



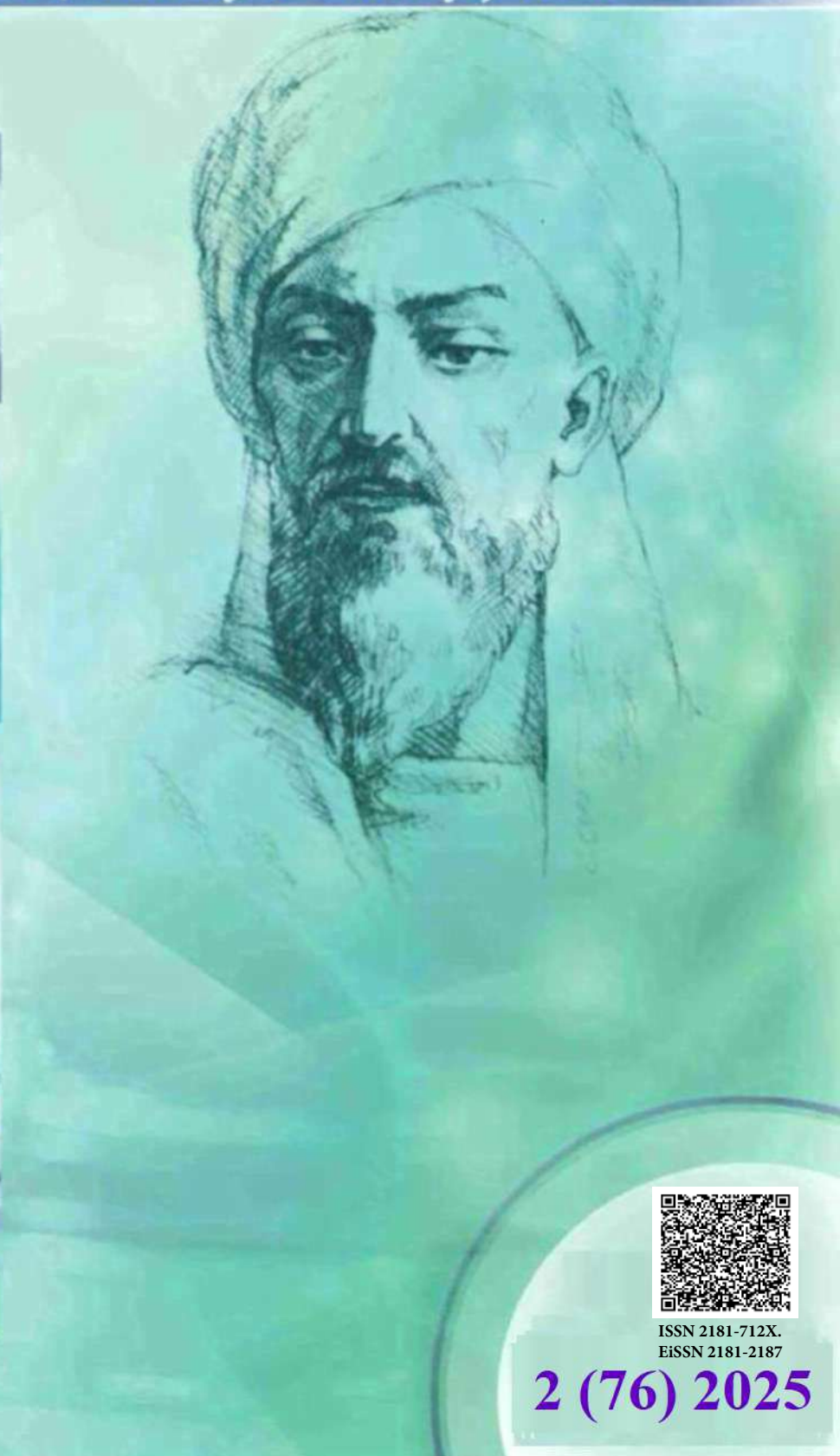
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ТИББИЁТДА ЯНГИ КУН НОВЫЙ ДЕНЬ В МЕДИЦИНЕ NEW DAY IN MEDICINE

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PRINCIPLES OF DIAGNOSIS AND PROGNOSIS IN ACUTE DOUBLE NECK VERTEBRAE AND SPINAL CORD INJURIES IN CHILDREN

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✓ Resume

This article examines the challenges associated with diagnosing and surgically treating pediatric spinal cord and vertebral injuries. The increasing prevalence of spinal trauma in children underscores the need for accurate diagnostic strategies and appropriate surgical interventions. A retrospective study of 237 pediatric patients revealed a range of diagnostic and surgical errors, including the misclassification of unstable fractures as non-surgical cases and inappropriate surgical techniques such as isolated laminectomy without stabilization.

Keywords: pediatric spinal trauma, vertebral injuries, spinal cord injury, spinal deformities, laminectomy, transpedicular fixation.

ПРИНЦИПЫ ДИАГНОСТИКИ И ПРОГНОЗИРОВАНИЯ ОСТРЫХ ДВОЙНЫХ ШЕЙНЫХ ПОЗВОНКОВ И ТРАВМ СПИННОГО МОЗГА У ДЕТЕЙ

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✓ Резюме

В этой статье рассматриваются проблемы, связанные с диагностикой и хирургическим лечением травм спинного мозга и позвоночника у детей. Растущая распространенность травм позвоночника у детей подчеркивает необходимость точной диагностики и соответствующих хирургических вмешательств. Ретроспективное исследование 237 педиатрических пациентов выявило ряд диагностических и хирургических ошибок, включая неправильную классификацию нестабильных переломов как нехирургических случаев и неподходящие хирургические методы, такие как изолированная ламинэктомия без стабилизации.

Ключевые слова: детская спинномозговая травма, повреждения позвонков, повреждение спинного мозга, деформации позвоночника, ламинэктомия, транспедикулярная фиксация

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✓ Rezyume

Ushbu maqolada Pediatrik orqa miya va umurtqali jarohatlarni tashxislash va jarrohlik yo'li bilan davolash bilan bog'liq muammolar ko'rib chiqiladi. Bolalarda o'murtqa travmaning tobora ko'payib borishi aniq diagnostika strategiyalari va tegishli jarrohlik aralashuvlar zarurligini ta'kidlaydi. 237 Pediatrik bemorni retrospektiv o'rganish bir qator diagnostik va jarrohlik xatolarni, shu jumladan beqaror yoriqlarni jarrohlik bo'lmagan holatlar sifatida noto'g'ri tasniflashni va stabillashmasdan izolyatsiya qilingan laminektomiya kabi noo'rin jarrohlik usullarini aniqladi.

Kalit so'zlar: bolalar orqa miya shikastlanishi, umurtqa pog'onasi shikastlanishi, orqa miya shikastlanishi, orqa miya deformatsiyalari, laminektomiya, transpedikulyar fiksatsiya.

Relevance

The importance of early diagnosis and appropriate treatment strategies for children with spinal cord and vertebral injuries is increasing due to the growing number of pediatric cases. This trend is confirmed by recent statistical data from Andijan, which indicate that the incidence of compression fractures of the spine in children has risen from 5% of all spinal injuries in 2013 to 7% in 2024. Both domestic and international studies have explored the surgical treatment of children with unstable and complicated spinal injuries [2–5, 7]. However, existing research primarily focuses on assessing complications and errors in the treatment of spinal cord injuries in adults [6].

A review of the available literature revealed a lack of publications specifically analyzing diagnostic errors, treatment approaches, and the scope of surgical intervention in pediatric patients with spinal cord and vertebral injuries.

The aim of the study: to study the principles of diagnosis and prediction of acute double cervical spine injuries and spinal cord trauma in children

Materials and methods

A retrospective study was conducted on 237 pediatric patients aged 3 to 17 years who had suffered spinal cord and vertebral injuries. Among them, 23% (54 children) were diagnosed with cervical, thoracic, or lumbar fractures complicated by neurological impairments, while the remaining 77% (183 children) had unstable spinal injuries. The distribution of injuries based on their location revealed that 10.1% involved cervical spine fractures, 23.2% affected the thoracic region, 30% were thoracolumbar fractures, and 36.7% involved the lumbosacral area.

All patients included in the study were referred from various hospitals across Uzbekistan, both pediatric and adult healthcare facilities. The time of admission varied significantly, ranging from a few hours to up to three years after the initial injury.

Upon hospital admission, spinal X-rays were conducted in two standard projections. When unstable fractures were suspected, CT scans were performed for a more detailed assessment, and in cases involving spinal cord trauma, MRI was considered mandatory. The study aimed to identify and analyze diagnostic and surgical errors at various stages of treatment, highlighting the critical importance of timely and accurate diagnosis in preventing complications and ensuring better clinical outcomes.

Results and discussion

The analysis of clinical data revealed both diagnostic and surgical errors in the management of pediatric spinal injuries. One of the primary diagnostic errors was the underestimation of the severity and nature of spinal trauma in children. Many unstable spinal fractures were mistakenly classified as compression fractures of the vertebral bodies, which were considered non-surgical cases. A retrospective review of medical records identified this misdiagnosis in 26 children (11%), leading to inappropriate treatment approaches.

Surgical errors were categorized into tactical and technical mistakes. Tactical errors included:

Performing laminectomy for complicated spinal fractures,

Using anterior metal constructs in cases where they were not indicated,

Failing to perform timely reconstruction of the anterior and middle spinal columns in unstable fractures.

Technical errors primarily involved incorrect placement of transpedicular screws, leading to inadequate stabilization and postoperative complications.

Children with misdiagnosed unstable spinal fractures were subjected to conservative therapy, which included strict bed rest, functional spinal traction, unloading of the affected vertebral-motor segment, therapeutic exercises based on the Gorinevskaya-Dreving method, spinal massage, and physiotherapy. However, relying on conservative treatment in the hope that children's natural growth potential would restore vertebral height and shape proved to be ineffective in these cases.

Inadequate treatment of unstable spinal injuries in growing children often led to rapid spinal decompensation, resulting in the progressive development of post-traumatic kyphotic deformities. These deformities were accompanied by spinal instability and persistent pain in the affected area, eventually leading to vertebro-medullary conflict at the apex of the curvature. Over time, this condition manifested as clinical myelopathy, further complicating the patient's prognosis and quality of life.

Another significant challenge in the surgical management of pediatric spinal cord and vertebral injuries is the inappropriate selection of surgical tactics and scope of intervention. One of the most common errors in treating complicated spinal fractures is performing laminectomy at the level of injury via a dorsal approach, followed by spinal canal revision for spinal cord decompression, without subsequent stabilization using metallic implants. This flawed surgical approach was identified in 9 cases (3.8%).

However, performing decompressive laminectomy alone in such patients not only failed to facilitate neurological recovery, but also led to the development of severe spinal instability due to the removal of the posterior supporting column at the affected level. This, in turn, resulted in the progression of post-traumatic kyphotic deformity of the spinal segment caused by segmental instability.

As a consequence, spinal cord compression worsened, leading to a further decline in neurological function. Instead of improving neurological deficits, this misguided approach exacerbated spinal deformity, causing worsening neurological symptoms and a more complex clinical course for the affected patients.

Another frequent surgical error in the treatment of unstable and complicated spinal injuries in children is the incorrect placement of transpedicular fixation elements. According to our study, this complication occurred in 6 cases (2.5%).

Improperly positioned pedicle screws failed to provide adequate realignment during surgery, preventing the restoration of vertebral height and shape, proper anatomical alignment of the damaged spinal segment, and spinal canal integrity. Additionally, incorrect screw placement compromised post-surgical stability, leading to insufficient fixation.

In the long-term postoperative period, these patients experienced destabilization of the metal implants, progressive spinal deformity at the injury site, spinal canal stenosis, and vertebro-medullary conflict. Clinically, these complications manifested as chronic pain and worsening neurological deficits.

As a result, radiological findings and worsening clinical symptoms often necessitated revision surgery to address implant failure, correct deformities, and restore spinal stability.

Another critical error in the surgical treatment of pediatric patients with unstable spinal injuries is the use of anterior spinal fixation systems. In our study, ventral metal implants were utilized in 3 cases

(1.3%). This surgical approach was intended to reconstruct the anterior and middle columns of the damaged vertebral body, restore spinal canal anatomy, and stabilize the injured segment through a single anterolateral approach.

However, ventral spinal fixation in growing children led to the development and progression of kyphotic deformities at the operated segment during the child's growth and development. This issue arose due to the continued growth of the intact posterior supporting column, while the anterior and middle columns remained fixed by the metal implants.

As a result, all three patients in this study experienced progressive kyphotic spinal deformities at the site of anterior fixation, which clinically manifested as myelopathy. The severity of the condition necessitated revision surgery to correct the pathological kyphosis and restore proper spinal alignment and function.

Another significant error in the surgical management of pediatric patients with unstable spinal injuries is the failure to perform timely reconstruction of the anterior and middle spinal columns at the fracture site. In our study, this mistake was observed in 3 cases (1.3%), all involving multiple unstable vertebral fractures.

In pediatric patients with unstable and often multi-level adjacent vertebral injuries, performing posterior internal realignment and fixation of the spinal motion segment is considered the optimal approach to correcting deformities during the acute phase of trauma. However, even when initial realignment successfully restores the shape and height of the anterior and middle columns, progressive kyphotic deformity may develop over time as the child continues to grow and develop.

This gradual worsening of spinal deformity is primarily caused by the lack of reconstructive stabilization surgeries in the ventral regions of the injured spinal segment. As a result, the long-term stability of the correction is compromised, leading to the loss of the initially achieved alignment and progression of kyphotic curvature at the injury level.

Conclusion

Among the key challenges in the comprehensive treatment of children with unstable and complicated spinal injuries, several critical factors can be identified.

A majority of pediatric patients are admitted to hospitals where neurosurgeons and traumatologists—who often lack specialized training in spinal surgery—provide medical care. Additionally, some children with spinal cord and vertebral injuries are admitted to adult hospitals, where physicians may overlook the unique characteristics of pediatric spinal fractures in a growing spine.

This lack of awareness leads to insufficient diagnostic assessments of spinal and spinal cord injuries in children. Many hospitals fail to conduct comprehensive imaging such as X-rays, CT scans, and MRI, which are essential for an accurate diagnosis. The absence of thorough evaluations, combined with a lack of expertise in diagnosing spinal injuries in pediatric patients, often results in diagnostic errors. Consequently, inadequate treatment strategies are applied to children with unstable and complicated spinal fractures.

Errors in surgical management of pediatric spinal injuries necessitate revision surgeries and, in some cases, can lead to irreversible complications. The failure to adopt appropriate surgical techniques increases the risk of long-term spinal deformities, neurological deterioration, and poor functional outcomes, highlighting the urgent need for specialized pediatric spinal care.

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