



Chronic Recurrent Hematogenous Osteomyelitis (Literature Review)

S. S. Zayniev^{1*}

¹Samarkand State Medical Institute, Uzbekistan.

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/BJMMR/2016/25477

Editor(s):

(1) Panagiotis Korovessis, Chief Orthopaedic Surgeon, Orthopaedic Department, General Hospital "Agios Andreas" Patras, Greece.

Reviewers:

(1) Hakan Sarman, Abant Izzet Baysal University, Turkey.

(2) Anonymous, University of Manitoba, Canada.

(3) Ozhan Pazarci, Reyhanlı State Hospital, Turkey.

Complete Peer review History: <http://sciencedomain.org/review-history/14830>

Review Article

Received 4th March 2016

Accepted 6th May 2016

Published 30th May 2016

ABSTRACT

The analyses of the existed literature devoted to chronic recurrent hematogenous osteomyelitis have been performed in this study. Pathogenesis and morphologic picture of the disease have been studied in detail. It has been presented modern imaginations about clinical manifestation and diagnostic of chronic recurrent hematogenous osteomyelitis. The principal basics of the complex therapy and surgical methods of treatment of chronic recurrent hematogenous osteomyelitis have been described.

Keywords: Osteomyelitis; children; treatment.

1. INTRODUCTION

Problem of treatment chronic osteomyelitis does not lose its actuality in surgery and traumatology in spite of the achievements of the modern medicine. So that according to the data of many authors in the structure of the diseases regarding purulent-surgical infection chronic osteomyelitis is 7-12% and among pathologies of locomotor apparatus it is up to 6% of cases [1,2]. However

in spite of the modern achievements in the treatment of chronic osteomyelitis recurrences in such pathology are not decreased and according to the data of different authors it is 58-78%. During recurrences of the disease patients were remained untreated during ten years and often were undergone repeated surgical interventions (73,9-80%) [3]. During disease recurrences the child is doomed for suffering of many years and chronic invalidity (50-90%) [1]. Especially

*Corresponding author: E-mail: suzayn@mail.ru, lsgp1972@mail.ru;

dramatic is the development of chronic recurrent hematogenous osteomyelitis (CRHO) in the contrast with children and adolescent contingent [2]. The last ones undoubtedly put the necessity of solving problems of going to the army, physical exertions and many situations which have been connected with able-bodied age.

2. PATHOGENESIS AND MORPHOLOGY OF CHRONIC HEMATOGENOUS OSTEOMYELITIS

Pathogenesis of chronic hematogenous osteomyelitis has been studied by some authors [4]. It is known bacterial infection could cause local inflammation in the bone tissue with microthrombic processes with local/general syndromes of disseminated intravascular coagulation. Such process subsequently led to the lyses of the tissues [5,6]. The decreased immunologic resistance of the human organism in this disease worsens treatment results and lead to unstable effects which could cause to the recurrences of the bone-purulent process [7]. For the present time pathomorphological changes in osteomyelitis, in particular acute and chronic types have not been studied well. However the requirements to the diagnostic and radical surgical treatment of CRHO dictate the necessity of the new understanding of this problem. During the recurrences of the disease morphological changes have a special character [5]. Bacteria localized in bone tissue have been intensively propagated inducing acute reaction of inflammation and provoking of cell destruction. Necrosis and bacterial inflammatory reaction quickly disseminating on gavers canals of the bone reaches periostitis which in children is closely adjacent to cortex. Significantly big in size subperiosteal abscesses have been formed quickly which disseminate in the longer distant on the bone. Inflammatory infiltrate exfoliating of the periosteum could cause the disorders of the blood supply with the development of suppuration and ischemic injuries led to the segmental necrosis of the bone and forming of sequesters [8].

3. MODERN IMAGINATIONS ABOUT CLINICAL MANIFESTATION AND DIAGNOSTIC OF THE CHRONIC HEMATOGENOUS OSTEOMYELITIS

Chronic osteomyelitis develops during unfavorable course of the acute hematogenous osteomyelitis (OHO). In spite of that in the last

years it has been observed tendency to the decrease of transition OHO in chronic stage of this index from 10 to 60%, the most authors consider that these results are not very comforting [3]. The basic causative agent of CHO is considering pathogenic staphylococcus, however, gram-negative microorganisms began to have a big importance particularly the frequency of determination proteus was increased from 4,7% to 16,4% and Pseudomonas aeruginosa from 3,8% to 11,3%. Also their different associations have been frequently identified [9,10]. In the first place forming of chronic osteomyelitis depends on the periods and treatment adequacy of OHO and also depends on the massiveness of the focus of bone injury, character of microflora preceding taking of antibacterial drugs, immunological status and many other factors [7].

Instrumental methods of diagnostic of osteomyelitis have been described in detail. One of the most frequently used informative methods is X-ray examination. Diagnostic of osteomyelitis according to the data of X-ray examination is going to have objective limits and not always allow us identify intraosteal abscesses with high precise. In CRHO massive periosteal thickenings and osteosclerosis make difficulties the precise diagnostic of the pathology [4,11]. Methods of osteopneumography and osteopneumotomography have described in detail and the evaluation of the effectiveness of these methods of diagnostic has been made [12]. In the fistula types of osteomyelitis fistulography allows us to determine form and size of cavities, direction of the sinus tract and purulent leakages [13]. For the last decade's radioisotope methods of investigations, computed tomography (CT) and magnet resonance imaging (MRI) have been successfully used to diagnose the character of pathology. Radioisotope methods allow us to visualize not only inflammation focus, but also to determine the activity of the inflammation process which is especially important during the development of indications to perform bone-plastic surgical interventions [12,14]. The importance of CT and MRI are going to have first of all for the specification proportion of the injure – determination of the cavities due to inflammation destruction, cortical defects and allow us with high precision identify intraosteal abscesses and also give us the possibility to control restoration process of the bone tissue in postoperative period [13,15].

Significant changes of the blood's protein composition which is directly proportional to the

severity of the process have been observed during transformation of the osteomyelitis process to the chronic stage. During the study of the S-reactive protein level could allow objectively judged about the development of inflammation process to one or the other side in the nearest time [9].

As it is known, the course of any somatic, surgical and infectious disease has been carried out by endogenous intoxication (EI). In that case in the literature study of EI in chronic osteomyelitis has been paid a big attention [16].

Numerous clinical observations show that osteomyelitis is carried out by significant signs of secondary immunodeficits which could vary from insignificant changes until rood shifts in all stages of the immune defence, in metabolic processes and hemodynamic. In that case the early immunodiagnostic and immunological monitoring of the treatment effectiveness is one of the integral complexes of diagnostic and treatment [7]. In purulent-septic diseases the study of the level of immune mediators – cytokines have been paid a big attention. In the available literature we have not found out data regarding investigations of the cytokine levels (IL-1 α and IL-8) in CRHO. Determination of cytokine levels pursues different purposes: assessment of severity process of the disease course, effectiveness of therapy, prevention and others [17].

4. COMPLEX TREATMENT OF CHRONIC HEMATOGENOUS OSTEOMYELITIS

The overwhelming majority of the authors concurred in their opinion that patients with CHO need in the complex treatment including normalization of metabolic disorders and functional impairments of the organs and systems of the organism, antibiotic therapy, correction of the immune system and local sanitization of the focus [18,1,8]. Antibacterial therapy takes the leading place in the treatment of patients with CHO. During selection of the antibacterial medication it is needed taking into consideration not only sensitivity of the causative agent, but also the ability of the active substance to penetrate and accumulate in the bone tissue. Until now, there is no general consensus regarding periods and durations of antibacterial therapy of CHO. One group of authors considers that injection of antibiotics from 7-10 days until 3 months before surgical operation is rational. The others suppose that antibiotic therapy before

surgical operation is irrational, because long term and in the most cases unstructured antibiotic therapy leads to the sensitization child's organism, dyspepsia, immune depression and microflora becomes insensitive to the used antibacterial medications [19-21].

For the last decades it has been appeared a series of the new methods of extracorporeal detoxication, in the first place hemofiltration and ultrahemofiltration which are gradually excluded such classical methods as hemodialyses, hemosorption and plasmapheresis [22].

Many authors have been pointed to the effectiveness of parenteral use of such medications as γ - globulin, anti-staphylococcal γ - globulin, normal immunoglobulin and anti-staphylococcal plasma in children with CHO. These medications with their wide acting spectrum increase host defenses and also lead to the disintoxication. However, due to the opinion of some authors performing immunotherapy before surgical operation is not reasonable in connection with additional allergic reaction of the organism and the absence of the effect during unsanitization of the purulent focus. The others emphasized the necessity of including immunologic medications during 7-12 days before surgical operation which due to our opinion is more substantiated [7].

There are also serious disagreements due to the periods of surgical intervention. These periods, according to the data of some authors vary from 1-2 to 6-12 months after beginning of the disease. Supporters of the early surgical operation consider that postponement of it until 3-4 months lead to the significant changes by the side of internal organs and decreasing of the immune status. Numerous supporters of the later interventions recommend waiting for the time before forming of clearly marked demarcation of sequesters which could be occurred in the periods from 3 to 6 months from the beginning of the disease [23].

Surgical treatment of CHO is one of the most important stages of the CHO treatment and directs to the removing of sequesters and necrotic areas, excision of healing tissue and fistulas [24]. For the present time one of the basic stages of surgical intervention of CHO in children is left sequesternectomy. There are debates regarding access to the focus of injure [17]. Due to the opinion of some authors, operational access should be passed through

healthy tissues, out of fistulas and scars. The intention of the wound edges is not admitted. This is the needed requirement to blind suturing which for the last years is method of choice. At the same time some authors are the supporters of performing aspiration and flowing-washing methods instead of using blind suturing [8]. Process of operation beginning from dissection of sequestral cavity, removing of sequestrs, curettage of granulation and dissection of the bone-narrow canals are good covered in the existed literature [17]. During surgical operation bone cavity has been undergone by the physical methods of processing and irrigated by antiseptic fluids. Hydrogen peroxide, furacillin, spirits, chlorhexidine, iodine, silver fluid and others have been proposed to this effect [8].

Local antibiotic therapy is performed by fractional injections of them into the bone cavity through micro irrigators within 6-8 days. However, some authors are not supported local antibiotic therapy considering that it is increased risk of reinfection by the use of micro irrigators and drainages [19].

After the main stage of surgical treatment of CHO – sequesterectomy and removing of all granulated and inflamed tissue method of filling bone cavity plays the important role for successful outcome of the all complex treatment. Different methods of the substitution of the residual cavity, such as hemostopping according to Shede, myoplastic and use of various transplants have been described. Large number of different materials, such as gypsum, gelatin, paraffin, catgut, celluloid, placenta, pieces of muscle, rubber, charcoal, organic glass and many others has been proposed. Plastic of the bone cavity by muscle on stem for the first time has been proposed by M.W. Schulten (1897). Muscle filing promotes to the cleaning of the bone wound from detritus, microorganisms and accelerates regeneration processes. S. Rakhimov has been received good and satisfactory results in 99% of children with CHO [6]. Along with it, there are opposite opinions regarding possibility of using myoplastic in children in the existed literature. The opposite argumentation is substantiated by traumatic of the operations, bigger percentage of transplant's necrotizing and development of traumatic dermatitis. This type of plastic is permitted only in children of the elderly age due to limited indications [5].

At the same time, due to the opinion of V.K. Gostishev et al., any filing is not only stimulated

bone regeneration, but also promoted to the development of microorganisms in the bone cavity. Problems of using auto- and allotransplant pointed from the above have been caused the necessity of the search the new methods of the bone transplantation [25].

For the present time the numerous amount of methods of transplants' purveyance have been described. Due to the opinion of the authors mineral component is oppressing factor for changing and replacing transplants [26]. For the present time it has been proved that transplants of the young animal and embryos have a high flexibility, ability to quicker assimilation and stimulating properties. Besides that embryonic tissue has less immune and allergic properties and less mineralization which makes easier its purveyance [27].

5. DIAGNOSTIC, FEATURES OF THE CLINICAL DURATION AND TREATMENT METHODS OF CHRONIC RECURRENT HEMATOGENOUS OSTEOMYELITIS

There has been only single literature regarding diagnostic, features of the clinical duration and treatment methods of CRHO. The authors have been analyzed the results of diagnostic and treatment of patients with CRHO [23]. Authors give a high assessment of radionuclide scintigraphy with the use of ^{99m}Tc-pirophosphate since this method allows us to determine distant focuses of inflammation [11]. At CRHO it also has been determined polyvalent microorganisms which allow making detailed antibioticogram. It has been large attention to the immune investigations. The asset statement for us is implacable refusal from antibiotic therapy before surgical operation and use of intra-arterial method of antibiotic injection in the postoperative period in order to make high concentration of antibiotic in the bone cavity for the prolonged period. The authors have been widely used immune therapy and local enzyme therapy [24]. Unfortunately reports regarding treatment of CRHO in children are single and odd.

6. CONCLUSION

Thus the analyses of the literature shows that methods of diagnostic and differentiating diagnoses of CRHO are elaborated and used as in adults and as in children contingent. However in the accessed literature there is not clear

indication regarding oversights of before operational diagnostic programs which along with errors in treatment complex could lead to the recurrence of CHO [14]. There also have been noted discrepancies in relation to treatment complex itself. It concerns to the surgical access to the pathologic focus, methods of dissection of the osteomyelitic box, sanitization methods, and completion of surgical operation by blind sutures or by drainage of the focus [28]. The method of filling bone cavity has not been clarified in detail. In connection with it, it is not still taken the answer about causes of the recurrences of CHO. In the acceptable literature we have not been determined works devoting to the problems of diagnostic and optimization of CRHO treatment [16].

In connection with analyses of the treatment results of CHO presented the above and development causes of its recurrences there have been necessity of using radical methods of surgical treatment – longitudinal osteotomy on the full length of the bone diaphyses in order to have access to all parts of the bone-narrow canal and use of progressive methods of surgical and alternative interventions on the affected focus.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Ishutov IV. Basic principles of ozonotherapy during the treatment of patients with chronic osteomyelitis. *Bulletin of Experimental and Clinical Surgery*. 2011;4(2):314-20.
2. Jones HW, Beckles VL, Akinola B, et al. Chronic haematogenous osteomyelitis in children. *J. Bone Joint Surg Br*. 2011;93(8):1005-10.
3. Shamsiev AM. Organization of emergency care for children with acute hematogenous osteomyelitis. *Bulletin of Emergency Care Medicine*. 2014;2:30.
4. Alexandrov YuM. Roentgen-morphologic features of the long bones and change its structure during removal of deformations of the knee joint in children with the consequences of hematogenous osteomyelitis. *Bulletin of Surgery Named After I.I. Grekov*. 2014;173(2):61-5.
5. Glukhov AA, Mukulich EV, Ostroushko AP. Assessment of morphological reaction of bone tissue during the treatment of experimental chronic osteomyelitis enriched by platelet autoplasm of the blood. *Journal of Health and Education in XXI century*. 2012;14(4):25-8.
6. Campbell R, Berry MG, Deva A, et al. Aggressive management of tibial osteomyelitis Shows Good Functional Outcomes. *Eplasty*. 2011;25;11:e3.
7. Baytursinov BU. The features of the immune status in patients with posttraumatic osteomyelitis. *Journal of Theoretical and Clinical Medicine*. 2014;42-6.
8. Tsibin AA. Aspiration drainage and morphological control of chronic hematogenous focus of osteomyelitis in children. *Pediatric Surgery*. 2015;19(5):41-46.
9. Rozova LV. Comparative characteristics of the type compound of microorganisms in chronic posttraumatic hematogenous osteomyelitis. *Genius of Orthopedics*. 2014;2:56-9.
10. Peyrani P, Allen M, Seligson D, et al. Clinical outcomes of osteomyelitis patients infected with methicillin-resistant *Staphylococcus aureus* USA-300 strains. *Am J Orthop (BelleMeade NJ)*. 2012;41(3):117-22.
11. Diachkova GV. Roentgen and CT semiotic of the consequences of hematogenous osteomyelitis of the bones which formed knee joint. *Genius of Orthopedics*. 2014;3:60-6.
12. Mikulich EV, Glukhov AA. Assessment of roentgen data in chronic osteomyelitis of the phone of the use platelet enriched serum in the experiment collection of the abstracts of international scientific-practical conference. *Surgical Processing of the Wounds and Purulent-necrotic Focuses in Children and Adults*. 2014;166-8.
13. Karnazanovskiy GG. Roentgen semiotic of the chronic osteomyelitis of the long bones. 2013;200.
14. Mantero E, Carbone M, Calevo MG. Diagnosis and treatment of pediatric

- chronic osteomyelitis in developing countries: Prospective study of 96 patients treated in Kenya. *Musculoskelet Surg.* 2011;95(1):13-8.
15. Al-Aubaidi Z. Preoperative magnetic resonance imaging of children with multifocal musculoskeletal infections. *Ugeskr Laeger.* 2011;173(15):1126-7. Danish.
 16. Shamsiev AM, Zayniev SS. The improvement of diagnostic and surgical treatment of chronic recurrent hematogenous osteomyelitis in children. *Medical Journal of Uzbekistan.* 2015;5:14-7.
 17. Ismailov AZ, Jakanov MK, Kononenko AA. The complex treatment of patients with chronic hematogenous osteomyelitis of the long tubular bones. Collection of the abstracts of International scientific-practical conference. *Surgical Processing of the Wounds and Purulent-necrotic Focuses in Children and Adults.* 2014;100-1.
 18. Glukhov AA. Experimental substantiation of the use of jet sanitation and platelet concentrate in the treatment of chronic osteomyelitis of the long tubular bones. *Bulletin of Experimental and Clinical Surgery.* 2012;5(1):131-6.
 19. Gafurova NS. Sensitivity of bacteria to some β -lactamase antibiotics isolated from children with osteomyelitis and soft tissue infections. *Infection, Immunity and Pharmacology.* 2015;3(38):14-6.
 20. Trunova OV. Laser therapy in the medical rehabilitation of children with chronic osteomyelitis. *Problems of Balneology, Physiotherapy, and Treatment Physical Training.* 2015;92:50-3.
 21. Rao N, Ziran BH, Lipsky BA. Treating osteomyelitis: Antibiotics and surgery. *Plast Reconstr Surg.* 2011;127(1):177S-187S.
 22. Kulikov AN, Soloviev AV. The treatment algorithm of posttraumatic osteomyelitis. Collection of the abstracts of International scientific-practical conference. *Surgical Processing of the Wounds and Purulent-necrotic Focuses in Children and Adults.* 2014;140-1.
 23. Borisov IV, Amiraslanov YuA. Improvement of surgical processing during the treatment of patients with osteomedullar osteomyelitis. Collection of the abstracts of International scientific-practical conference. *Surgical Processing of the Wounds and Purulent-necrotic Focuses in Children and Adults.* 2014;55-7.
 24. Bogomolov MS. Management features of the purulent wounds complicated by osteomyelitis in patients with chronic ischemia of lower extremities. Collection of the abstracts of International scientific-practical conference. *Surgical Processing of the Wounds and Purulent-necrotic Focuses in Children and Adults.* 2014;40-2.
 25. Panov VV, Oganov AI, Levchenko SF, Emelianov VI. The use of collapaine implants of purulent surgery in osteomyelitis enriched by platelet autoplasm of the blood. *XII Congress of Surgeons of Russian Federation.* 2015;64-65.
 26. Amiraslanov YuA. Treatment of patients with chronic medullar osteomyelitis of the femoral bone with the presence of foreign bodies in the bone marrow canal. *Surgery. Journal Named after N. I. Pirogov.* 2014;6:31-5.
 27. Vinnik YuS, Markelova NM, et al. The use of the new generation biopolymers for the treatment of chronic osteomyelitis in the experiment. *XII Congress of surgeons of Russian Federation.* 2015;57-9.
 28. Mashkov AE, Zakharova NM, Tsibin AA. Surgical treatment of chronic osteomyelitis. *Pediatric Surgery.* 2010;2:43-7.

© 2016 Zayniev; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<http://sciedomain.org/review-history/14830>