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DIFFERENTIATED APPROACH TO DIAGNOSIS AND COMPREHENSIVE TREATMENT OF ODONTOGENIC PURULENT-INFLAMMATORY DISEASES OF THE MAXILLOFACIAL REGION IN CHILDREN

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Abstract

Background. Odontogenic purulent-inflammatory diseases of the maxillofacial region in childhood represent a significant problem in pediatrics and maxillofacial surgery. Despite the development of modern diagnostic and treatment methods, the frequency of this pathology has no tendency to decrease, and the course of inflammatory processes is often characterized by aggressiveness, rapid spread of infection, development of complications, and the need for emergency surgical interventions. Features of the anatomical and physiological structure of the maxillofacial region in children, specifics of immunological status, changes in the etiological structure of pathogens, and increasing antibiotic resistance necessitate a differentiated approach to the diagnosis and treatment of this pathology.

Objective. To develop and implement a differentiated approach to the diagnosis and comprehensive treatment of odontogenic purulent-inflammatory diseases of the maxillofacial region in children, considering age-related features, etiological factors, and the nature of the inflammatory process to optimize treatment outcomes, reduce hospitalization duration, and prevent complications.

Materials and Methods: Results of examination and treatment of 173 patients aged 1 to 17 years with odontogenic purulent-inflammatory diseases of the maxillofacial region who were hospitalized from 2017 to 2025 were analyzed. The diagnostic algorithm included clinical examination, laboratory tests (complete blood count, biochemical parameters, microbiological monitoring, immunological tests), ultrasound examination of soft tissues, X-ray diagnostics, and computed tomography when indicated. By nosological forms, patients were distributed as follows: periostitis of the jaw – 87 (50.3%) children, odontogenic abscess – 43 (24.9%), odontogenic phlegmon – 32 (18.5%), odontogenic osteomyelitis – 11 (6.3%).

Results. In the treatment of odontogenic purulent-inflammatory diseases of the maxillofacial region in children, a comprehensive approach was applied, including surgical treatment, antibiotic therapy, immunocorrection, detoxification, physiotherapeutic methods, and oral cavity sanitation. Microbiological examination of purulent foci contents revealed the prevalence of associations of aerobic and anaerobic microflora (57.2%) over monocultures (42.8%). The dominant pathogens were Streptococcus spp. (38.5%), Staphylococcus aureus (26.7%), anaerobic bacteria Prevotella, Peptostreptococcus (23.1%), and Enterobacteriaceae (11.7%). The choice of antibiotic therapy was made differentially depending on the child's age, nosological form, process severity, presence of comorbidities, and presumed etiological structure of pathogens. The effectiveness of initial antibiotic therapy was 78.6%; in other cases, correction based on microbiological data was required. In severe forms of phlegmon and odontogenic osteomyelitis, detoxification therapy, immunocorrection, and nutritional support were applied. A differentiated approach to selecting surgical tactics depending on the localization and extent of the process allowed optimizing treatment results, reducing the average hospitalization duration from 9.4±2.1 to 6.8±1.5 days, and decreasing the complication rate from 15.3% to 6.7%.

Conclusion. The developed differentiated approach to the diagnosis and comprehensive treatment of odontogenic purulent-inflammatory diseases of the maxillofacial region in children allows individualizing therapeutic tactics and optimizing treatment results. Key components of effective therapy are timely and adequate surgical intervention, rational etiotropic antibiotic therapy considering age-related features and the presumed spectrum of pathogens, pathogenetic therapy, and active measures for oral cavity sanitation. The application of developed diagnostic and treatment algorithms contributes to accelerating recovery, reducing hospitalization duration, and decreasing complication rates.

Keywords: *odontogenic inflammatory diseases, maxillofacial region, children, periostitis, odontogenic abscess, odontogenic phlegmon, odontogenic osteomyelitis, antibiotic therapy, surgical treatment, differentiated approach.*

Relevance. Odontogenic purulent-inflammatory diseases of the maxillofacial region constitute a major component of surgical pathologies in the maxillofacial area among children and represent a serious medical challenge due to their high prevalence and the tendency for rapid infection spread and complication development [1]. According to World Health Organization data, odontogenic inflammatory diseases of the maxillofacial region account for 30–45% of all dental conditions requiring surgical intervention in children [2]. Acute odontogenic inflammatory processes are the reason for hospitalization in specialized facilities in 65–70% of all cases involving maxillofacial region diseases [3].

A distinctive feature of odontogenic purulent-inflammatory diseases in children is the rapid spread of the infectious process, driven by the anatomical and physiological characteristics of the pediatric maxillofacial region: rich vascularization, immature connective tissue barriers, an incompletely developed immune system, and the specific structural properties of the bone tissue and jaw ligamentous apparatus [4]. These factors facilitate the swift progression of inflammation from localized forms (periostitis, abscess) to diffuse forms (phlegmon, osteomyelitis) and increase the risk of severe complications–such as mediastinitis, sepsis, and cavernous sinus thrombosis–that can pose a threat to the child's life [5].

Over the past decade, a shift has been observed in the etiological profile of pathogens causing odontogenic inflammatory diseases, characterized by an increasing role of opportunistic microorganisms and mixed aerobic-anaerobic bacterial infections, alongside a significant rise in antibiotic resistance; these factors substantially complicate the selection of effective antibacterial therapy [6]. Multicenter studies indicate that the isolation rate of multidrug-resistant pathogen strains in pediatric odontogenic inflammatory diseases reaches 35–40%, necessitating a differentiated approach to the selection of antimicrobial agents [7].

Diagnosing odontogenic purulent-inflammatory diseases in children presents certain challenges due to the specific nature of the clinical course, the difficulty of conducting an objective examination caused by the child's psycho-emotional reactions, and the atypical presentation of symptoms in younger children [8]. Modern diagnostic imaging techniques–including ultrasound, computed tomography, and magnetic resonance imaging–significantly expand diagnostic capabilities, enabling the precise localization and extent of the inflammatory process to be determined and an optimal surgical strategy to be planned [9].

The treatment of odontogenic purulent-inflammatory diseases in children requires a comprehensive approach that takes into account age-related characteristics, the etiology and pathogenesis of the disease, the extent of the inflammatory process, and the presence of comorbidities [10]. Issues regarding the optimization of surgical approaches for draining purulent foci, the selection of appropriate antibiotic therapy regimens, and methods of drainage, detoxification, and rehabilitation remain highly relevant [11].

Despite significant advances in the diagnosis and treatment of odontogenic purulent-inflammatory diseases of the maxillofacial region in children, there is no unified, differentiated approach that takes into account age-related characteristics, etiology, pathogenesis, and clinical manifestations; this necessitates the development of optimal diagnostic and treatment algorithms to improve outcomes and prevent complications.

Research objective. To develop and implement a differentiated approach to the diagnosis and comprehensive treatment of odontogenic purulent-inflammatory diseases of the maxillofacial region in children–aking into account age-related characteristics, etiological factors, and the nature of the inflammatory process–in order to optimize treatment outcomes, reduce the duration of hospitalization, and prevent complications.

Materials and methods. An analysis was conducted of the examination and treatment results for 173 patients aged 1 to 17 years with odontogenic purulent-inflammatory diseases of the maxillofacial region who received inpatient care between 2017 and 2025. The study was carried out in accordance with the ethical principles of the Declaration of Helsinki and following the receipt of informed consent from the patients' parents or legal representatives.

The age distribution of patients was as follows: 1–3 years – 24 (13.9%), 4–7 years – 62 (35.8%), 8–12 years – 58 (33.5%), and 13–17 years – 29 (16.8%). Boys predominated among the examined children, accounting for 98 (56.6%) patients. The distribution of patients by nosological form was as follows: periostitis of the jaw – 87 (50.3%) children, odontogenic abscess – 43 (24.9%), odontogenic phlegmon – 32 (18.5%), and odontogenic osteomyelitis – 11 (6.3%).

The diagnostic algorithm included:

1. Clinical examination involving assessment of the child's general condition and local manifestations of the inflammatory process, as well as determination of the localization and extent of the inflammation.

2. Laboratory tests: complete blood count with leukocyte differential, biochemical blood parameters (C-reactive protein, fibrinogen, total protein, albumin, creatinine, urea, ALT, AST), coagulogram (in severe cases), microbiological analysis of purulent focus contents with antibiotic sensitivity testing, and immunological testing (in recurrent or severe forms of the disease).

3. Instrumental methods: ultrasound of maxillofacial soft tissues, jaw radiography, orthopantomography, and computed tomography (if osteomyelitis or spread of the process into deep tissue spaces is suspected).

Depending on the localization of the inflammatory process, the patients were distributed as follows: submandibular region – 57 (32.9%), submental region – 31 (17.9%), buccal region – 29 (16.8%), parotid-masseteric region – 21 (12.1%), infraorbital and zygomatic regions – 16 (9.2%), infratemporal and pterygopalatine fossae – 12 (6.9%), and multiple localizations – 7 (4.0%).

The primary sources of odontogenic infection were: deciduous molars – 83 (48.0%), first permanent molars – 41 (23.7%), second deciduous molars – 26 (15.0%), permanent premolars – 14 (8.1%), and incisors and canines – 9 (5.2%).

Results. A comprehensive approach was employed in the treatment of odontogenic purulent-inflammatory diseases of the maxillofacial region in children, comprising four main components: surgical treatment, antibacterial therapy, pathogenetic treatment (detoxification, immunocorrection, and anti-inflammatory therapy), and oral cavity sanitation.

Microbiological analysis of the contents of purulent foci revealed a predominance of mixed aerobic and anaerobic microflora (57.2%) over monocultures (42.8%). The predominant pathogens were *Streptococcus* spp. (38.5%), *Staphylococcus aureus* (26.7%), anaerobic bacteria such as *Prevotella* and *Peptostreptococcus* (23.1%), and *Enterobacteriaceae* (11.7%). Antibiotic susceptibility testing of the isolated microorganisms demonstrated high efficacy for protected aminopenicillins (86.3%), third-generation cephalosporins (82.1%), and lincosamides (76.4%), whereas resistance to penicillins and macrolides was 42.8% and 38.2%, respectively.

Surgical treatment was administered to all patients, tailored to the location and extent of the pathological process. In cases of periostitis, a periosteotomy was performed, accompanied by the mandatory extraction of the causative tooth, or–if tooth preservation was feasible—the pulp chamber was opened and drained. For abscesses and phlegmons, the purulent focus was incised and drained with regard to topographic-anatomical landmarks; active drainage methods were employed (such as perforated drains or continuous flow-through irrigation drainage for deep phlegmons). In cases of odontogenic osteomyelitis, in addition to the incision and drainage of perimaxillary abscesses and phlegmons, sequestrectomy was performed at a later stage, following the formation of sequestra.

Based on the data obtained, we developed a differentiated approach to the selection of antibacterial therapy, taking into account the child's age, the clinical form of the disease, the severity of the condition, the presence of comorbidities, and the presumed etiological spectrum of the pathogens:

- For periostitis of the jaw in children under 7 years of age, protected aminopenicillins (amoxicillin/clavulanate) were prescribed at age-appropriate dosages; for children over 7, lincosamides (clindamycin) were used, provided there was no history of allergy.
- For odontogenic abscesses in younger children, a combination of third-generation cephalosporins (ceftriaxone) and metronidazole was used; in older children, protected aminopenicillins or lincosamides were employed.
- For odontogenic phlegmon, combination therapy was applied: third-generation cephalosporins with metronidazole, or protected aminopenicillins with lincosamides for severe cases.
- For odontogenic osteomyelitis, combination therapy was prescribed based on the antibiotics' ability to penetrate bone tissue: lincosamides combined with third-generation cephalosporins for children under 12, and fluoroquinolones with lincosamides for children over 12 in severe cases or when prior therapy had been ineffective.

Table 1. Efficacy of a differentiated approach to the treatment of odontogenic purulent-inflammatory diseases in children

Indicator	Traditional approach (n=82)	Differentiated approach (n=91)	p
Mean duration of fever (days)	3,6±0,8	2,1±0,6	<0,05
Time frame for normalization of leukocytosis (days)	4,8±1,1	3,2±0,9	<0,05
Wound cleansing timeframes (days)	5,3±1,4	3,8±1,0	<0,05
Average length of hospital stay (days)	9,4±2,1	6,8±1,5	<0,05
Complication rate (%)	15,3	6,7	<0,05
Recurrence rate (%)	8,5	3,3	<0,05

The efficacy of initial antibiotic therapy was 78.6%; in the remaining cases, adjustments based on microbiological data were required. The mean duration of antibiotic therapy was 5.2 ± 1.1 days for periostitis, 7.4 ± 1.3 days for abscess, 9.6 ± 1.8 days for phlegmon, and 16.3 ± 3.2 days for osteomyelitis.

In severe cases of phlegmon and odontogenic osteomyelitis, treatment included detoxification therapy (infusion of crystalloid solutions, enterosorbents), immunocorrection (immunoglobulins and immunomodulators in cases of identified immunological abnormalities), and nutritional support. Physiotherapeutic modalities (UHF therapy, laser therapy, magnetotherapy) were employed during the phase of subsiding acute inflammation.

An analysis of the efficacy of the developed differentiated approach to treating odontogenic purulent-inflammatory diseases in children demonstrated a statistically significant reduction in the mean duration of fever, the time required for the normalization of laboratory parameters and wound cleansing, and the mean length of hospital stay (from 9.4 ± 2.1 to 6.8 ± 1.5 days; $p < 0.05$), as well as a decrease in the complication rate (from 15.3% to 6.7%; $p < 0.05$).

Conclusion. The developed differentiated approach to the diagnosis and comprehensive treatment of odontogenic purulent-inflammatory diseases of the maxillofacial region in children enables the individualization of therapeutic strategies and the optimization of treatment outcomes. Key components of effective therapy include timely and appropriate surgical intervention, rational etiotropic antibacterial therapy tailored to age-related characteristics and the suspected spectrum of pathogens, pathogenetic therapy, and active measures for oral cavity sanitation.

Microbiological monitoring makes it possible to identify changes in the etiological profile of pathogens and their antibiotic resistance patterns, providing a basis for the rational selection of antimicrobial agents. Adopting a differentiated approach to selecting antibacterial therapy—taking into account the child's age, the specific clinical condition, the severity of the disease, and the suspected etiology–ensures high efficacy of initial treatment and reduces the need for subsequent adjustments.

Sanitation of the oral cavity and elimination of the odontogenic source of infection are of particular importance, serving as a prerequisite for successful treatment and the prevention of disease recurrence. A comprehensive approach incorporating physiotherapeutic methods during the phase of subsiding acute inflammation accelerates reparative processes and shortens rehabilitation time.

The implementation of the developed algorithm for the diagnosis and treatment of odontogenic purulent-inflammatory diseases of the maxillofacial region in children made it possible to reduce the duration of hospitalization and the incidence of complications and recurrences, demonstrating the high clinical efficacy of the proposed differentiated approach.

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