma. These masses may run in families, but a genetic cause is not always seen. Doctors usually recognise skin haemangiomas in babies by their appearance and when they appear. Usually, using specific tests for diagnosis is not necessary. If doctors need to check how deep the haemangioma is under the skin and whether it is affecting internal organs, ultrasound or magnetic resonance imaging is recommended.

Summarising the main theses, it can be stated that haemangiomas are congenital anomalies of blood vessels and are one of the most common birth defects in girls.
In most cases, they appear on the surface of the skin and soft tissues, sometimes penetrating into the deep layers of the skin.

Conclusions

Thus, haemangioma is the most common benign tumour characterised by an increase in the number of normal or abnormally altered vessels filled with blood. They are sometimes difficult to distinguish from developmental abnormalities of the blood vessels. These tumours account for about 7% of all benign tumours in children of all ages. Perithelial haemangiomas and haemangiomas of the nasal or oral mucosa in children should be treated immediately after diagnosis to avoid progressive growth of this neoplasm, which leads to various cosmetic and functional disorders of the child’s body. All capillary and stellate haemangiomas and pyogenic granulomas of any localisation and size are recommended to treat with a hypothermic approach, which is 100% effective and provides good antitumor, functional and cosmetic results. Although most neonatal haemangiomas are uncomplicated, problems can still occur in some cases. It is essential to recognise the formidable dangerous morphology and/or localisation of the haemangioma, perform further diagnosis if necessary and choose a treatment strategy for severe lesions.

Thus, this research demonstrates that in most cases of detected haemangiomas, there is self-elimination of this tumour due to the reactivity of the body. The main method for diagnosis of vascular lesions is clinical. To improve the effectiveness of the treatment for vascular malformations, it is necessary to use additional diagnostic measures for correcting surgical intervention at a higher level to restore functional and aesthetic parameters. In particular, radiodiagnostic methods are used to determine the form of the lesion before surgery, to clarify its stage and depth, and to identify haemodynamic features of haemangioma when the differential diagnosis of vascular lesions is not clear. The main method of making the correct diagnosis is morphological examination. It is frequently used to determine the nature of changes or detect residual disease in samples taken during surgery, and to determine the benignity or malignancy of skin neoplasms.

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Клініко-морфологічна характеристика та діагностика зовнішніх гемангіом у дітей

Резюме. Актуальність. Актуальність теми полягає в тому, що в дітей віком до 1 року все частіше зустрічаються гемангіоми, коли необхідне підтвердження діагнозу морфологічними методами. Мета дослідження: охарактеризувати початкові та кінцеві гістологічні зміни гемангіом шкіри та представити основні клінічні прояви гемангіом у дітей. Матеріали та методи. У роботі використано декілька клінічних (для детальної діагностики захворювання), морфологічних (гістологічне дослідження матеріалу) та статистичних методів. Об'єктом дослідження були 98 дітей з гемангіомами шкіри віком від 6 місяців до 16 років. Результати. Проведене морфологічне дослідження показало, що в 49 випадках (50 %) виявлено типову просту капілярну структуру гемангіоми, у 35 випадках (35,7 %) — кавернозний тип новоутворення. Лише 18,3 % досліджуваних дітей мали комбіновані гемангіоми. Гемангіоми капілярного типу містять багато дрібних капілярів із вузьким просвітом, покритих спаяним епітелієм. Висновки. Під час фази активного росту гемангіоми спостерігається переважання масивних ендотеліальних клітин. Це свідчить про те, що основна і найбільша частина гіперплазії представлена судинним компонентом, зокрема проліферуючими капілярними епітеліальними клітинами. Ключові слова: шкіра; новоутворення; судинний компонент; вроджена патологія; кріодеструкція