TIBBIYOT
TA'LIMI & INNOVATSIYALARI



- 14.00.00 - Tibbiyot fanlari;
- 14.00.01 - Akusherlik va ginekologiya;
- 14.00.02 - Morfologiya;
- 14.00.03 - Endokrinologiya;
- 14.00.04 - Otorinolaringologiya;
- 14.00.05 - Ichki kasalliklar;
- 14.00.06 - Kardiologiya;
- 14.00.07 - Gigiena;
- 14.00.08 - Oftal'mologiya;
- 14.00.09 - Pediatriya;
- 14.00.10 - Yuqumli kasalliklar;
- 14.00.11 - Dermatologiya va venerologiya;
- 14.00.12 - Tibbiy reabilitologiya;
- 14.00.13 - Nevrologiya;
- 14.00.14 - Onkologiya;
- 14.00.15 - Patologik anatomiya;
- 14.00.16 - Normal va patologik fiziologiya;
- 14.00.17 - Farmakologiya va klinik farmakologiya;
- 14.00.18 - Psixiatriya va narkologiya;
- 14.00.19 - Klinik radiologiya;
- 14.00.20 - Tibbiy genetika;
- 14.00.21 - Stomatologiya;
- 14.00.22 - Travmatologiya va ortopediya;
- 14.00.23 - Hamshiralik ishini tashkil etish;
- 14.00.24 - Sud tibbiyoti;
- 14.00.27 - Xirurgiya;
- 14.00.28 - Neyroxirurgiya;
- 14.00.41 - Xalq tabobati;
- 14.00.35 - Bolalar xirurgiyasi;
- 14.00.34 - Yurak-qon tomir xirurgiyasi

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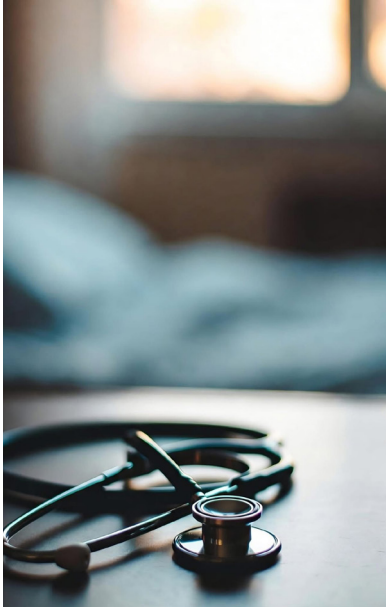
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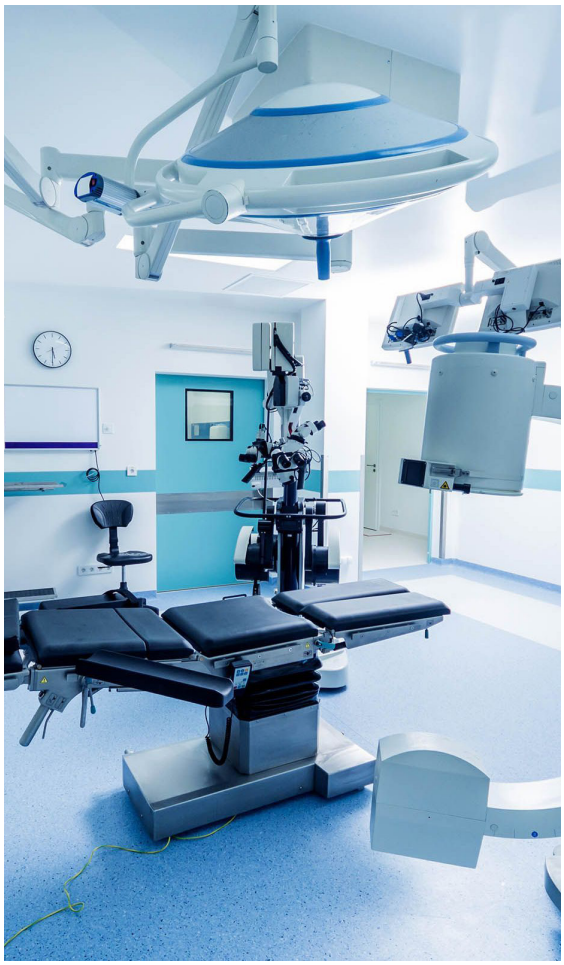
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MUNDARIJA

SEREBROVASKULYAR KASALLIKLARDA BUYRAK SHIKASTLANISHINING ISHEMIK-GIPOKSIK MEXANIZMLARI: HIF-1α VA TGF-β1 KO‘RSATKICHLARINING YOSHGA BOG‘LIQ O‘ZGARISHLARI 16
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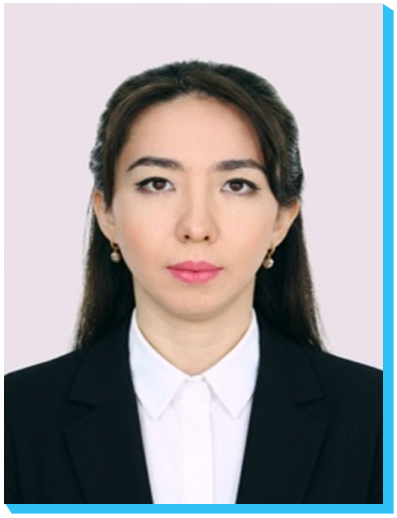
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NEUROLOGICAL COMPLICATIONS ASSOCIATED WITH EPIDURAL ANESTHESIA IN OBSTETRIC PATIENTS: A CLINICAL-STATISTICAL ANALYSIS

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Abstract: Epidural anesthesia (EA) remains the gold standard for labor analgesia worldwide. While its efficacy in pain management is well established, neurological complications present critical challenges for both obstetricians and neurologists. This study evaluates the incidence, clinical spectrum, and underlying risk factors of neurological complications associated with EA in a cohort of 1,240 obstetric patients. Prospective clinical monitoring and neuroimaging were used to assess postpartum neurological deficits. The overall incidence of neurological complications was 0.89% (11 cases). Transient postpartum nerve palsies, predominantly involving the peroneal nerve, were the most prevalent mechanical complications (0.48%), followed by post-dural puncture headache (PDPH) requiring epidural blood patch intervention (0.32%). Severe structural injuries, such as spinal epidural hematoma or abscess, occurred in 0.08% of cases. Statistical analysis confirmed that multiple insertion attempts (>3) and maternal body mass index (BMI >35 kg/m²) were significantly associated with an increased risk of neurological sequelae ($p < 0.05$). Early multidisciplinary diagnosis, including prompt neurological assessment, ensures favorable outcomes and helps prevent permanent motor or sensory deficits.

Key words: Epidural anesthesia; neurological complications; obstetric neurology; postpartum neuropathy; post-dural puncture headache; clinical statistics.

Annotatsiya: Epidural anesteziya (EA) butun dunyoda tug‘ruqni og‘riqsizlantirishning oltin standarti bo‘lib qolmoqda. Uning og‘riqni boshqarishdagi samaradorligi yaxshi tasdiqlangan bo‘lsa-da, nevrologik asoratlar akusherlar va nevrologlar uchun jiddiy muammolarni yuzaga keltiradi. Ushbu tadqiqot 1 240 nafar akusherlik bemoridan iborat kohortada EA bilan bog‘liq nevrologik asoratlarning uchrash chastotasi, klinik spektri va asosiy xavf omillarini baholashga qaratilgan. Tug‘ruqdan keyingi nevrologik buzilishlarni baholash uchun prospektiv klinik monitoring va neyrovizualizatsiya usullaridan foydalanildi. Nevrologik asoratlarning umumiy uchrash chastotasi 0,89%ni (11 ta holat) tashkil etdi. Eng ko‘p uchragan mexanik asoratlar asosan peroneal nerv zararlanishi bilan namoyon bo‘lgan tranzitor tug‘ruqdan keyingi nevropatiyalar (0,48%) bo‘lib, ulardan keyin epidural qon patchi yordamida davolashni talab qilgan postdural punksion bosh og‘rig‘i (PDPH) (0,32%) qayd etildi. Orqa miya epidural gematomasi yoki absessi kabi og‘ir strukturaviy shikastlanishlar 0,08% holatda kuzatildi. Statistik tahlil bir necha marta kiritishga urinishlar (>3) va onaning tana massasi indeksi (BMI >35 kg/

m²) nevrologik oqibatlar rivojlanish xavfining oshishi bilan statistik jihatdan sezilarli bog‘liqligini tasdiqladi ($p < 0,05$). Erta multidissiplinar diagnostika, shu jumladan o‘z vaqtida nevrologik baholash, ijobiy klinik natijalarni ta’minlaydi va doimiy motor yoki sensor nuqsonlarning oldini olishga yordam beradi.

Kalit so‘zlar: epidural anesteziya; nevrologik asoratlar; akusherlik nevrologiyasi; tug‘ruqdan keyingi nevropatiya; postdural punksion bosh og‘rig‘i; klinik statistika.

Аннотация: Эпидуральная анестезия (ЭА) остаётся золотым стандартом обезболивания родов во всём мире. Несмотря на доказанную эффективность в обеспечении адекватного обезболивания, неврологические осложнения представляют собой серьёзную проблему как для акушеров, так и для неврологов. Целью данного исследования была оценка частоты, клинического спектра и основных факторов риска неврологических осложнений, связанных с ЭА, в когорте из 1 240 пациенток акушерского профиля. Для оценки послеродовых неврологических нарушений проводились проспективное клиническое наблюдение и нейровизуализация. Общая частота неврологических осложнений составила 0,89% (11 случаев). Наиболее распространёнными механическими осложнениями были транзиторные послеродовые невропатии, преимущественно с поражением малоберцового нерва (0,48%), за которыми следовала постпункционная головная боль (PDPH), потребовавшая проведения эпидуральной пломбировки аутологичной кровью (0,32%). Тяжёлые структурные повреждения, такие как спинальная эпидуральная гематома или абсцесс, наблюдались в 0,08% случаев. Статистический анализ подтвердил, что многократные попытки введения иглы (>3) и индекс массы тела матери (ИМТ >35 кг/м²) были статистически значимо связаны с повышенным риском неврологических последствий ($p < 0,05$). Ранняя мультидисциплинарная диагностика, включающая своевременную неврологическую оценку, способствует благоприятным исходам и помогает предотвратить стойкий двигательный или чувствительный дефицит.

Ключевые слова: эпидуральная анестезия; неврологические осложнения; акушерская неврология; послеродовая невропатия; постпункционная головная боль; клиническая статистика.

INTRODUCTION

The utilization of neuraxial analgesia, specifically epidural anesthesia (EA), has revolutionized modern obstetric practice by providing effective pain relief during labor and delivery. Annually, millions of women undergo this procedure worldwide. Despite advances in needle design, refined drug regimens, and improved clinician training, the anatomical proximity of the epidural space to vital central and peripheral nervous system structures inherently carries a baseline risk of neurological injury [1]. Neurological complications following labor epidural procedures can range from benign, self-limiting sensory blocks to catastrophic, permanent paraplegia. In obstetric neurology, distinguishing between intrinsic obstetric palsies—caused by fetal head compression or maternal positioning during prolonged labor—and direct anesthesia-induced trauma can be highly complex. Anesthesia-induced complications typically result from direct needle trauma to the nerve roots, chemical neurotoxicity of local anesthetics, ischemic injury due to spinal or epidural hematoma, or infectious processes such as epidural abscesses [4].

Given the urgent need for clinicians to ensure maternal safety, understanding the exact statistical distribution and clinical presentation of these complications is paramount. There is a scarcity of comprehensive clinical and statistical data from regional healthcare centers specifically correlating maternal physical parameters, such as body mass index (BMI) and anatomical variations, with the technical difficulty of neuraxial block placement and subsequent neurological outcomes [11]. This study aims to systematically analyze the clinical spectrum, determine the precise incidence rates, and identify major risk factors contributing to neurological complications in parturients undergoing epidural anesthesia at a tertiary perinatology center.

LITERATURE REVIEW

The neurological safety of neuraxial analgesia in obstetrics has been the subject of rigorous clinical investigation over the past several decades. Early seminal studies primarily focused on identifying the structural and chemical risks associated with central neuraxial blocks. Over time, large-scale clinical registries, such as the Serious Complication Repository Project of the Society for Obstetric Anesthesia and Perinatology (SOAP), established that while severe injuries are rare, the clinical burden of transient neurological deficits remains significant. Recent epidemiological data confirm that the incidence of these complications varies according to institutional protocols and patient demographics. Contemporary literature divides epidural-associated neurological deficits into direct mechanical trauma and indirect ischemic or infectious injuries. Direct needle

trauma to nerve roots during difficult punctures can result in immediate or delayed paresthesia and motor weakness.

Furthermore, technical complications such as accidental dural puncture can lead to intracranial hypotension, manifesting as severe post-dural puncture headache (PDPH). The management of PDPH has shifted toward early intervention with an autologous epidural blood patch (EBP), with clinical trials demonstrating rapid symptomatic relief compared with conservative therapies. Recent research has placed considerable emphasis on the role of maternal physiological risk factors in complicating neuraxial placement. Obese parturients present significant anatomical challenges, including loss of palpable landmarks, which substantially increases the likelihood of multiple needle passes. Repeated insertion attempts significantly increase the risk of accidental dural puncture and direct mechanical trauma to peripheral and radicular nerves. Consequently, modern obstetric guidelines increasingly advocate for the integration of pre-procedure spinal ultrasound to map spinal anatomy in high-risk patients, particularly those with obesity, in order to mitigate these preventable technical risks.

RESEARCH METHODOLOGY

A prospective, observational cohort study was conducted over a defined clinical period at a high-volume tertiary obstetric hospital. A total of 1,240 pregnant women who received epidural anesthesia for either vaginal delivery or elective or urgent cesarean section were enrolled in the study. Institutional ethical approval was obtained, and written informed consent was obtained from all participants prior to neuraxial placement. Inclusion criteria: Term pregnancies (≥37 weeks), singleton gestations, and successful or attempted placement of a labor epidural catheter. Exclusion criteria: Pre-existing peripheral neuropathies, spinal deformities, active neurological diseases (e.g., multiple sclerosis), or absolute contraindications to neuraxial blocks [8]. Epidural blocks were performed by senior staff anesthesiologists or supervised fellows. Procedures were carried out under sterile conditions with patients in either the sitting or lateral decubitus position. Standard Tuohy needles (18G) were used, and the epidural space was identified primarily using the loss-of-resistance (LOR) to saline or air technique. Catheters were advanced 3–5 cm into the epidural space. The primary local anesthetic regimens consisted of low-dose bupivacaine or ropivacaine combined with fentanyl [2].

All patients were clinically monitored daily during their postpartum hospitalization. Patients presenting with persistent paresthesia, localized motor weakness, severe atypical headaches, or bladder dysfunction lasting more than 24 hours after delivery underwent an immediate, comprehensive neurological examination by a staff neurologist. Neuroimaging modalities, including lumbar spinal magnetic resonance imaging (MRI) or computed tomography (CT), were mandated for any patient presenting with progressive motor weakness, signs of spinal cord compression, or suspected epidural hematoma. Electromyography (EMG) and nerve conduction studies were reserved for patients with peripheral deficits persisting beyond 3 weeks [5]. Statistical analyses were performed using SPSS Version 26.0. Continuous variables were expressed as mean ± standard deviation (M ± SD), while categorical data were analyzed using frequencies and percentages. The chi-square test (χ^2) and Fisher's exact test were used to evaluate associations between maternal risk factors (BMI, number of needle passes, and spinal anatomy) and the occurrence of complications. A p-value of <0.05 was designated as the threshold for statistical significance.

ANALYSIS AND RESULTS

Among the 1,240 parturients evaluated, 11 patients developed confirmed neurological complications directly or indirectly attributable to epidural anesthesia, representing an overall incidence rate of 0.89%. The remaining 1,229 patients experienced an uneventful recovery with normal return of sensory and motor functions. The clinical presentations observed among the affected cohort were categorized based on their anatomical and pathological characteristics. Transient peripheral neuropathies were the most common mechanical event, noted in 6 cases (0.48%). Post-dural puncture headache (PDPH), presenting with severe postural cephalalgia requiring aggressive management, occurred in 4 cases (0.32%). Structural central nervous system injury, specifically a minor spinal epidural hematoma that resolved with conservative management, was detected in 1 patient (0.08%). No cases of permanent paraplegia or deep epidural abscesses were recorded. The detailed breakdown of these clinical events, along with their respective onset times and resolution windows, is presented systematically in Table 1.

Table 1. Statistical and Clinical Classification of Observed Neurological Complications (n=1,240)

Complication Type	Number of Cases (n)	Percentage (%)	Clinical Onset (Post-procedure)	Average Resolution Time
Peroneal/Femoral Neuropathy	6	0.48%	12–24 hours	2–6 weeks
Post-Dural Puncture Headache (PDPH)	4	0.32%	24–48 hours	3–5 days (with Blood Patch)
Spinal Epidural Hematoma	1	0.08%	6–12 hours	3 months (Conservative)
Epidural Abscess / Meningitis	0	0.00%	—	—
Total	**11**	**0.89%**	—	—

Statistical correlation analyses demonstrated that technical difficulty during needle exploration and maternal physiological traits were critical indicators of complication development. Specifically, a maternal Body Mass Index (BMI) exceeding 35 kg/m² significantly limited clear anatomical landmark palpation, inevitably escalating the number of needle passes. As illustrated in the clustered bar chart (Figure 1), the baseline neurological complication rate in parturients with a normal BMI (<25 kg/m²) was exceptionally low at 0.24%, whereas it rose to 1.85% in the severely obese cohort (BMI >35 kg/m²). Furthermore, a highly critical correlation was confirmed between the number of needle insertion attempts and the occurrence of either transient nerve root compression or accidental dural puncture leading to severe headache. As tracked in the trendline graph (Figure 2), in patients where the epidural space was successfully identified within 1 pass, the complication probability remained at 0.16%. However, when 3 or more insertion attempts were required due to anatomical challenges, the risk increased to 4.75%. This difference was found to be highly significant under the chi-square test ($\chi 2=18.45, p<0.01$).

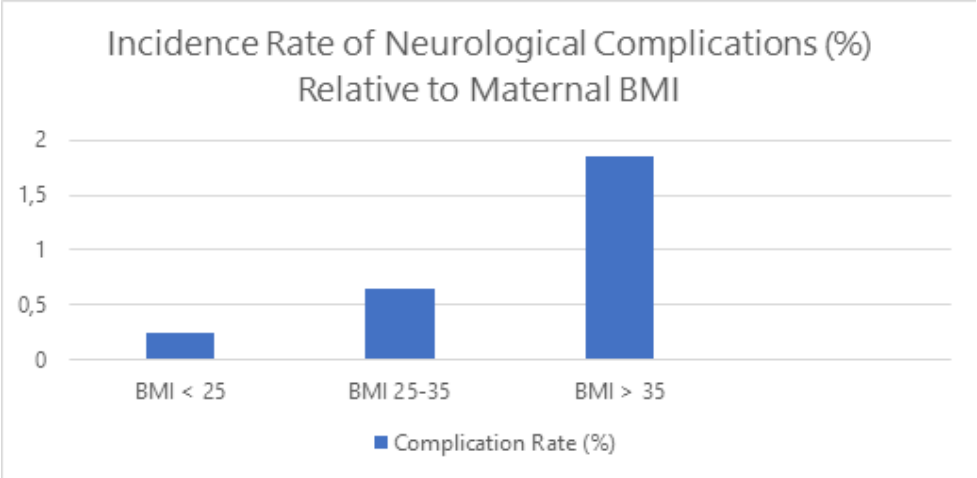


Figure 1. Incidence Rate of Neurological Complications (%) Relative to Maternal BMI

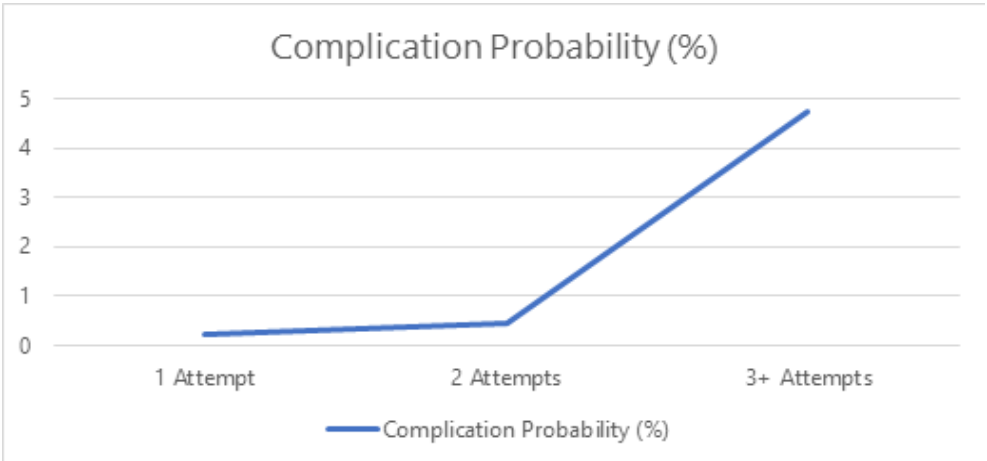


Figure 2. Complication Probability (%) Based on Number of Needle Insertion Passes

The results of our prospective clinical and statistical analysis confirm that, while epidural anesthesia remains an extremely safe modality for labor pain management, it carries a small but clinically significant risk of neurological complications (0.89%). This incidence is consistent with major international registries, which report neuraxial complication rates ranging from 0.1% to 1.2% [3, 6]. Our finding that transient peripheral neuropathies were the most common complication (0.48%) underscores the ongoing diagnostic dilemma in obstetric wards. Most of these peripheral neuropathies—manifesting as foot drop or thigh paresthesia—are secondary to compression of the lumbosacral trunk against the pelvic rim during difficult labor rather than direct needle trauma. However, prolonged or poorly directed Tuohy needle manipulation can cause direct microvascular damage to radicular nerves. The statistical significance of multiple needle passes ($p < 0.01$) in our cohort supports the hypothesis that mechanical trauma during difficult insertions is a major modifiable risk factor [7, 12]. Post-dural puncture headache occurred in 0.32% of our patients. This is typically caused by an unintended puncture of the arachnoid mater, leading to cerebrospinal fluid (CSF) leakage and subsequent intracranial hypotension. In our study, 3 out of 4 PDPH cases required an autologous epidural blood patch (EBP) because conservative measures (hydration, caffeine, and NSAIDs) failed. The rapid resolution of symptoms within 48 hours after EBP highlights its role as a highly effective intervention [9, 10].

The occurrence of one case of spinal epidural hematoma (0.08%) serves as a stark reminder of potential structural complications. Even in the absence of documented coagulopathy, multiple needle attempts can damage the extensive epidural venous plexus. This patient presented with severe, localized back pain and an evolving sensory deficit 8 hours postpartum. Prompt neurological consultation and urgent MRI allowed for a definitive diagnosis. Because the neurological deficits were non-progressive and mild, conservative management under strict hourly neurological monitoring was selected, resulting in complete clinical resolution at the 3-month follow-up [13, 14]. These outcomes emphasize that maternal obesity (BMI >35 kg/m²) acts as a primary catalyst for technical complications. The resulting loss of palpable anatomical landmarks inevitably leads to multiple punctures, increasing the probability of both accidental dural puncture and nerve root irritation. Utilizing pre-procedure spinal ultrasound in obese parturients could serve as a valuable technological advancement to minimize these risks [15].

CONCLUSION

Epidural anesthesia in obstetrics exhibits a favorable safety profile, with an overall neurological complication rate of 0.89% in our study. The vast majority of these events are transient and minor, resolving completely within a few weeks with conservative management. However, severe complications such as spinal epidural hematoma can occur. Maternal obesity and repetitive needle insertion attempts are the strongest predictors of neurological sequelae. To ensure optimal maternal outcomes, obstetric units must implement a strict multidisciplinary approach. Any postpartum sensory or motor deficit should trigger an immediate neurological assessment to rule out compressive structural lesions and initiate early, targeted rehabilitation.

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TIBBIYOT
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Mas’ul kotib: Surmaniso Mirzaliyeva

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