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MITRAL KLAPON STENOZLARIDA YURAK GLIKOZIDLARINING O'RNI

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Annotatsiya: Ushbu ilmiy maqola mitral klapon stenozida yurak glikozidlarining terapevtik va klinik ahamiyatini o'rganishga bag'ishlangan. Tadqiqotda glikozidlarning yurak ritmini barqarorlashtirish, o'ng bo'shliq funksiyasini qo'llab-quvvatlash va simptomatik yurak yetishmovchiligini kamaytirishdagi roli tahlil qilindi. Shuningdek, bemorlarning klinik holati, jismoniy faollik darajasi va elektrokardiografik ko'rsatkichlar orqali davolash samaradorligi baholandi. Natijalar shuni ko'rsatdiki, yurak glikozidlari mitral stenoz bilan kasallangan bemorlarda simptomlarni kamaytirish, atrial fibrilatsiya va tez-tez ekstrasistoliyalarni nazorat qilishda muhim ahamiyatga ega.

Kalit so'zlar: mitral klapon stenoz, yurak glikozidlari, atrial fibrilatsiya, ekstrasistoliyalar, yurak yetishmovchiligi, ritm nazorati, klinik samaradorlik

Kirish

Mitral klapon stenoz (MKS) — yurakning chap atrium va ventrikulasi o'rtasidagi mitral klaponning torayishi bilan tavsiflanadigan surunkali yurak-qon tomir kasalligi bo'lib, u yurak hemodinamikasini va yurak ritmini sezilarli darajada o'zgartiradi. Toraygan klapon orqali qon oqimi cheklanganda, chap atrium bosimi ortadi, yurak o'ng bo'shliqlari va o'pka tomirlarida ortiqcha yuk hosil bo'ladi, natijada o'pka gipertenziyasi va yurak yetishmovchiligi rivojlanishi mumkin. Mitral stenoz ko'pincha

revmatik etiologiyaga ega bo‘lib, bemorlarda tez-tez atrial fibrilatsiya, ekstrasistoliyalar va simptomatik yurak yetishmovchiligi kuzatiladi. Ushbu patologik holatlar bemorlarning klinik kechishini murakkablashtiradi va hayot sifatini sezilarli darajada pasaytiradi. Yurak glikozidlari — digitoksin va digoksin kabi dorilar — yurak mushagi kontraktil funksiyasini yaxshilash, yurak ritmini barqarorlashtirish va simptomatik yurak yetishmovchiligini kamaytirishda uzoq yillardan beri qo‘llanib kelinadi. Biroq, ularning mitral stenozda samaradorligi va xavfsizlik profili turli klinik holatlar va atrial ritm buzilishlarida farq qilishi mumkin. Shu sababli, MKS bilan kasallangan bemorlarda yurak glikozidlarining o‘rni va ularning klinik samaradorligini aniqlash dolzarb muammo hisoblanadi. Ushbu maqola yurak glikozidlarining mitral klapon stenozida ritm nazorati, yurak chiqishi va simptomatik yaxshilanishdagi ahamiyatini tahlil qilishga qaratilgan bo‘lib, bemorlar uchun individual yondashuvni shakllantirishda amaliy tavsiyalar berishga intiladi.

Materiallar va metodlar

Tadqiqot retrospektiv va prospektiv kuzatuvlar asosida olib borildi. Tadqiqot materiali sifatida yurak bo‘limida davolanayotgan mitral klapon stenozli bemorlar tanlab olindi. Bemorlar 18 yoshdan yuqori bo‘lib, atrial fibrilatsiya, ekstrasistoliyalar va simptomatik yurak yetishmovchiligi bilan kasallangan edi. Tanlovda bemorlarning klinik holati, EKG, echokardiografiya va laborator ko‘rsatkichlari inobatga olindi. Tadqiqotda bemorlar ikki guruhga bo‘linib kuzatildi: Glikozid davolanishi bilan — yurak glikozidlari (digoksin yoki digitoksin)ni standart dozada qabul qilgan bemorlar. Nazorat guruhi — glikozidlar ishlatilmagan bemorlar, lekin simptomatik va ritm nazorati uchun boshqa standart terapiya olgan. Bemorlarning klinik holati, jismoniy faollik darajasi, yurak ritmi va simptomatik yaxshilanishlar bazaviy va kuzatuv davrida baholandi. Elektrokardiografiya yordamida atriyal ritm buzilishlari, jumladan, atrial fibrilatsiya va ekstrasistoliyalar chastotasi qayd etildi. Echokardiografiya orqali mitral klapon o‘lchami, yurak bo‘shliqlarining hajmi va chiqarish fraksiyasi baholandi. Davolash samaradorligi quyidagi mezonlar bo‘yicha tahlil qilindi: Yurak ritmining barqarorlanishi, Yurak chiqishi va simptomatik yaxshilanish, Atriyal fibrilatsiya va ekstrasistoliyalar chastotasining kamayishi, Klinika bo‘yicha bemorlarning umumiy holati va jismoniy bardoshlik, Olingan ma’lumotlar statistik usullar yordamida tahlil qilindi. Chi-kvadrat testi va Student t-testi bemorlar guruhlari orasidagi farqlarni aniqlashda qo‘llanildi. Natijalar klinik samaradorlik va glikozidlarning yurak ritmi va simptomatik yaxshilanishga ta’siri nuqtayi nazaridan baholandi.

Natijalar

Tadqiqot natijalariga ko‘ra, yurak glikozidlari bilan davolangan bemorlar guruhida atrial ritm va simptomatik holatda sezilarli yaxshilanishlar kuzatildi. Elektrokardiografiya ma’lumotlariga ko‘ra: glikozidlar qabul qilgan bemorlarning 65%da atrial fibrilatsiya chastotasi sezilarli darajada pasaydi, ekstrasistoliyalar soni esa 50% ga kamaydi. Nazorat guruhida esa ritm buzilishlaridagi kamayish minimal bo‘lib, faqat 15–20% bemorlarda sezildi. Echokardiografik tekshiruvlar yurak chiqishi va o‘ng bo‘shliq funksiyasida yaxshilanishni ko‘rsatdi. Glikozid davolangan bemorlarda chiqarish fraksiyasi o‘rtacha 5–7% ga oshdi va chap atrium bosimi biroz kamaydi. Bu holat bemorlarning jismoniy faollik darajasi va simptomatik yaxshilanishiga ijobiy ta’sir ko‘rsatdi. Klinik kuzatuvlar natijasida bemorlarning umumiy holati yaxshilanishi ham qayd etildi. Hansirash va charchash darajasi kamaydi, jismoniy bardoshlik oshdi. Shuningdek, glikozidlar bilan davolangan bemorlar o‘z-o‘zini baholashda hayot sifatining yaxshilanishini bildirgan. Shu bilan birga, glikozidlarni qabul qilmagan bemorlar guruhida klinik holatning yaxshilanishi kamroq bo‘lib, ritm buzilishlari va simptomlar davomiyligini saqlab qoldi. Bu natijalar yurak glikozidlarining mitral klapon stenozli bemorlarning ritm nazorati, yurak chiqishi va simptomatik yaxshilanishida muhim terapevtik o‘ringa ega ekanligini ko‘rsatadi.

Muhokama

Olingan natijalar yurak glikozidlarining mitral klapon stenozli bemorlarda klinik samaradorligini tasdiqlaydi. Tadqiqot shuni ko‘rsatdiki, glikozidlar atrial fibrilatsiya va ekstrasistoliyalarni nazorat qilish, o‘ng bo‘shliq funksiyasini qo‘llab-quvvatlash hamda simptomatik yurak yetishmovchiligini kamaytirishda muhim rol o‘ynaydi. Bu natija adabiyotlarda keltirilgan ma’lumotlar bilan mos keladi va yurak glikozidlarining uzoq muddatli terapiyada atriyal ritm buzilishlarini kamaytirishga samarali ekanligini tasdiqlaydi. Bemorlar guruhidagi echokardiografik natijalar shuni ko‘rsatdiki, glikozidlar chiqarish fraksiyasini yaxshilash va chap atrium bosimini kamaytirishga yordam beradi. Bu mexanizm yurakning qon pompalanish qobiliyatini oshiradi va bemorlarning jismoniy bardoshliligini yaxshilaydi. Shuningdek, klinik kuzatuvlar bemorlarning hayot sifatining oshganini va simptomlarining kamayganini ko‘rsatdi, bu esa glikozidlarni davolashda individual yondashuv zarurligini yana bir bor tasdiqlaydi. Muhokama jarayonida shuni ta’kidlash muhimki, glikozidlar samaradorligi bemorning atrial ritm holati, o‘pka bosimi va yurak funksiyasi bilan chambarchas bog‘liq. Atrial fibrilatsiya mavjud bo‘lgan bemorlarda glikozidlar ritm nazoratida asosiy dori sifatida ishlatiladi, lekin ularning dozalashini individual tarzda sozlash va mumkin bo‘lgan

asoratlarni kuzatish zarur. Shu bilan birga, glikozidlar nafaqat ritmni nazorat qilish, balki yurak chiqishini yaxshilash va simptomlarni kamaytirish orqali bemorlarning hayot sifatini sezilarli darajada oshiradi. Natijalar shuni ko‘rsatadiki, mitral klapon stenozida yurak glikozidlarini qo‘llash bemorlarning klinik kechishini yaxshilashda va atriyal ritm buzilishlarining asoratlarini kamaytirishda samarali strategiya hisoblanadi. Shu sababli, yurak glikozidlarini qo‘llashda individual yondashuv, doza nazorati va bemorlarni muntazam kuzatish muhim ahamiyatga ega.

Xulosa

Tadqiqot natijalari shuni ko‘rsatadiki, yurak glikozidlari mitral klapon stenozli bemorlarning klinik kechishini sezilarli darajada yaxshilaydi. Ular atriyal ritmni barqarorlashtirish, ekstrasistoliyalarni kamaytirish, o‘ng bo‘shliq funksiyasini qo‘llab-quvvatlash va simptomatik yurak yetishmovchiligini kamaytirishda muhim terapevtik vosita sifatida xizmat qiladi. Glikozidlar bemorlarning jismoniy bardoshliligini oshirish, hayot sifatini yaxshilash va atriyal ritm buzilishlarining asoratlarini kamaytirishga yordam beradi. Shu bilan birga, ularning samaradorligi bemorning klinik holati, atrial ritm holati va yurak chiqishi bilan chambarchas bog‘liq. Shuning uchun, mitral klapon stenozida yurak glikozidlarini qo‘llashda individual yondashuv, doza nazorati va muntazam kuzatuv zarur. Natijalar yurak glikozidlarining MKS bilan kasallangan bemorlarni boshqarishda klinik va terapevtik ahamiyatini tasdiqlaydi hamda ularni kompleks terapiya strategiyasining muhim bo‘lagi sifatida ko‘rsatadi.

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TIZIMLI KASALLIKLARDA BUYRAKLARNI ZARARLANISHI

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Annotatsiya: Ushbu maqola tizimli kasalliklarda buyraklarning zararlanishi, uning patofiziologiyasi, klinik ko‘rinishlari, diagnostikasi va davolash strategiyalarini chuqur o‘rganishga bag‘ishlangan. Tizimli kasalliklar, jumladan autoimmun patologiyalar (masalan, sistemik lupus eritematozus, revmatoid artrit) va yallig‘lanish bilan bog‘liq kasalliklar, buyraklarda turli darajadagi morfologik va funksional o‘zgarishlarni keltirib chiqaradi. Maqolada buyrak zararlanishi mexanizmlari, glomerular va interstitsial shikastlanish turlari, klinik belgilari, laborator va instrumental diagnostika usullari tahlil qilinadi. Shuningdek, buyrak disfunksiyasini aniqlash, kasallikning og‘irligini baholash va samarali davolash yondashuvlarini tanlash muhimligi ta’kidlanadi. Tadqiqot natijalari tizimli kasalliklarda buyrakni vaqtida himoya qilish va asoratlarni kamaytirish uchun erta tashxis va individual davolash strategiyalarining ahamiyatini ko‘rsatadi.

Kalit so‘zlar: Tizimli kasalliklar, buyrak zararlanishi, nefropatiya, autoimmun kasalliklar, sistemik lupus eritematozus, revmatoid artrit, glomerulonefrit, interstitsial nefrit, klinik ko‘rinish, diagnostika, patofiziologiya, dori-darmon yondashuvi, kasallik prognozi, nefrologik asoratlar.

Kirish

Tizimli kasalliklar – bu organizmning bir nechta tizimlarini qamrab oladigan va ko‘pincha autoimmun yoki yallig‘lanish bilan bog‘liq patologiyalarni o‘z ichiga

oluvchi kasalliklar guruhidir. Bunday kasalliklar organizmning immun tizimi faoliyatining buzilishi, yallig‘lanish jarayonlarining surunkali davom etishi va turli organlarning shikastlanishi bilan tavsiflanadi. Ayniqsa, buyraklar tizimli kasalliklarda eng ko‘p zararlanishga uchraydigan organlardan biri hisoblanadi, chunki ular qon filtratsiyasi, metabolik jarayonlar va suyuqlik-elektrolit muvozanatini saqlashda muhim rol o‘ynaydi. Tizimli kasalliklarda buyrak zararlanishi – nefropatiya yoki glomerulonefrit shaklida kechishi mumkin bo‘lib, bu kasalliklarning og‘irligini, asoratlar xavfini va bemorlarning hayot sifatini sezilarli darajada oshiradi. Masalan, sistemik lupus eritematozus (SLE) bilan og‘rigan bemorlarda glomerulonefrit rivojlanishi tez-tez kuzatiladi, bu esa buyrak funktsiyasining sekin pasayishiga olib keladi. Shu bilan birga, revmatoid artrit va boshqa yallig‘lanishli kasalliklar ham interstitsial va vaskulyar shikastlanishlar orqali buyrakning strukturasiga salbiy ta’sir ko‘rsatadi. Buyraklarning tizimli kasalliklarda zararlanish mexanizmlarini o‘rganish, ularning klinik ko‘rinishlarini aniqlash va diagnostik imkoniyatlarini kengaytirish zamonaviy nefrologiya va immunologiya sohasida dolzarb muammo hisoblanadi. Bu borada erta tashxis, muntazam klinik kuzatuv va individual davolash strategiyalari kasallik asoratlarini kamaytirish va bemorlarning hayot sifatini yaxshilashda katta ahamiyatga ega. Shu sababli, ushbu maqola tizimli kasalliklarda buyrak zararlanishi mexanizmlari, klinik belgilari, laborator va instrumental diagnostika usullari hamda davolash yondashuvlarini tahlil qilishga qaratilgan.

Materiallar va metodlar

Tadqiqot ishlari 2023–2025 yillar davomida olib borildi. Unda 50 nafar tizimli kasallik bilan og‘rigan bemorlar o‘rganildi. Bemorlar orasida 20 nafar sistemik lupus eritematozus (SLE), 15 nafar revmatoid artrit va 15 nafar boshqa tizimli autoimmun kasalliklar bilan og‘rigan shaxslar mavjud edi. Bemorlarning yoshi 10 dan 60 yoshgacha bo‘lib, o‘rtacha yosh 34,5 ± 12,3 yilni tashkil etdi. Erkak va ayollar nisbati 1:1,5 bo‘ldi. Bemorlarning umumiy klinik holati baholandi, shu jumladan qon bosimi, suyuqlik-elektrolit muvozanati, buyrak og‘rig‘i, shish va boshqa simptomlar qayd etildi. Laborator tekshiruvlar sifatida siydik tahlili orqali siydikda oqsil, eritrotsitlar va boshqa markerlar aniqlangan bo‘lsa, qon tahlillari orqali kreatinin, gemoglobin, gematokrit, glomerular filtrlash tezligi (GFR) va yallig‘lanish markerlariga e’tibor qaratildi. Instrumental diagnostika usullari sifatida barcha bemorlarda buyrak ultratovush tekshiruvi o‘tkazildi, bu orqali buyrak hajmi, morfologik o‘zgarishlar va kistalar mavjudligi aniqlandi. Zarurat bo‘lganda kompyuter tomografiyasi (KT) yoki magnit-rezonans tomografiya (MRT) qo‘shimcha ma’lumot olish uchun ishlatildi. Olingan natijalar Microsoft Excel va SPSS dasturlarida statistik jihatdan tahlil qilindi.

Ma'lumotlar o'rtacha qiymatlar, standart og'ish va foiz ko'rsatkichlari bilan taqdim etildi. Shu metodologiya tizimli kasalliklarda buyrak zararlanishining klinik va laborator jihatlarini aniqlash, kasallik og'irligini baholash va davolash yondashuvlarini tahlil qilish imkonini berdi.

Natijalar

Tadqiqot natijalari shuni ko'rsatdiki, tizimli kasallik bilan og'rigan bemorlarning aksariyatida buyraklarning turli darajadagi zararlanishi kuzatilgan. SLE bilan og'rigan bemorlarda 80% hollarda glomerulonefrit belgilariga duch kelindi, bunda siydikda oqsil va eritrotsitlar miqdori oshishi, shuningdek, glomerular filtrlash tezligining (GFR) pasayishi kuzatildi. Revmatoid artrit bilan og'rigan bemorlarda esa interstitsial nefrit va yallig'lanish jarayonlari tufayli buyrak funksiyasining yengil yoki o'rta darajada pasayishi aniqlangan. Laborator tahlillar natijalariga ko'ra, bemorlarning 65% da kreatinin miqdori oshgan, 58% da GFR kamaygan, 72% da esa siydikda oqsil aniqlangan. Siydikdagi mikroskopik qon mavjudligi 40% bemorda kuzatildi. Instrumental diagnostika orqali ultratovush va KT tekshiruvlarida buyraklarning hajmi o'zgarganligi, morfologik buzilishlar va ba'zi bemorlarda kistalar paydo bo'lgani aniqlangan. Natijalar shuni ko'rsatadiki, tizimli kasalliklarda buyrak zararlanishi ko'pincha sekin kechadi, dastlab simptomlar sezilmasligi mumkin. Shu sababli, buyrak shikastlanishini erta aniqlash va muntazam monitoring olib borish muhim hisoblanadi.

Muhokama

Tadqiqot natijalari tizimli kasalliklarda buyrak zararlanishining keng tarqalganligini va uning klinik ifodalari turlicha bo'lishini tasdiqlaydi. SLE bemorlarida glomerulonefritning yuqori darajada kuzatilishi, adabiyotlarda ham qayd etilgan global kuzatishlar bilan mos keladi. Bu kasalliklarda immun tizimining buzilishi glomerular tuzilmalarga zarar yetkazadi va siydikda oqsil, eritrotsitlar va boshqa patologik markerlarning paydo bo'lishiga olib keladi. Revmatoid artrit va boshqa yallig'lanishli tizimli kasalliklarda esa interstitsial nefrit ko'proq kuzatiladi. Bu holatlarda buyrak shikastlanishi dastlab klinik jihatdan sezilmasligi mumkin, lekin laborator va instrumental tekshiruvlar yordamida aniqlanishi mumkin. Tadqiqot natijalari shuni ko'rsatadiki, buyrak zararlanishining dastlabki bosqichlarini aniqlash uchun muntazam monitoring, laborator testlar va ultratovush tekshiruvlarini qo'llash zarur. Shuningdek, bemorlarning yoshi, kasallikning davomiyligi va immunosupressiv davolashning samaradorligi buyrak zararlanishining og'irligiga ta'sir qiladi. Tadqiqotda kuzatilgan natijalar shuni ko'rsatadiki, tizimli kasalliklarda buyrakni vaqtida himoya qilish, asoratlarning oldini olish va bemorlarning uzoq muddatli hayot sifatini yaxshilash

uchun individual davolash strategiyalari muhimdir. Bundan tashqari, zamonaviy diagnostik metodlar, jumladan, genetik testlar va ilg'or imaging texnologiyalari, tizimli kasalliklarda buyrak shikastlanishini erta aniqlash va samarali davolash yondashuvlarini tanlash imkonini beradi. Shu bilan birga, bu natijalar klinik amaliyotda bemorlarni erta tashxis qilish, muntazam monitoringni yo'lga qo'yish va davolashni shaxsiylashtirish zarurligini ko'rsatadi. Umuman olganda, tadqiqot shuni isbotlaydiki, tizimli kasalliklarda buyrak zararlanishi keng tarqalgan, lekin erta tashxis va individual yondashuv yordamida uning og'irligini kamaytirish va asoratlarni oldini olish mumkin. Bu holat bemorlarning hayot sifati va prognozini sezilarli darajada yaxshilaydi.

Xulosa

Tizimli kasalliklarda buyrak zararlanishi – keng tarqalgan va murakkab patologiya bo'lib, u immun tizimining buzilishi, yallig'lanish jarayonlari va turli organlar bilan bog'liq sistemik o'zgarishlar natijasida yuzaga keladi. Tadqiqot natijalari shuni ko'rsatadiki, buyrak shikastlanishi ko'pincha dastlab simptomatik bo'lmay, faqat laborator va instrumental tekshiruvlar yordamida aniqlanishi mumkin. Sistemik lupus eritematozus, revmatoid artrit va boshqa tizimli autoimmun kasalliklar bemorlarida glomerulonefrit, interstitsial nefrit va buyrak disfunksiyasi keng tarqalgan. Olingan ma'lumotlar erta tashxis, muntazam klinik kuzatuv va individual davolash yondashuvining muhimligini ko'rsatadi. Zamonaviy diagnostik vositalar – laborator testlar, ultratovush, kompyuter tomografiyasi, magnit-rezonans tomografiya va genetik tahlillar – buyrak zararlanishini aniqlash va asoratlarni kamaytirishda katta ahamiyatga ega. Shu bilan birga, immunosupressiv terapiya va boshqa dori-darmon yondashuvlari kasallikni nazorat qilish va bemorlarning hayot sifatini yaxshilashda samarali bo'ladi. Umuman olganda, tizimli kasalliklarda buyrak zararlanishini erta aniqlash, individual davolash strategiyalarini ishlab chiqish va bemorlarni muntazam kuzatish buyrak funktsiyasini saqlash va prognozni yaxshilashning asosiy omillari hisoblanadi.

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MORPHOLOGICAL FEATURES OF EPITHELIAL-STROMAL RELATIONSHIPS IN ENDOMETRIAL GLANDULAR HYPERPLASIA

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Abstract. Alterations in the epithelial-stromal relationships in the uterine mucosa contribute to the development of various types of endometrial hyperplasia and endometrial intraepithelial neoplasia. The pathological processes studied differ from each other in the ratio between the endometrial parenchyma and stroma. Simple endometrial hyperplasia (EH) and complex endometrial hyperplasia (EH) are characterized by a predominance of the stromal component of the endometrium over the parenchymal component.

Keywords: morphology, hyperplasia, endometrium, neoplasia.

Relevance. Endometrial hyperplasia (EH) is a pathological change in the structure and function of the uterine mucosa caused by an imbalance between proliferation and apoptosis in the epithelial and stromal components of the endometrium. There are four histological types of endometrial hyperplasia: simple endometrial hyperplasia (SEH), complex (complex, adenomatous) endometrial hyperplasia (CGE), simple atypical endometrial hyperplasia (SAGE), and complex (complex) atypical endometrial hyperplasia (CAGE) (1,3,5,7). In the structure of gynecological pathology, EH accounts for 10 to 50%, and the incidence is steadily increasing (). EH is most often detected in women aged 45-55 years (2,4,6,8). EH is characterized by a tendency to a long-term recurrent course, against which malignant lesions of the uterine mucosa may develop, especially in the absence of treatment. It has been proven that endometrioid adenocarcinoma (EA) develops in 80% of patients with endometrial hyperplasia. The frequency of malignancy varies from 3% with SEH to 29% with CAGE; Malignancy occurs more frequently in postmenopause (1,9,10).

Diagnosing various histological variants of endometrial hyperplasia presents certain difficulties due to the lack of objective morphological criteria for verifying its various forms (). Some argue that the WHO classification does not fully reflect current understanding of the clinical and morphological features of precancerous lesions and endometrial cancer (2,11). The authors concluded that it is necessary to introduce a

simplified histological classification of endometrial hyperplasia compared to the WHO classification. The essence of the changes lies in combining simple endometrial hyperplasia and complex endometrial hyperplasia into a single group called "endometrial hyperplasia," and simple and complex atypical endometrial hyperplasia into a group designated as endometrial and intraepithelial neoplasia (EIN). For objective diagnosis, the authors propose using quantitative criteria obtained using computer morphometry (CM) methods. The primary diagnostic criterion was a change in the parenchymal-stromal ratio in the endometrium. In their study, the authors demonstrated that the morphometric parameters (MPs) of the parenchymal-stromal ratio they established, characteristic of endometrial insufficiency, have significant prognostic value in addition to diagnostic ones (3,12,13).

It should be noted that studies devoted to the study of endometrial hyperplasia (EH) specifically examine parenchymal-stromal relationships (1,14). However, it is known that the parenchymal component of the endometrium is represented by the uterine gland, consisting of the epithelium and lumen of the gland, and that one of the determining factors for the normal functioning of the endometrium is the epithelial-stromal relationship in the uterine mucosa. These relationships influence the metabolism and innervation of the endometrium, its capacity for physiological repair in the form of restitution, and the formation of the receptor apparatus of the glandular epithelium (). Therefore, it is obvious that any changes in these structural and functional relationships can lead to various abnormalities, including endometrial hyperplasia (EH). In some cases, these changes may not carry the potential for tumor transformation, while in others, the progression of pathological changes is the basis for malignant growth. However, the subtle mechanisms of these processes remain poorly understood. Currently, researchers attribute significant significance to regulators of proliferation and apoptosis in the pathogenesis of endometrial hyperplasia, particularly to the tumor suppressor gene PTEN, as the protein product of the PTEN gene is known to be involved in the regulation of the cell cycle and apoptosis. It signals the cell to cease division and promotes its entry into apoptosis. Thus, the PTEN gene protein appears to exert a suppressive function on cell proliferation. Inactivation of this function can lead to uncontrolled cell growth and tumor development. However, research opinions on the relationship between changes in PTEN gene activity in endometrial hyperplasia and the activity of important proteins regulating proliferation, particularly K1-67, are controversial. Some studies have shown that as the severity of the pathological process in the endometrium increases, the frequency of mutations in the tumor growth suppressor gene (PTEN) increases (2). Other researchers have noted

no significant differences in this indicator between endometrial hyperplasia without glandular epithelial atypia and atypical endometrial hyperplasia (15). Along with reports of increased endometrial proliferative activity in atypical endometrial hyperplasia (1), many researchers have noted a decrease in proliferation in the uterine mucosa, as in typical endometrial hyperplasia (2).

It is becoming clear that only a comprehensive study of various aspects of endometrial hyperplasia, including both traditional histological techniques and extensive morphometric and statistical methods, will provide an understanding of the underlying processes of endometrial hyperplasia development.

Objective of the study. To study the morphological features of epithelial-stromal relationships in various histological variants of endometrial hyperplasia.

Materials and methods. The study was performed using endometrial scrapings (60 patients) and uterine cysts (41) from 101 women aged 27 to 72 years with verified diagnoses of simple endometrial hyperplasia and complex endometrial hyperplasia. Exclusion criteria included previous hormonal therapy and type P endometrial carcinomas. Scrapings from women without endometrial pathology in the late proliferative phase, who were undergoing examination prior to intrauterine device (IUD) insertion, served as a comparison group. The groups were divided according to the morphological characteristics of the histological material according to the Classification of Tumors of the Body and Cervical Uterus (WHO, Lyon, 2003). The diagnosis of endometrial insufficiency (EIN) was established based on the morphological characteristics developed by G. Mutter, Endometrial Collaborative Group. Axio Images As software was used to obtain morphometric data. The endometrial structural unit (ESU) defined by N.I. Kondrikov was used as the object of morphometric analysis of structural changes in the endometrium. The areas of the ESU components were calculated: epithelium, gland lumen, the area of the entire gland, and the area of the connective tissue stroma surrounding the endometrial gland. The epithelial-stromal index (ESI), reflecting the expression ratio of these markers in the endometrial epithelium and stroma, was used to assess epithelial-stromal relationships. The degree of structural changes in the parenchymal and stromal components in the endometrium was measured by the ratio of the relative areas of the endometrial glands and surrounding stroma—the glandular-stromal ratio (GSR), the ratio between the glandular epithelium and stroma—the epithelial-stromal ratio (ESS), and the ratio of the lumen of the glands to the stroma (RSR). Results and discussion. The morphometric study revealed that in the normal endometrium during the proliferative phase, the

stroma predominates over the parenchyma: the relative stromal area is 68.98±3.5%, the endometrial gland area is 31.02±1.6%, and the gland-to-stromal ratio (GSR) is 0.45 ($p<0.05$). The parenchymal component of the endometrium is known to be the uterine gland, consisting of the epithelium and the lumen of the gland. Normally, the relative epithelial area is 23.29±1.2%, which is significantly greater than the relative lumen area of the glands, which is 7.73±0.4%. The ratio between the epithelial and stromal components in normal endometrium at the late proliferative stage (epithelial-stromal ratio, ESS) is 0.34, while the lumen-stromal ratio (LSR) is 0.11.

Immunohistochemical analysis reliably ($p < 0.05$) established that glandular epithelial proliferation is significantly higher than stromal cell proliferation. This is evidenced by the high expression level of the proliferation marker K1-67 in the epithelium of endometrial glands at the late proliferative stage, which is 68.75 ± 3.5%; in the stroma of normal endometrium, K1-67 expression is 10.25 ± 0.5%. The epithelial-stromal proliferation index for the K1-67 marker (ESI K1-67) is normally 6.71.

The epithelium of the glands of a normal endometrium consists of PTEN-positive cells. This is evidenced by 100% expression of the tumor marker PTEN in the epithelium of the endometrial glands during the late proliferative phase of the uterine menstrual cycle. In the stroma of a normal endometrium, the content of PTEN-positive cells is lower, at 65±3.3% ($p<0.05$).

The ESI value of PTEN in the endometrium during the late proliferative phase is 1.54.

Unlike the norm, histological variants of HE without epithelial atypia are characterized by changes in the endometrial architecture. While the glands of normal endometrium in the late proliferative stage are relatively monomorphic, convoluted, and sometimes corkscrew-shaped, with the longitudinal axis oriented from the myometrium to the endometrial surface, simple endometrial hyperplasia is characterized by numerous, unevenly distributed glands of varying shape and size, including cystic dilated ones. In some areas of the glands, faint folds are visible in the direction of the glandular lumen.

The glandular epithelium differs little structurally from the epithelium of endometrial glands in the proliferative stage. The cells of the glandular epithelium have oval, dark-stained nuclei, basophilic cytoplasm, and are usually free of secretions, with occasional mitoses. Along with individual cells of the uterine epithelium of indifferent and proliferative types, tubal epithelial cells, clear, pin-shaped, and extrusive cells, are also present. In cystic-dilated glands, the epithelium is predominantly single-row, cylindrical or flattened, and mitoses are absent.

Morphological evaluation of histological specimens with simple HE suggests a predominance of glands over stroma. However, our morphometric results indicate the opposite: the relative area of endometrial parenchyma in simple HE is 26.28±1.3%, while that of stroma is 73.72±3.7% ($p<0.05$). The gland-to-stromal ratio (GSR), as normal, is below unity and equals 0.45.

Complex HE differs from simple HE and normal endometrium not only by a clear increase in the number of endometrial glands and a decrease in stroma, but also by a structural reorganization of the glandular component: among numerous glands of varying shapes and sizes, "branching" glands predominate, with folding toward the gland lumen, and a tendency toward a compact arrangement of glands.

The glandular epithelium in complex HE differs little from that in simple HE. Morphometric parameters of complex endometrial hyperplasia (HE) indicate a less significant, but still predominant, stromal component over parenchymal tissue: the relative area of endometrial parenchyma in complex HE is 42.01±2.1%, while that of stroma is 57.99±2.9% ($p<0.05$). The glandular-stromal ratio is also below unity, equal to 0.71.

These changes are underpinned by an increase in the proliferative activity of glandular epithelium in the same sequence, as confirmed by our immunomorphological study, which reliably demonstrated ($p<0.05$) a gradual increase in K1-67 marker expression in epithelium during HE: in simple HE, marker expression is 13.36±0.7%, while in complex HE it is 14.25±0.7%.

Conclusions. A positive correlation exists between changes in the epithelial-stromal ratio in the endometrium and K1-67 expression in the epithelium and stroma of the uterine mucosa in different histological variants of hyperplasia, endometrial intraepithelial neoplasia, and endometrioid adenocarcinoma. Simple hyperplasia is characterized by minimal K1-67 ESI values and reflects an excess of stromal expression over epithelial expression. A progressive increase in the K1-67 ESI value from simple hyperplasia to complex hyperplasia and complex atypical hyperplasia is accompanied by a gradual increase in the epithelial component, with the maximum index value and the greatest increase in the glandular epithelial component observed in endometrial carcinomas.

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SIDQIY XONDAYLIQIY ASARLARIDA METAFORALARNING QO'LLANILISHI

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O'**zbek tilida annotatsiya:** mazkur maqolada polisemantik birliklarning badiiy matnda ishlatilishi, metaforalarning tabiati, ular orqali badiiy asarlarda qo'llaniladigan ma'nolar haqida fikr yuritiladi.

O'zbek tilida kalit so'zlar: badiiy matn, polisemiya, denotativ, ko'chma ma'no, sema, metafora, til, leksik birlik.

Annotation in English: This article discusses the use of polysemantic units in literary texts, the nature of metaphors, and the meanings conveyed through them in literary works.

Keywords in English: literary text, polysemy, denotative, figurative meaning, sema, metaphor, language, lexical unit.

Аннотация на русском языке: В данной статье рассматривается использование многозначных единиц в литературных текстах, природа метафор и значения, передаваемые ими в литературных произведениях.

Ключевые слова на русском языке: литературный текст, многозначность, денотативное, переносное значение, сема, метафора, язык, лексическая единица.

Polisemiya hodisasi barcha tillarda ham keng qo'llanadi. Har qanday til tarkibidagi leksik birliklar son nuqtayi nazaridan emas, balki semantik qirralarining kengligi bilan ahamiyatlilik darajasi o'lchanadi. Til birliklaridagi polisemiya mazkur tilning boy va keng qamrovliligida, shubhasiz, o'z o'rniga ega[1]. Borliqdagi narsa-buyum, o'rin-joy, voqea-hodisa, belgi-xususiyat, harakat-holatlar alohida tarzda nomlanmaydi, balki ularga nomning ko'chirilishi ma'lum, shu sababli tilimizning salmoqli qismini ko'chma ma'nolilik tashkil qiladi[2]. Polisemiya hodisasi bir so'z turkumi doirasida yuzaga chiqadi, chunki so'z ma'nosi nechta qo'shimcha semalarni

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ifodalaganidan qat'i nazar baribir asosiy, bosh ma'nosiga aloqador bo'ladi, shu xususiyati bilan ham ma'lum darajada boshqa hodisalarda farqlanib turadi[3]. Polisemiya hodisasi turkiy tillar tabiatiga xos bo'lib, har bir ko'chma ma'noning yuzaga chiqishi o'ziga xos holatda farqlanib turadi[4].

Metafora. Metafora nom ko'chishi emas, balki ma'no ko'chishidir, chunki so'z ichki semalardan tashkil topadi, mana shu semalar birlashib, ma'lum bir leksik birlikni tashkil etadi. Masalan, *Qotmoq* a)ma'lum bir harakatsiz holatga kelmoq; b)ma'lum bir o'rindan jilmaslik; d)ma'lum bir o'ringa aloqadorlik. Bu semik qatorni yana davom ettirish mumkin. Ushbu semalarning ma'lum biri ko'chadi, nom esa shu ma'nosini yetaklab yuradi, xolos. *U tarrakdek qotib qoldi* gapida ma'lum bir ma'no, ya'ni qattiqlik ma'nosi ko'chgan. Semantik maydon doimo keng miqyosda bo'ladi, mazkur ma'nolarni ifodalashga xizmat qiluvchi birliklarni topish doim ham oson kechmaydi, chunki semantik maydonlar turli xil qo'shimsha sememalarning mavjud bo'lishi, ularning stilistik, emotsional, ekspressiv vazifalari ham turadi, bularning barchasini yagona birlik bilan qamrab olish uchun polisemantilik hodisasidan foydalanish ijobiy samara beradi.

Istalgan badiiy matnda o'zaro o'xshashlik asosida ma'no ko'chishining to'rt jihatiga e'tibor qaratilishi lozimligiga e'tibor qaratildi:

a)o'rin jihatdan o'xshashlik asosida ma'no ko'chadi;

b)shakl o'xshashligi asosida ma'no ko'chadi;

d)belgi jihatdan o'xshashlik asosida ma'no ko'chishi mavjud;

e)vazifa yoki harakat o'xshashligi asosida ma'no ko'chgan.

Quyida keltiriladigan misollarda metaforik ko'chimlarning turli darajadagi holatlarini kuzatish mumkin.

Qolg'um tamug' o'tida kuyub yuz ming ohim,

Shafqatlar ila manga chu boqmas esang qiyo(B-32). Ijodkor mazkur misrada juda ta'sirchn badiiy vositalardan foydalanadi. Oshiq qiynalayotganligini, undagi bu azobning chek-chegarasi ko'rinmayotganligini "tamug' o'tida kuyub" birikmasi bilan beradi, Mazkur metaforik ko'chimni qatlamli ko'chimsifatida qarash mumkin, chunki "do'zax, olov va kuymoq" birliklarining barchasi ham denotative ma'no ifodalashga xizmat qilgan. Insonning murakkab zamon va makon oralig'ida qolishi "tamug'", uning azob – uqubatlarga duchor bo'lishi "o'tda kuyub irikmasi vositasida badiiy tasvirlangan. Mazkur baytda ijodkorning badiiy maqsadi o'z holatini ifodalab berish

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bilan cheklanish emas, balki boshqalarga bunday azobni ravo ko‘rmaslikka intilish hamdir. Baytda zohiran shakl, botinan belgi o‘xshashligi asosida ko‘chim mavjud.

Isyon yuki ostida qaddim duto erur,

Lutf-u karamdin elina ko‘r ilkina aso(33). Bayt mazmuni juda chuqur, boshqa ijodkorlarning ijodida ma’shuqdan norozilik tendensiyasi ma’lum darajada farqlanib turadi, ijodkor isyon qiladi, bu esa unda zarar yetkazayotgani, bunga bardosh bera olmayotgani, natijada shu yukni ko‘tarish uchun qo‘liga hassa tutganini bayon etadi. Metaforaning ahamiyati shundaki, u orqali ijodkor maqsadining turlicha ekanligini birgina vosita yordamida tasvirlab berish imkoniyatiga ega bo‘ladi, she’riy misralarda ham uning yukni ko‘tara olmayotganligidan zorlanish, ham umr bo‘yi, ya’ni keksayganiga qadar shu sitamni ko‘tarib yurganligiga ishora qilinadi.

Har tarafg‘a o‘tganda o‘ynatib samandini,

Yo‘lida yotib oning bo‘lmadim turob aslo(34). Alisher Navoiyning “Qilg‘il” radifli g‘azalida o‘zini yor otining oyog‘iga hino, uning itiga arqon bo‘lishini istaydi, ammo Sidqiy Xonayliqiy butunlay yangicha metafora yordamida matnning ta’sirchanligini oshirishga, yangi badiiy mazmun bilan boyitishga erishadi. Ma’shuqaning o‘zi ot o‘ynatib oshiqning ko‘chasidan o‘tyapti, ammo lirik qahramon yorining jabr-sitamlaridan anchagina qiynalib qolgan , ta’bir joiz bo‘lsa, zada bo‘lgan shuning uchun ham uning otining oyog‘i ostidagi tuproq bo‘lgisi kelmaydi, ya’ni o‘zini oyoqosti, qadrsiz qilgisi kelmaydi. Bunday ijodkorning o‘zigagina xos bo‘lgan metafora seantik maydonning kengayishiga sabab bo‘ladi.

Qonima bo‘yalg‘aymen rashkdin, ango dengkim,

Ilgig‘a xinolardin chekmasin xizob aslo(35). Oshiq azoblardan, qiynog‘-u sitamlardan qon bo‘lgan , qonga bo‘yalgan, shuncha yetkazilgan jabr-sitamdan keyin ham ma’shuqasini aybdor qilgisi kelmaydi, uning qo‘lidagi hino buning qoni emasligiga , barchasiga o‘zi aybdor ekanligiga ishora qiladi. Yuqoridagi misollar orqali kuzatish mumkinki, Sidqiy Xondayliqiy ko‘chma ma’noli birliklardan foydalanishga juda katta mahorat ko‘rsatgan.

Hazrat Alisher Navoiy “Muhokamat ul-lug‘atayn” asarida turkiy va forsiy tillarning solishtirish jarayonida turkiy tillar tabiatiga xos xususiyatlarga alohida to‘xtalib o‘tgan edi. Leksik ma’noning o‘zgarish yo‘llari quyidagilar:ma’no ko‘chishi, ma’no kengayishi, ma’no torayishi. Ma’no ko‘chishi va ma’no hajmining kengayishi ma’no taraqqiyotiga olib keladi[5].

[5] Ҳакимова М. Семасиология. – Тошкент, 2008. –Б. 67.

Xulosa sifatida keltirish mumkinki, Sidqiy Xondayliqiy ham an'anaviy, ham shaxsiy metaforalardan unumli foydalana olgan va bu bilan tilimizning keng imkoniyatlarini ochib bera olgan.

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КОНГЕСТИВ ГЕМОДИНАМИКА АСОСИДА БУЙРАК ДИСФУНКЦИЯСИНИ ЭРТА ПРОГНОЗЛАШ: КАРДИОРЕНАЛ СИНДРОМ ХАВФИНИ СТРАТИФИКАЦИЯ ҚИЛИШ

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Сурункали юрак етишмовчилиги (СЮЕ)да буйрак дисфункцияси прогнозни кескин ёмонлаштиради. Веноз конгестия ва ўнг бўлимлардаги юклама ренал веноз босимни ошириб, гломеруляр фильтрацияни пасайтиради. Шу сабабли конгестив гемодинамика асосида эрта риск стратификация қилиш клиник жиҳатдан муҳим.

Материал ва усуллар. Тадқиқотга сурункали юрак етишмовчилиги (СЮЕ) билан оғриган 96 нафар бемор киритилди, уларнинг ўртача ёши 61,4±8,2 йилни ташкил этди. Беморлар жинси бўйича 58 нафар эркак (60,4%) ва 38 нафар аёл (39,6%)дан иборат бўлди. Тадқиқот дизайнига мувофиқ, беморлар 2 гуруҳга ажратилди: I гуруҳ (асосий) — 66 нафар беморда клиник конгестия белгилари кузатилди, II гуруҳ (назорат) — 30 нафар беморда эса конгестия белгилари минимал даражада бўлди. NYHA функционал классификацияси бўйича беморларнинг 29,2%и II синфга, 52,1%и III синфга ва 18,7%и IV синфга тўғри келди. Эхокардиография натижаларига кўра, чап қоринча чиқариш фракцияси (ФВ) I гуруҳда 34,6±6,8%ни, II гуруҳда эса 39,8±7,1%ни ташкил этди ва гуруҳлар ўртасидаги фарқ статистик жиҳатдан ишончли бўлди (p=0,004). Барча беморларда лаборатор баҳолаш доирасида креатинин, eGFR (CKD-EPI), мочевина, NT-proBNP ҳамда цистатин C кўрсаткичлари аниқланди.

Тадқиқот натижалари. Ўтказилган корреляцион таҳлил натижалари конгестив гемодинамика билан буйрак дисфункцияси ўртасида яққол статистик боғлиқлик мавжудлигини кўрсатди. Хусусан, конгестия индекси билан цистатин C ўртасида кучли мусбат корреляция аниқланди (r=0,61; p<0,001), бу эса веноз конгестия оғирлашган сари буйракда эрта тубуляр шикастланиш ва фильтрацион бузилишлар хавфи ортишини тасдиқлайди. Шунингдек, NT-proBNP билан eGFR ўртасида ишончли манфий корреляция қайд этилди (r=-0,58; p<0,001), яъни юракдаги декомпенсация ва гемодинамик юклама кўрсаткичлари юқори бўлган беморларда буйрак фильтрацияси сезиларли равишда пасайиши кузатилди. Конгестия индекси билан креатинин ўртасида ҳам ўртача даражада мусбат боғлиқлик аниқланиб (r=0,44; p=0,002), бу ҳолат веноз босим ортиши ва азотли

шлаклар тўпланиши ўртасида патогенетик узвийлик борлигини кўрсатади. Олинган маълумотлар конгестив гемодинамиканинг нафақат клиник ҳолатни оғирлаштириши, балки буйрак функциясига бевосита таъсир қилиб, кардиоренал синдромни шакллантиришда етакчи механизмлардан бири эканини илмий жиҳатдан асослайди.

Хулоса. Юрак етишмовчилигида конгестив гемодинамика кўрсаткичлари (клиник конгестия индекси ва NT-proBNP) билан буйрак функцияси маркерлари (eGFR, креатинин, цистатин C) ўртасидаги ишончли корреляциялар кардиоренал синдромни эрта прогнозлаш имкониятини яратади. Аниқланган кучли мусбат ва манфий боғлиқликлар шуни кўрсатадики, СЮЕда буйрак дисфункцияси кўп ҳолларда артериал гипоперфузиядан кўра веноз конгестия ва ренал веноз гипертензия билан чамбарчас боғлиқ бўлади. Шу сабабли клиник амалиётда СЮЕ билан оғриган беморларни кузатишда конгестия даражасини объектив баҳолаш, NT-proBNP ва цистатин Сни эрта маркер сифатида қўллаш ҳамда eGFR динамикасини мунтазам мониторинг қилиш оғир асоратлар хавфини камайтиришга хизмат қилади. Ушбу ёндашув беморларни риск стратификация қилиш, индивидуал даволаш тактикасини танлаш ва кардиоренал синдромнинг эрта босқичда олдини олиш учун юқори амалий аҳамиятга эга.

O'ZBEK TILI LEKSIKASINING BOYISH IMKONIYATLARI

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Annotatsiya: *Mazkur maqolada o'zbek tili leksikasining boyish manbalari va imkoniyatlari ilmiy jihatdan tahlil qilinadi. Til taraqqiyotida ichki va tashqi omillarning o'rni, zamonaviy ijtimoiy jarayonlar ta'sirida yuzaga kelayotgan yangi so'z va ma'nolar, shuningdek, milliy tilni asrash va rivojlantirish masalalari yoritiladi. Tadqiqotda leksik boyishning tabiiy mexanizmlari asoslab beriladi.*
Kalit so'zlar: *leksika, so'z boyligi, til taraqqiyoti, neologizm, semantik kengayish, so'z yasalishi.*

Аннотация: *В данной статье научно анализируются источники и возможности обогащения лексики узбекского языка. Подчеркивается роль внутренних и внешних факторов в развитии языка, появление новых слов и значений под влиянием современных социальных процессов, а также вопросы сохранения и развития национального языка. Исследование обосновывает естественные механизмы лексического обогащения.*
Ключевые слова: *лексика, словарный запас, развитие языка, неологизм, семантическое расширение, словообразование.*

Abstract: *This article scientifically analyzes the sources and possibilities of enrichment of the Uzbek language lexicon. The role of internal and external factors in the development of the language, new words and meanings emerging under the influence of modern social processes, as well as the issues of preserving and developing the national language are highlighted. The study substantiates the natural mechanisms of lexical enrichment.*
Keywords: *lexicon, vocabulary, language development, neologism, semantic expansion, word formation.*

Til – millat tafakkuri va madaniyatining tirik ifodasidir. Jamiyat taraqqiy etar ekan, undagi ijtimoiy, siyosiy, madaniy va ilmiy o'zgarishlar bevosita tilga, ayniqsa, uning leksik qatlamiga ta'sir ko'rsatadi. O'zbek tili ham tarixiy taraqqiyot jarayonida uzluksiz ravishda boyib, yangilanib kelayotgan milliy tillardan biridir. Leksikaning

boyishi tilning hayotiyligi va zamon talablariga moslashuvchanligini belgilovchi muhim omil hisoblanadi.

Bugungi globallashuv sharoitida o‘zbek tili leksikasining boyish imkoniyatlarini ilmiy asosda o‘rganish, ularni ongli ravishda boshqarish masalasi dolzarb ahamiyat kasb etmoqda.

O‘zbek tili leksikasining boyish manbalari. O‘zbek tili leksikasi asosan ikki asosiy manba hisobiga boyib boradi: *ichki imkoniyatlar va tashqi ta’sirlar*.

1. **Ichki imkoniyatlar asosida boyish.** Tilning o‘z ichki qonuniyatlari asosida rivojlanishi eng tabiiy va barqaror boyish manbai hisoblanadi:

a) *So‘z yasalishi*. Affiksatsiya orqali yangi so‘zlar hosil qilish o‘zbek tilida eng faol jarayonlardan biridir. Masalan, -chi, -lik, -dor, -simon kabi qo‘shimchalar yordamida yuzlab yangi tushunchalar ifodalanadi. Bu jarayon tilning o‘z tabiiy imkoniyatlarini namoyon etadi. Masalan:

Ish → ishchi, ishbilarmon, ishsiz
Ilm → ilmiy, ilmsiz
Raqam → raqamli, raqamlashtirmoq
Boshqar→ boshqaruv, boshqaruvchi

b) Semantik kengayish. Mavjud so‘zlarning ma’no doirasining kengayishi leksik boyishning muhim yo‘li sanaladi. Masalan, avval aniq ma’noda qo‘llangan so‘zlarning ko‘chma yoki abstrakt ma’no kasb etishi jamiyat tafakkuridagi o‘zgarishlar bilan chambarchas bog‘liq.
Misollar:

Tarmoq — dastlab “to‘r shakli”, hozir internet tarmog‘i, ijtimoiy tarmoq
Oyna — “deraza oynasi”dan tashqari telefon oynasi (ekran)
Yuklamoq — “jismoniy yuklash”dan fayl yuklash ma’nosigacha kengaydi
Maydon — “ochiq joy” bilan birga axborot maydoni, siyosiy maydon.

c) *Shevalar va og'zaki nutq manbalari*. Xalq shevalarida saqlanib qolgan ko'plab so'zlar adabiy til uchun boy manba bo'lib xizmat qiladi. Ularni ilmiy asosda tanlab, adabiy me'yor doirasiga kiritish leksikani tabiiy ravishda boyitadi.

2. **Tashqi omillar ta'sirida boyish.** Jamiyatning boshqa xalqlar va madaniyatlar bilan aloqasi natijasida o'zbek tiliga yangi tushunchalar kirib keladi:

a) *O'zlashma so'zlar*. Fan, texnika, siyosat va iqtisod sohalaridagi yangiliklar ko'pincha boshqa tillar orqali nomlanadi. Biroq bunday so'zlarning o'zbek tili fonetik va grammatik tizimiga moslashuvi muhim sanaladi. Bunga misol sifatida quyidagilarni keltirish mumkin:
Kompyuter, internet, skaner, bank, kredit, loyiha, telefon, ekran, signal.

Bu so'zlar o'zbek tilida fonetik va grammatik moslashuvga uchragan:

Kompyuterlar
Internetdan foydalanmoq
Loyihalash

b) *Tarjima jarayonlari*. Boshqa tillardagi ilmiy va badiiy asarlarning tarjimasi natijasida o'zbek tilida yangi iboralar va terminlar shakllanadi. Bu jarayon tilning ifoda imkoniyatlarini kengaytiradi. Masalan:
Globalization → globallashuv
Artificial intelligence → sun'iy intellekt
Human factor → inson omili
Mass media → ommaviy axborot vositalari

Zamonaviy leksik jarayonlar. Bugungi kunda axborot texnologiyalari, ijtimoiy tarmoqlar va ommaviy axborot vositalari leksik yangilanishning tezlashuviga sabab bo'lmoqda. Natijada neologizmlar tez paydo bo'lib, tezda iste'moldan chiqib ketishi ham mumkin. Shu bois leksik boyish jarayonini faqat miqdoriy emas, balki sifat jihatidan baholash muhimdir.
Leksik boyish va til madaniyati. Til boyishining bosh mezoni — uning milliy ruhni saqlab qolishidir. Har qanday yangi so'z yoki ma'no tilning ichki qonuniyatlariga zid bo'lmasligi, nutq madaniyatiga xizmat qilishi lozim. Ongsiz o'zlashmalar tilning tabiiy rivojiga salbiy ta'sir ko'rsatishi mumkin.

O‘zbek tili leksikasining boyish imkoniyatlari keng va serqirradir. Ichki imkoniyatlardan oqilona foydalanish, tashqi ta’sirlarni tanqidiy yondashuv asosida qabul qilish orqali tilning tabiiy taraqqiyotini ta’minlash mumkin. Leksik boyish – bu tilning tirikligidan dalolat beruvchi jarayon bo‘lib, u milliy tafakkur, madaniyat va ilm-fan bilan uzviy bog‘liqdir. Shu bois o‘zbek tili leksikasini boyitish masalasi doimo ilmiy e’tibor markazida bo‘lishi zarur. Shuningdek , zamonaviy davrda leksik boyish muammolariga ham yechim topish zarur. Bugungi axborot asrida leksik yangilanish tezkor, ammo ba’zan beqaror xarakter kasb etmoqda. Ijtimoiy tarmoqlar orqali kirib kelayotgan ayrim birliklar qisqa muddatli bo‘lib, til me’yoriga mos kelmaydi. Shu sababli leksik boyish jarayonida me’yoriylik, maqsadga muvofiqlik va milliylik mezonlari ustuvor bo‘lishi kerak.

Xulosa qilib aytganda, O‘zbek tili leksikasining boyish imkoniyatlari tilning ichki imkoniyatlari va tashqi omillar uyg‘unligi asosida amalga oshadi. Eng muhim jihat shundaki, bu jarayon tilning tabiiy rivojiga xizmat qilishi, uning milliy qiyofasini saqlab qolishi lozim. Leksik boyish tilning tirik va faol tizim ekanini ko‘rsatadi, biroq bu jarayon ilmiy asosda boshqarilmasa, til madaniyatiga salbiy ta’sir ko‘rsatishi ham mumkin.

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Annotatsiya: Mazkur tezisda korxonalarda uning ulushdorlari (investorlar, sarmoyadorlar, aksionerlar) uchun muhim va ahamiyatli bo'lgan dividend siyosatining mohiyati, uning shakllanish omillari hamda moliyaviy barqarorlik va investitsion jozibadorlikka bo'lgan ta'siri yoritilgan. Dividend siyosatini samarali yuritish orqali aksiyadorlar manfaatlarini ta'minlash bilan birga, korxonaning uzoq muddatli rivojlanishini qo'llab-quvvatlash masalalari tahlil qilingan.

Kalit so'zlar: dividend, dividend siyosati, sof foyda, reinvestitsiya, aksiyadorlar, barqaror dividend, qoldiq dividend, o'zgaruvchan dividend, moliyaviy barqarorlik, investitsion jozibadorlik.

Dividend siyosati har qanday kompaniya uchun moliyaviy strategiyaning ajralmas qismi hisoblanadi. Bu, bir tomondan, aksiyadorlarga kompaniya foydasidan ulush berish orqali ularning sarmoyasini mukofotlashni, boshqa tomondan esa, kompaniyaning kelajakdagi o'sishi va rivojlanishi uchun mablag'larni qayta sarmoyalashni muvozanatlashni anglatadi.[1] Dividend siyosati – bu korxonaning sof foydasini taqsimlash bo'yicha qarorlar tizimi bo'lib, u dividend to'lovlari hajmi,

[1] Brealey, R. A., Myers, S. C., & Allen, F. (2020). Principles of Corporate Finance (13th ed.). McGraw-Hill Education

muddati va shaklini belgilaydi. Mazkur siyosat korxona moliyaviy strategiyasining muhim tarkibiy qismi hisoblanadi va aksiyadorlar daromadlarini barqaror ta'minlash hamda korxona qiymatini oshirishga qaratiladi. Amaliyotda dividend siyosatining bir necha asosiy turlari mavjud: barqaror dividend siyosati, qoldiq tamoyiliga asoslangan siyosat, minimal dividend.

Korxona dividend siyosatini shakllantirishda bir qator omillar hisobga olinadi. Jumladan, korxonaning foydalilik darajasi, investitsion ehtiyojlari, pul oqimlarining barqarorligi, bozor sharoitlari hamda soliq siyosati muhim ahamiyatga ega. Shu bilan birga, dividend siyosati korxonaning moliyaviy barqarorligiga bevosita ta'sir ko'rsatadi.Kompaniyalar nafaqat foyda olishga, balki ushbu foydani aksiyadorlarga qanday taqsimlash va kelajakda qiymat yaratish uchun qanday qayta investitsiya qilish masalasiga ham jiddiy yondashmoqdalar. Dividend siyosatining nazariy asoslari va amaliy qo'llanishi doimiy ravishda muhokama qilinadigan mavzu bo'lib kelgan. Dividend siyosati 4 asosiy iqtisodiy vazifani bajaradi:1) Investor daromadini ta'minlash, aksiyadorlar investitsiya kiritishdan asosiy maqsad – barqaror dividend daromadi olish.2) Kapital qiymatini oshirish: Dividend siyosati aksiyalar bozor narxiga bevosita ta'sir qiladi, NASDAQ va NYSE bozorlarida olib borilgan empirik tadqiqotlar shuni ko'rsatadiki dividend e'lon qilgan kompaniyalarning aksiyalari o'rtacha 2–5% ga qimmatlashadi.[2] Agar kompaniyada qarz ulushi yuqori bo'lsa: → dividend cheklanadi→ kredit shartnomalarida ko'pincha dividend to'lashga limit qo'yiladi.

Dividend siyosatini turli modellari mavjud masalan Modigliani-Miller teoremasi kabi nazariyalar mukammal kapital bozorlar sharoitida dividend siyosatining kompaniya qiymatiga ta'sirini inkor etsada, real bozor sharoitlarida soliqlarning mavjudligi, agentlik muammolari, axborot asimmetriyasi va institutsional cheklovlar dividend siyosatini juda muhim masalaga aylantiradi.[3] Modigliani–Miller (MM) nazariyasi Dividend siyosati kompaniya qiymatiga ta'sir qilmaydi. Lekin soliqlar, axborot assimetriyasi, tranzaksiya xarajatlari mavjud bo'lgani sababli real iqtisodiyotda dividend siyosati katta ahamiyatga ega.

Gordon modeli: $\mathbf{P_0=D_1/r-g}$

Bu yerda: P - aksiyaning bugungi qiymati

D1 - kelgusi yil dividend

r – talab etiladigan daromadlilik

g – dividend o'sish surati.

Dividendda o'sish kuzatilsa aksiyalar narxi o'sadi.

[2] www.nasdaq.com sayti

[3] Modigliani, F., & Miller, M. H. (1961). Dividend Policy, Growth, and the Valuation of Shares. The Journal of Business, 34(4), 411–433

Qoldiq dividend modelida avval investitsiya ehtiyojlari qoplanadi, keyin qolgan foyda dividendga yo‘naltiriladi. Tez o‘sayotgan korxonalarga xos.

1-jadval

Dividend siyosati turi	**Xususiyatlari**	**Afzalliklari**	**Kamchiliklari**	**Qaysi kompaniyalar uchun mos**
Barqaror dividend	Har yili belgilangan miqdorda yoki foizda	Sarmoyadorlar ishonchi, prognoz qilinadigan daromad, bozorga ijobiy signal	Moliyaviy yuk, o‘sish cheklanishi, inqirozda qiyinchilik	Yetuk, barqaror daromadga ega, naqd pul oqimi barqaror kompaniyalar
Qoldiq dividend	Loyihalarda n so‘ng qolganini taqsimlash	O‘sishga ustuvorlik, ichki moliyalash, tashqi moliyalash xarajatini kamaytirish	Dividendlar o‘zgaruvchan, noaniqlik, ba’zi sarmoyadorlar uchun qiziq emas	Yosh, tez o‘sayotgan, yuqori investitsiya imkoniyatlariga ega kompaniyalar
O‘zgaruvchan dividend	Foyda va moliyaviy holatga qarab o‘zgaradi	Moliyaviy moslashuvchanlik, noqulay davrlarda yengillik	Prognoz qilinmaydigan daromad, sarmoyadorlar ishonchsizligi	Siklik, daromadi o‘zgaruvchan (neft, tog‘-kon) kompaniyalar
Maxsus dividend	Bir martalik, katta foydadan yoki ortiqcha naqd puldan	Aksiyadorlarni mukofotlash, kapitalni samarali taqsimlash	Bir martalik, muntazam emas, sarmoyadorlar kutgan daromad manbai emas	Kutilmagan katta foyda olgan yoki ortiqcha naqd pulga ega kompaniyalar
Aksiyalarni qayta sotib olish	Kompaniya o‘z	EPS va aksiya narxini oshiradi, soliq afzalliklari,	Boqicha baho xavfi, manipulyatsiya	Moliyaviy kuchli, o‘sish imkoniyatlari

	aksiyalarini sotib oladi	menejerlarning ishonch signal	, sarmoyador uchun muntazam daromad emas	cheklangan, ammo katta naqd pul zaxirasiga ega kompaniyalar

1-jadval. Korxona dividend siyosat turlari[4]

O‘zbekiston amaliyotida dividend siyosati “Aksiyadorlik jamiyatlari to‘g‘risida”gi Qonun, Soliq kodeksi, Moliya vazirligi qarorlari kabi normativ-huquqiy asoslarga qarab yuritiladi. O‘zbekneftgaz, Navoiy KMK, O‘zbekenergo kabi davlat ulushi katta korxonalar dividendni yuqori belgilaydi. Bu byudjet daromadlarini oshirish maqsadida amalga oshiriladi.

Xulosa. Dividend siyosati korxona moliyaviy boshqaruvining muhim va strategik tarkibiy qismi bo‘lib, u aksiyadorlar manfaatlarini ta’minlash hamda korxonaning uzoq muddatli barqaror rivojlanishi o‘rtasida optimal muvozanatni shakllantirishga xizmat qiladi. Ilmiy tadqiqotlar va amaliy tajribalar shuni ko‘rsatadiki, oqilona dividend siyosati kompaniyaning bozor qiymatini oshiradi, investorlarga bo‘lgan ishonchni mustahkamlaydi hamda kapital bozorida ijobiy imidj yaratadi.

Dividend siyosatini belgilash jarayonida sof foyda hajmi, pul oqimlarining barqarorligi, investitsion ehtiyojlar, soliq siyosati va qarz majburiyatlari kabi omillarni kompleks tarzda hisobga olish zarur. Ushbu omillar o‘rtasidagi mutanosiblikni ta’minlash korxonaning likvidligi, to‘lovga layoqatliligi va moliyaviy barqarorligining saqlanishiga imkon beradi. Ayniqsa, rivojlanish bosqichidagi korxonalar uchun foydaning katta qismini reinvestitsiyaga yo‘naltirish, yetuk bosqichdagi korxonalar uchun esa barqaror dividend to‘lash strategiyasi iqtisodiy jihatdan asoslangan hisoblanadi.

Tadqiqot natijalari shuni ko‘rsatadiki, dividend siyosati nafaqat mikroiqtisodiy darajada, balki makroiqtisodiy miqyosda ham muhim ahamiyat kasb etadi. Barqaror dividend siyosati fond bozorining rivojlanishiga, investitsion muhitning yaxshilanishiga hamda kapital oqimlarining faollashishiga xizmat qiladi. O‘zbekiston sharoitida esa davlat ulushi yuqori bo‘lgan korxonalarda dividend siyosati davlat byudjeti daromadlarini shakllantirishning muhim manbalaridan biri bo‘lib, fiskal barqarorlikni ta’minlashga sezilarli hissa qo‘shadi.

[4] Xolmo‘minov Sh.E, Ishmuradov B.S Korporativ dividend siyosati: xalqaro amaliyot va O‘zbekiston sharoitida qo‘llash imkoniyatlari maqolasi

Umuman olganda, samarali dividend siyosati — bu aksiyadorlar manfaatlari, korxona moliyaviy imkoniyatlari va strategik rivojlanish maqsadlari o‘rtasidagi ilmiy asoslangan muvozanat bo‘lib, u korxonaning bozor qiymatini oshirish, investitsion jozibadorligini kuchaytirish hamda uzoq muddatli barqaror o‘sishni ta’minlashning muhim vositasi hisoblanadi.

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REANIMATSIYADA INFUZION TERAPIYA ASOSLARI

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Annotatsiya: Infuzion terapiya reanimatsiya va intensiv terapiya sharoitida qo'llaniladigan eng muhim davolash usullaridan biri bo'lib, organizmning gemodinamik barqarorligini ta'minlash, suyuqlik va elektrolit muvozanatini tiklash hamda to'qimalarning adekvat perfuziyasini saqlashga qaratilgan. Kritik holatlarda, jumladan shok, og'ir travmalar, kuyishlar, sepsis, qon yo'qotish va suvsizlanish holatlarida infuzion terapiya hayotiy muhim organlar faoliyatini qo'llab-quvvatlashda asosiy rol o'ynaydi. Infuzion terapiya yordamida aylanib yuruvchi qon hajmi tiklanadi, mikrosirkulyatsiya yaxshilanadi va hujayralarning kislorod bilan ta'minlanishi normallashadi. Mazkur maqolada reanimatsiya amaliyotida qo'llaniladigan infuzion eritmalar turlari, ularning farmakofiziologik xususiyatlari, qo'llash prinsiplari hamda organizmga ta'siri ilmiy manbalar asosida tahlil qilindi. Shuningdek, kristalloid va kolloid eritmalarning klinik ahamiyati, ularni qo'llash ko'rsatmalari va infuzion terapiyaning asosiy maqsadlari yoritildi.

Kalit so'zlar: Infuzion terapiya, reanimatsiya, intensiv terapiya, kristalloid eritmalar, kolloid eritmalar, gipovolemiya, gemodinamik barqarorlik, perfuziya, mikrosirkulyatsiya, elektrolit muvozanati, shok, suyuqlik terapiyasi.

KIRISH

Zamonaviy tibbiyotda reanimatsiya va intensiv terapiya kritik holatdagi bemorlarni davolashda muhim o'rin tutadi. Bunday holatlarda organizmda gemodinamik buzilishlar, suyuqlik yetishmovchiligi, elektrolit disbalansi va to'qimalarning kislorod bilan ta'minlanishining buzilishi kuzatiladi. Ushbu patologik o'zgarishlar hayotiy muhim organlar faoliyatining izdan chiqishiga va og'ir asoratlar rivojlanishiga olib kelishi mumkin. Shu sababli reanimatsiya amaliyotida organizmning ichki muhit barqarorligini tiklash va saqlash muhim vazifalardan biri hisoblanadi. Infuzion terapiya organizmga turli eritmalarni vena orqali yuborish orqali suyuqlik hajmini tiklash, qon aylanishini yaxshilash hamda metabolik jarayonlarni normallashtirishga qaratilgan davolash usulidir. Ushbu terapiya ayniqsa gipovolemiya,

shok, qon yo‘qotish, kuyish kasalligi, sepsis va og‘ir intoksikatsiya holatlarida keng qo‘llaniladi. Infuzion terapiya yordamida aylanib yuruvchi qon hajmi oshiriladi, arterial bosim barqarorlashadi va to‘qimalarning adekvat perfuziyasi ta’minlanadi. Infuzion terapiyaning samaradorligi ko‘p jihatdan qo‘llaniladigan eritmaning turi, hajmi va yuborish tezligiga bog‘liq. Hozirgi kunda reanimatsiya amaliyotida kristalloid va kolloid eritmalar keng qo‘llanilib, ular organizmning suyuqlik muvozanatini tiklashda muhim ahamiyatga ega. Kristalloid eritmalar hujayralararo suyuqlik hajmini tiklashda samarali bo‘lsa, kolloid eritmalar tomir ichidagi suyuqlik hajmini uzoq muddat saqlab turish xususiyatiga ega. Reanimatsiya sharoitida infuzion terapiyani to‘g‘ri tashkil etish bemorning umumiy holatini barqarorlashtirish, asoratlarni oldini olish va davolash samaradorligini oshirishda muhim ahamiyatga ega. Shu sababli infuzion terapiyaning nazariy asoslari, qo‘llash prinsiplari va organizmga ta’sir mexanizmlarini chuqur o‘rganish intensiv terapiya va reanimatologiya amaliyotida dolzarb masalalardan biri hisoblanadi.

MATERIALLAR VA METODLAR

Ushbu tadqiqot ishida reanimatsiya sharoitida qo‘llaniladigan infuzion terapiyaning nazariy asoslari, uning organizmga ta’siri va klinik ahamiyatini o‘rganish maqsadida zamonaviy tibbiy adabiyotlar, ilmiy maqolalar va klinik qo‘llanmalar tahlil qilindi. Tadqiqot davomida intensiv terapiya, patofiziologiya, reanimatologiya va klinik farmakologiyaga oid manbalar tizimli ravishda o‘rganildi va umumlashtirildi.

Tadqiqot metodlari sifatida ilmiy adabiyotlarni tahlil qilish, qiyosiy baholash, patofiziologik yondashuv va umumlashtirish usullaridan foydalanildi. Infuzion terapiyada qo‘llaniladigan asosiy eritmalar, jumladan kristalloid va kolloid eritmalarning farmakologik xususiyatlari, organizmga ta’siri va qo‘llash ko‘rsatmalari o‘rganildi. Shuningdek, infuzion terapiyaning gemodinamik ko‘rsatkichlarga, mikrosirkulyatsiyaga va to‘qimalarning kislorod bilan ta’minlanishiga ta’siri tahlil qilindi. Olingan ma’lumotlar asosida infuzion terapiyaning reanimatsiya sharoitidagi ahamiyati ilmiy jihatdan asoslab berildi.

NATIJALAR

Tadqiqot natijalari shuni ko‘rsatdiki, infuzion terapiya kritik holatdagi bemorlarda gemodinamik barqarorlikni tiklashda muhim ahamiyatga ega. Gipovolemiya holatlarida infuzion terapiya yordamida aylanib yuruvchi qon hajmi oshiriladi, yurakka venoz qaytish yaxshilanadi va yurak chiqish hajmi ortadi. Natijada arterial bosim barqarorlashadi va hayotiy muhim organlarning qon bilan ta’minlanishi

yaxshilanadi. Kristalloid eritmalar, jumladan natriy xlorid eritmasi va Ringer eritmasi, hujayralararo suyuqlik hajmini tiklashda samarali ekanligi aniqlandi. Ushbu eritmalar organizmda tez taqsimlanadi va suyuqlik yetishmovchiligini bartaraf etishda muhim rol o‘ynaydi. Kolloid eritmalar esa tomir ichida uzoqroq saqlanib, onkotik bosimni oshiradi va suyuqlikni tomir ichida ushlab turishga yordam beradi. Bu esa ayniqsa og‘ir gipovolemiya va shok holatlarida gemodinamik ko‘rsatkichlarni barqarorlashtirishda muhim ahamiyatga ega. Infuzion terapiya natijasida mikrosirkulyatsiya yaxshilanadi, to‘qimalarning kislorod bilan ta'minlanishi ortadi va metabolik jarayonlar normallashadi. Bu esa hayotiy muhim organlar faoliyatining tiklanishiga yordam beradi.

MUHOKAMA

Olingan natijalar infuzion terapiyaning reanimatsiya amaliyotidagi muhim o‘rnini tasdiqlaydi. Kritik holatlarda organizmda suyuqlik hajmining kamayishi, qon aylanishining buzilishi va to‘qimalarda gipoksiya rivojlanadi. Ushbu holatlar hayot uchun xavf tug‘diradi va tezkor tibbiy aralashuvni talab qiladi. Infuzion terapiya yordamida organizmning suyuqlik muvozanati tiklanadi, gemodinamik ko‘rsatkichlar barqarorlashadi va to‘qimalarning perfuziyasi yaxshilanadi. Bu esa hujayralarda metabolik jarayonlarning normallashishiga va organlar funksiyasining tiklanishiga olib keladi. Kristalloid eritmalar organizmda suyuqlik yetishmovchiligini tez bartaraf etishda samarali bo‘lsa, kolloid eritmalar tomir ichidagi suyuqlik hajmini uzoqroq saqlab turish xususiyatiga ega. Shu sababli reanimatsiya amaliyotida ushbu eritmalarni to‘g‘ri tanlash va qo‘llash muhim ahamiyatga ega. Infuzion terapiyani noto‘g‘ri yoki ortiqcha qo‘llash esa o‘pka shishi, yurak yuklamasining ortishi va boshqa asoratlarni keltirib chiqarishi mumkin. Shu sababli infuzion terapiya bemorning umumiy holati, gemodinamik ko‘rsatkichlari va laborator tekshiruv natijalariga asoslangan holda individual ravishda olib borilishi kerak.

XULOSA

Infuzion terapiya reanimatsiya va intensiv terapiya amaliyotining ajralmas qismi bo‘lib, kritik holatdagi bemorlarning hayotini saqlab qolishda muhim ahamiyatga ega. Ushbu terapiya yordamida organizmning suyuqlik muvozanati tiklanadi, gemodinamik barqarorlik ta'minlanadi va to‘qimalarning adekvat perfuziyasi yaxshilanadi. Kristalloid va kolloid eritmalar infuzion terapiyaning asosiy vositalari hisoblanib, ularning to‘g‘ri qo‘llanilishi davolash samaradorligini oshiradi. Infuzion terapiya natijasida mikrosirkulyatsiya yaxshilanadi, to‘qimalarning kislorod bilan ta'minlanishi ortadi va hayotiy muhim organlar faoliyati tiklanadi.

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ENERGY CONSUMPTION REDUCTION AND EFFICIENCY IMPROVEMENT IN ELECTROCHEMICAL WATER TREATMENT PROCESSES

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Annotation

The efficient treatment of industrial wastewater is a critical environmental concern, as many conventional methods are often ineffective for dealing with complex effluents. Electrochemical treatment methods, such as electrooxidation, electrocoagulation, and electroflotation, have been proposed as highly effective alternatives. However, energy consumption remains a key challenge in the widespread adoption of electrochemical processes. This article focuses on strategies to reduce energy consumption while enhancing the treatment efficiency of electrochemical processes in wastewater treatment. It discusses various factors influencing energy use, optimization techniques, and the development of more efficient electrochemical systems, with a focus on electrode material improvements, reactor design, and hybrid approaches.

Keywords: Electrochemical treatment, energy consumption, wastewater treatment, electrooxidation, electrocoagulation, electroflotation, energy efficiency, optimization, electrode materials, hybrid systems.

Introduction

Electrochemical methods for wastewater treatment offer significant advantages over conventional techniques, including the ability to degrade a wide range of organic pollutants, heavy metals, and other contaminants. These methods, which include electrooxidation, electrocoagulation, and electroflotation, are increasingly being used

to treat industrial effluents. Despite their efficiency and versatility, the high energy consumption associated with electrochemical processes is one of the main factors limiting their large-scale implementation. As energy costs rise and environmental concerns over energy consumption grow, it is crucial to develop strategies that reduce energy use while maintaining or improving treatment efficiency.

Energy consumption in electrochemical processes primarily depends on the applied current density, electrode material, reactor configuration, and the nature of the wastewater being treated. High current densities often result in faster treatment times but also lead to higher energy consumption. Thus, optimizing these parameters is essential for improving the efficiency of electrochemical water treatment systems. This article reviews the various strategies to reduce energy consumption in electrochemical processes, including advancements in electrode materials, reactor design, process optimization, and the integration of electrochemical methods with other treatment technologies.

Literature Review

The energy efficiency of electrochemical treatment methods has been extensively studied in recent years. Electrooxidation, electrocoagulation, and electroflotation are all energy-intensive processes, but they offer superior performance in removing difficult-to-treat pollutants. According to studies by Karimov (2017) and Kholbekov & Turgunov (2020), reducing energy consumption while maintaining high treatment efficiency requires careful control of several factors, including current density, electrode material choice, and reactor design.

One of the main challenges in electrochemical treatment is the optimization of electrode materials. The efficiency of electrochemical reactions is strongly influenced by the conductivity and surface area of the electrodes. Platinum and titanium electrodes, commonly used in electrochemical processes, offer excellent conductivity and durability but are costly. Recent research has focused on developing alternative materials, such as carbon-based electrodes and conductive polymers, which offer

similar performance at a lower cost. These materials have the potential to reduce energy consumption by improving the electrochemical reaction rates, thereby lowering the required current density.

Another important factor influencing energy consumption is the reactor design. Electrochemical reactors can vary significantly in terms of their configuration, such as flow-through reactors, batch reactors, and electrochemical cells. Optimizing the reactor design to maximize the surface area of the electrodes, minimize resistance, and ensure efficient mixing can significantly reduce energy requirements. Additionally, using larger electrode surface areas allows for the use of lower current densities, thus reducing energy consumption.

The integration of electrochemical methods with other treatment technologies, such as biological treatment or membrane filtration, has also been explored as a way to enhance treatment efficiency and reduce energy use. Hybrid systems, which combine electrochemical processes with other methods, can achieve higher removal efficiencies at lower energy costs. For instance, combining electrooxidation with ultrafiltration membranes has been shown to improve the removal of organic pollutants while reducing energy consumption by operating at lower current densities.

Methodology

This study is based on an extensive review of current literature on energy reduction techniques in electrochemical wastewater treatment. Research articles, technical papers, and case studies from various industries were analyzed to understand the challenges and strategies for reducing energy consumption in electrochemical processes. The focus was on the optimization of current density, electrode materials, reactor designs, and hybrid systems.

In addition to the literature review, several case studies from the textile, pharmaceutical, and chemical industries were examined to assess the practical implementation of energy-saving techniques. These case studies highlight the

challenges faced by industries in reducing energy consumption and offer insights into the best practices for energy-efficient electrochemical treatment.

Results

The contamination of water sources due to industrial discharge remains one of the most pressing global environmental issues. As industries continue to proliferate, the volume of industrial wastewater containing hazardous pollutants such as heavy metals, organic compounds, oils, and other toxins increases. Conventional treatment methods, including biological and chemical treatments, often face limitations in addressing the diverse and complex nature of industrial effluents. Electrochemical water treatment, an innovative and efficient technology, has emerged as a promising solution to tackle these challenges. This process uses the application of electric current through electrodes to degrade pollutants, offering several advantages, including reduced chemical usage, improved efficiency, and the potential for real-time treatment.

Electrochemical water treatment encompasses several methods, including electrooxidation, electrocoagulation, and electroflotation. These processes utilize electrochemical reactions that occur when an electric current passes through the wastewater, promoting oxidation, reduction, coagulation, and flotation reactions that result in the removal of contaminants. The primary advantage of these methods over traditional treatments lies in their ability to treat a wide range of pollutants, particularly organic substances, which are often difficult to remove using conventional approaches. The effectiveness of electrochemical methods is attributed to the generation of highly reactive species, such as hydroxyl radicals (•OH), at the anode, which can break down complex organic compounds into simpler, non-toxic byproducts like carbon dioxide and water. This makes electrochemical water treatment both environmentally sustainable and cost-effective.

The electrooxidation process is one of the most widely researched electrochemical methods for wastewater treatment. In this process, water passes through an electrochemical cell containing electrodes, typically made of materials like platinum,

titanium, or graphite. When an electric current is applied, oxidation reactions occur at the anode, leading to the generation of hydroxyl radicals that degrade organic pollutants. Electrooxidation has proven to be particularly effective for removing organic compounds such as phenols, pesticides, dyes, and pharmaceutical residues from industrial wastewater. In one study conducted by Muminov et al., electrooxidation was shown to remove over 90% of phenolic compounds from wastewater, making it a suitable technology for treating wastewater from industries like petrochemical, pharmaceutical, and textile manufacturing.

The efficiency of electrochemical water treatment depends significantly on the choice of electrode materials. Materials such as platinum and titanium are commonly used due to their high conductivity, chemical resistance, and stability in harsh environments. However, the high cost of these materials presents a challenge for large-scale applications. Consequently, researchers have focused on developing more affordable alternatives, such as carbon-based electrodes. Studies have shown that activated carbon, graphite, and carbon composites can achieve comparable performance to platinum and titanium electrodes, yet at a fraction of the cost. These alternative electrodes also offer additional benefits, such as higher surface area, which can enhance the electrochemical reaction rate, allowing for lower current densities and reduced energy consumption. This improvement in electrode materials is crucial for increasing the cost-effectiveness of electrochemical water treatment.

Another important consideration in electrochemical treatment is the reactor design. The design of the electrochemical reactor influences the energy efficiency and overall performance of the process. Electrochemical reactors vary in their configuration, with flow-through reactors, batch reactors, and fixed-bed reactors being the most common. Flow-through reactors, in particular, have gained attention due to their ability to process large volumes of wastewater continuously, making them suitable for industrial applications. The efficiency of a reactor depends on factors such as the electrode arrangement, flow rate, and residence time, which can be optimized to

improve treatment efficiency and minimize energy consumption. Studies have shown that optimizing these parameters can result in up to a 30% reduction in energy usage without compromising treatment performance.

Energy consumption remains a key challenge in electrochemical water treatment, particularly in large-scale applications. The energy required for electrochemical processes is proportional to the applied current density, which in turn affects the rate of pollutant removal. Higher current densities can accelerate the treatment process, but they also increase energy consumption. To address this issue, research has focused on optimizing current density and reactor design to achieve a balance between treatment efficiency and energy use. Studies by Akhmedov et al. (2021) have demonstrated that reducing the current density from 100 A/m² to 50 A/m² can result in a 40% reduction in energy consumption while still achieving effective pollutant removal. This optimization of process parameters is essential for making electrochemical water treatment more energy-efficient and economically viable.

In addition to energy consumption, the production of byproducts during electrochemical treatment is another factor that requires attention. Some electrochemical processes, particularly electrooxidation, can generate harmful byproducts such as chlorine gas and ozone. These byproducts can pose risks to both the environment and human health if not properly managed. For example, chlorine gas is a toxic substance that can be harmful when released into the atmosphere or waterways. To mitigate these risks, researchers have developed methods to control and capture these byproducts. For instance, the use of gas scrubbers or catalytic converters can safely remove chlorine and ozone, ensuring that the electrochemical treatment process remains environmentally friendly.

Recent advancements in electrochemical treatment also include the development of hybrid systems that combine electrochemical methods with other treatment technologies. For example, electrooxidation has been successfully combined with membrane filtration systems, such as ultrafiltration or nanofiltration, to improve the

removal of fine particulates and dissolved organic matter. These hybrid systems offer enhanced treatment efficiency and can be tailored to meet the specific needs of different industries. In a study conducted by Kholbekov and Turgunov, the integration of electrooxidation with ultrafiltration resulted in an impressive 98% removal rate of organic contaminants, compared to 85% removal using electrooxidation alone. Hybrid systems also offer the advantage of reducing energy consumption by operating at lower current densities, further enhancing the sustainability of electrochemical water treatment.

Electrochemical treatment has found widespread application in various industries. In the textile industry, for example, electrooxidation has been used to effectively remove azo dyes and other synthetic chemicals from wastewater. A study by Karimov demonstrated that electrooxidation could remove up to 95% of dye content from textile effluents, significantly reducing the environmental impact of textile manufacturing. Similarly, in the pharmaceutical industry, electrochemical treatment has been shown to degrade pharmaceutical residues, such as antibiotics and analgesics, which are commonly found in wastewater and pose risks to aquatic ecosystems. Electrooxidation has proven to be effective in removing up to 90% of pharmaceutical pollutants from wastewater, making it a promising solution for wastewater treatment in the pharmaceutical sector.

In conclusion, electrochemical water treatment processes offer an efficient and sustainable solution to the problem of industrial wastewater management. By utilizing the power of electrochemical reactions, these processes can effectively degrade a wide range of organic pollutants, including those that are resistant to traditional treatment methods. The reduction in energy consumption and the development of cost-effective electrode materials are key factors in making electrochemical treatment more feasible for industrial applications. Furthermore, the integration of electrochemical methods with other treatment technologies, such as membrane filtration and biological treatment, provides a more energy-efficient and cost-effective approach to wastewater

treatment. As the demand for sustainable wastewater treatment technologies grows, electrochemical treatment is poised to play a key role in improving water quality and minimizing the environmental impact of industrial activities.

The reduction of energy consumption in electrochemical water treatment has been achieved through several strategies, each targeting different aspects of the electrochemical process.

1. **Electrode Material Optimization**: Research on electrode materials has demonstrated that carbon-based electrodes, such as graphite and activated carbon, offer a cost-effective alternative to platinum and titanium electrodes. These materials have shown comparable electrochemical performance and can significantly reduce energy consumption by enhancing the reaction efficiency. Carbon electrodes, in particular, have a high surface area, which increases the electrochemical reaction rates, allowing for lower current densities and reduced energy usage.

2. **Reactor Design**: Optimizing the design of electrochemical reactors has proven to be a critical factor in reducing energy consumption. In particular, the use of flow-through reactors with high electrode surface areas and efficient mixing can lower the resistance in the system, allowing for the application of lower current densities. Additionally, using modular reactors with adjustable configurations allows for fine-tuning the system to the specific needs of the wastewater, further reducing energy use.

3. **Process Optimization**: Process parameters, such as current density, voltage, and electrolyte concentration, can be optimized to minimize energy consumption while maximizing pollutant removal. Lowering the current density reduces the energy needed for electrochemical reactions but may result in longer treatment times. A balance must be struck between energy efficiency and treatment time to ensure cost-effectiveness. Studies by Kholbekov, Turgunov and Akhmedov highlight the importance of adjusting these parameters based on the characteristics of the wastewater being treated.

4. **Hybrid Systems**: The integration of electrochemical methods with other treatment technologies has shown promise in reducing energy consumption. For example, combining electrooxidation with membrane filtration, such as ultrafiltration or nanofiltration, allows for the removal of fine particulates and dissolved organic matter at lower energy inputs. Hybrid systems that combine electrochemical methods with biological treatment have also been shown to achieve high removal efficiencies with reduced energy consumption. These hybrid systems provide a more sustainable and cost-effective solution for wastewater treatment, particularly for complex industrial effluents.

The overall reduction in energy consumption achieved through these strategies varies depending on the specific treatment method and wastewater characteristics. However, in many cases, energy consumption can be reduced by up to 30-40% by optimizing electrode materials, reactor designs, and process parameters.

Conclusion

Reducing energy consumption while maintaining or improving the treatment efficiency of electrochemical processes is crucial for the widespread adoption of electrochemical methods in industrial wastewater treatment. The optimization of electrode materials, reactor design, and process parameters has proven to be effective in achieving energy efficiency. Advances in electrode material technology, particularly the use of carbon-based electrodes, have allowed for lower current densities and reduced energy usage. Furthermore, the integration of electrochemical methods with other treatment technologies, such as membrane filtration or biological treatment, has provided a more energy-efficient approach to wastewater treatment.

As energy costs continue to rise and environmental regulations become stricter, the need for energy-efficient wastewater treatment technologies will increase. By optimizing electrochemical systems and developing hybrid approaches, industries can reduce their environmental impact and operational costs while improving the sustainability of their wastewater management practices.

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