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Х А Б А Р Ш Ы С Ы

ВЕСТНИК

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NAS RK is pleased to announce that Bulletin of NAS RK scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of Bulletin of NAS RK in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential multidiscipline content to our community.

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НАН РК сообщает, что научный журнал «Вестник НАН РК» был принят для индексирования в Emerging Sources CitationIndex, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Вестника НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному мультидисциплинарному контенту для нашего сообщества.

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MULTIFACTORIAL ANALYSIS OF NEUROLOGICAL DETERIORATION IN CHILDREN WITH SPINAL TRAUMA AFTER SURGICAL TREATMENT

Abstract. The article presents a multifactorial analysis of assessing the dynamics of neurological deficit in pediatric patients with unstable complicated thoracic and thoracolumbar spine fractures. The effect of the terms of surgery that has passed from the moment of injury, as well as the severity of the damage to the spinal cord and its elements, has been studied in details. Magerl spinal fractures classification was implemented to evaluate the type of spine fracture, neurological deterioration were evaluated according to the international ASIA scale.

Longest result follow-up period was 5 years after surgery. Surgical treatment of 36 patients at the age of 3 years to 17 years with unstable thoracic and thoracolumbar spine fractures complicated by neurologic deficit were performed.

Longest result was monitored for up to 5 years in all patients. It was in studies revealing that a full recovery of neurological functions in children with complicated spinal fractures is noted during surgical treatment in the first 6-12 hours from the time of trauma, with the main cause of neurological deficit associated with compression of the spinal cord.

Key words: spinal trauma, spine cord injury, ASIA, children, spine surgery.

Background. Traumatic injuries of the spine can be observed in 1% - 10% of all traumatic cases in children reaching the rate from two to twenty per 1 000 000 [1]. In large central city each year more than a thousand children get a spine fracture, about two to three percents are mechanically non-stable and has neurological impact [2]. In an up to five percents of traumatized children cord is also damaged, but one can say that SCI can be found with higher prevalence than initially was thought due to existence of reports in literature about more frequent rate of cord injury [3].

Spinal cord deficit occur in these patients due to a lot of causes: significant displacement of the fractured fragments, damage to the neural tissue after development of the traumatic stenosis. Resolution of symptoms may depend on these primary factors and the surgical activity. Not necessary primary contusion leads to the deficit development – it can also occur later due to vascular issues which are secondary to persistent ischemia [4].

One of the most significant injury pattern can be observed in patients with thoracic fractures and dislocations. This region is distinguished by its narrowness and lack of free space available for the cord [4] and even non-significant canal compromise can lead to significant problems.

It is unclear whether or not the size of canal left intact plays a role in development of neurological deficit. Sometimes gross compression of the conus leads to no deterioration at all. At the same time minor (less than 1.0 cm) fragment dislocation and non-profound deformity in saggital plane can cause marked neurological devastation [5].

One of the biggest issues discussed in literature is when to make surgery. It was shown by many authors that "the sooner - the better", but there are situations when surgical aggression can deteriorate a patient. According to different authors different points of view on how long early post-injury is exist

varying from four weeks [6] to first five days [7] or even 3 days [8, 9]. Many surgeons accept first 8 hours as "golden hours" for surgery [10].

According to Vaccaro et al. [8] there was no any significant difference between patients with cervical spine injury who were operated surgically either during first 3 days or five days post-injury. Relationship between cord compression and function was studied by Wagner and Chehrazi in 44 patients with damage of the subaxial cervical region [10] using such factors like value of stenosis and time to decompression. It was shown that only stenosis played significant role in the course of neurological deterioration as both groups of patients (those who were operated in first 8 hours or those – during first 2 days) showed the same level post-operatively even after a year. Many experienced surgeons such as Fehlings et al. advocate that neurologically compromised patient should have his operation as soon as possible and no longer than a day after injury [11]. Although they agree that no universally accepted time limits exist.

Both interesting and controversial data was shown in the article of Bohlman and Anderson who operated on patients as late as 9 years post injury [12]. There were 58 surgical procedures and 29 patients became walkers again after being paralyzed. 9 people didn't show any benefit. Controversy consists in the fact which authors advocated in paper that those who showed improvement could show it without the fact of surgery.

Group of Aganesov et al. strongly agree with the hypothesis that timing plays major role and early decompression with fusion is a key to success [1].

Blood supply of the damaged segments also plays big role as it was experimentally shown that 3 hours of blood watershed leaded to irreversible cell death [13]. Soviet scientists and spine surgeon Lutsik [14] could show that the most sensitive structures are anterior spinal artery and its branches. This fact obviates the necessity for early surgical intervention to help free the injured cord. Another interesting feature is that white and grey matter have different sensitivity to ischemia: later is more sensitive and the aforementioned first one can last for four hours which gives an opportunity to restore function in terms of early surgical intervention [15].

Objectives. To explore which factors affect the outcome in children with unstable complicated thoracic and thoracolumbar spine fractures the most.

Materials and Methods: 36 patients (2/3 were boys and 1/3 were girls) at the age of 3 years to 17 years (with more than 75% older than 11 years) with unstable thoracic and thoracolumbar spine fractures with neurological deterioration were surgically treated at the hospital with further evaluation of neurological status.

Table 1 – Patient's distribution according to age

Age	3 years - 7 years	7 years - 11 years	11 years - 17 years	Total
Males	4	4	16	24 (66,7%)
Females	–	–	12	12 (33,3%)
Total	4 (11,1%)	4 (11,1%)	28 (77,8%)	36 (100%)

Motor vehicle accident was a leading cause for trauma in 19 (52.8%) patients followed by fall from height in the rest 17 (47.2%) patients.

Evaluation of neurological deterioration was performed using ASIA score [16] - table 2 presents the results. Type of fracture, amount of stenosis and type of medulla compression and its condition was assessed with x-ray, CT scans and MRI.

Data present in table 2 shows distribution of those patients according to ASIA score: almost half of them (16) were classified as A (complete injury), 14 – class B (sensory function preserved), 4 – class C and 2 patients as class D. It should be noted that clinical picture of complete spinal cord injury was observed in 12 patients who had injury at the thoracic area and in 4 patients with injured thoracolumbar area.

Table 2 – Patient's distribution according to results of neurological assessment

Group	Level of injury	ASIA class				Total
		A	B	C	D	
I	Thoracic Thoracolumbar	2 –	– 6	– –	– –	8
II	Thoracic Thoracolumbar	– 2	– –	– –	– 2	4
III	Thoracic Thoracolumbar	2 –	– 2	– 4	– –	8
IV	Thoracic Thoracolumbar	8 2	4 2	– –	– –	16
Total	Thoracic Thoracolumbar	12 4	4 10	– 4	– 2	16 20

Magerl spinal fracture classification [17] was implemented to evaluate the type of spine fracture. Type A3 fractures were observed in 18 (50%) patients, type B – in two (5.6%) and type C in 16 (44.4%) children. According to the level of injury data distributed in the next manner: thoracic area in 16 (44.4%) patients, thoracolumbar area (Th10-L2) in 20 (55.6%) patients.

Surgical treatment for all patients consisted of procedure aimed to restore canal clearance and stabilize injured segments: either only dorsal or combined approach was used with pedicle screw instrumentation as a primary type of implants [2,3,4]. Patients with complete paraplegia (type A) were operated from posterior approach to correct the deformity and stabilize an injured segment with metal device and at the same surgical session anterior approach was performed to clear the canal and replace the fractured vertebral body with Pyramesh filled with autologous bone. In fracture-dislocation injuries surgical treatment was performed through the dorsal approach to restore the relationship between segments, stabilize them in achieved position which all led to cord decompression on its own without the necessity for anterior decompression. 360 degrees fusion was an obligate step of the procedure.

Despite controversial attitude to steroids in neurologically compromised patients in our clinic NASICS – 1 protocol exists for treatment of such patients: steroid bolus (30mg/kg during first 6 hours) with further supplementation using dosage of 5.4mg/kg per hour during next 23 hours was used. Post - surgery patients continued to receive hormone therapy in the same dosage during two days.

After surgery all patients received physical rehabilitation including passive and possible active exercises, muscle stretching and robotic – assisted kinesiotherapy.

Mean period of treatment of one patient was 24 days. After this period patients were discharged with further recommendation of continuing physical rehabilitation.

During the research we analyzed an influence of different factors which could affect the patient's outcome after surgical treatment. Next criteria were used: level of injury, amount of canal compromise, timing to surgery, ASIA scale.

Monitoring of the patient's neurological status was performed daily during first postoperative week and every 2-3 days after. After discharge patients were examined every 6 months with neurological assessment provided and its results saved. Longest follow-up period was 5 years after surgery.

Results. Injury at the thoracic region were accompanied by neurological deterioration much more often and more severe comparing to thoracolumbar. From 16 patients with trauma at that level 12 were graded as class A (complete paraplegia) and 4 as class B (sensory function preserved) according to ASIA. 20 patients with thoracolumbar fracture varied in their level of deterioration from A to D, with 10 patients having class B.

Great variance was observed in time past prior surgery: in some patients only few hours took place, for some 1.5 years had passed. Based on that four clusters of patients were gathered and table 3 presents these data: unfortunately only 8 patients were able to be surgically treated no longer than 12 hours post-injury. Almost half of the patients were operated later than two weeks. All the rest were treated in terms of 0.5-3 days to 14 days.

Table 3 – Patients distribution according to type and level of injury and timing to surgery

Type of injury Level of injury Timing to surgery	Type A3		Type B		Type C		Total
	Thoracic	Thoraco lumbar	Thoracic	Thoraco lumbar	Thoracic	Thoraco lumbar	
First 6 – 12 hours after injury (group I)	–	6	–	–	2	–	8
From 12 hours to 3 days (group II)	–	2	–	–	–	2	4
From 3 days to 2 weeks (group III)	–	4	–	–	2	2	8
More than 2 weeks (group IV)	4	2	2	–	6	2	16
Total	4	14	2	–	10	6	36

Thus most of the patients were operated at intermediate and late trauma periods.

Surgical treatment allowed to achieve complete removal of the stenosis, clear the canal and stabilize injured area in all patients (table 4).

Table 4 – Amount of stenosis before and after surgical treatment

Groups	Level of injury	Amount of stenosis %	
		Before surgery	After surgery
I	Thoracic Thoracolumbar	min 90 - max 97 (93,5±3,5) min 73 - max 94 (83,7±6,7)	0 0
II	Thoracolumbar	min 42 - max 88 (65,0±22)	0
III	Thoracic Thoracolumbar	min 96 - max 100 (98,0±2,0) min 44 - max 82 (53,7±18,2)	0 0
IV	Thoracic Thoracolumbar	min 18 - max 100 (63,8±18,7) min 46 - max 73 (59,0±12,0)	0 0

In group I patients the amount of stenosis was markedly increased comparing to the rest groups: mean 93% for the thoracic and mean 84% for the thoracolumbar areas.

Neurological examination performed in early post-op period showed improvement of motor and sensory (pain, light touch) function equivalent to 1-2 points according ASIA, pain sensation improved faster.

In group I patients improvement of neurological function after surgical decompression occurred on the 1-2 day after treatment, in group II – on the 2-3 day, in group II – on the 5-7 day, in group 4 – after 4-5 months. The most rapid improvement was observed in patients from I group with ASIA class B treated in first 6-12 hours after trauma.

Evaluation of the long-term results showed following data:

Group I. 6 patients with incomplete spinal cord injury showed marked improvement especially in sensory function: 3 children became class E and 3 more patients had an increase of pain and light touch sensation for a mean of 18 points from the baseline. Their motor function improved for a mean of 26 points from the baseline. In the long-term follow-up (5 years) after surgical treatment patients from this group were assessed as 71 points (50 – 100) in motor function and 85 points (54-112) in sensory function. Four of these became ambulatory and two patients were able for assistance walking. In two patients classified as ASIA - A after trauma no improvement occurred. They remained paraplegic and had bladder and bowel incontinence.

Group II. Complete restoration of neurological function was observed in 2 patients with class D according ASIA at the baseline. In two more patients with class A no improvement occurred. In the long-term follow-up period mean motor function scores were 73 (50 – 97) points and mean sensory function scores were 95 (78-112) points.

Group III. In four out of eight patients there was an improvement observed as a restoration from class C to class D, and two patients improved from class B to class D. In 2 patients with class A neurologic deterioration no improvement was observed after surgery. In the long-term follow - up motor function

scores were in mean of 77 (50-93) points, and sensory function scored with a mean of 91 (38-107) points. Mean increase in sensory function score was 10 (6-15) points and in motor function 19 (0-34) points. After 4-5 years of observation no further improvements were observed.

Group IV. In patients with incomplete spinal cord injury improvements were also observed but with a lower rate. Six out of 16 patients from this group with baseline class B according ASIA improved to class C in 2-3 years after surgery. In 10 patients with class A there was no improvement observed. Mean motor function score was evaluated as 59 (50-82) points and sensory function as 67 (24-84) points.

Special attention should be paid to 16 patients with class A neurologic injury. Regardless timing to surgery none of these children improved their function. There was only slight and very slow restoration in 2-3 years after surgery but not more than on 5-8 points from the baseline.

Discussion. Our results shows that injury at the thoracic region were accompanied by much more pronounced neurological deficit probably due to the fact that this region same as cervical spine is distinguished by less reserve space available for the spinal cord in situation when canal compromise by fractured fragment is present. We couldn't observe this in patients with thoracolumbar fractures.

Another fact which was shown in our study is relationship between time passed prior to surgery and the end result. Literally "the sooner – the better": when surgery took place early, much faster resolution of symptoms and recovery of neurologic deficit occurred. Unfortunately the same couldn't be applied to patients with complete loss of motor and sensory function – those graded A score according ASIA: there were no resolution of their neurologic deficit except some tendency for improvement of sensory function.

It should be noted that for those patients who were surgically treated during first 12 hours stenosis of the cord was significantly more pronounced: up to 97% at the thoracic spine and almost 90% at the thoracolumbar area. Those patients with A score according ASIA (n=2) had injury in the thoracic region with marked stenosis and no improvement.

Patients graded class B (n=6) showed better benefit from early surgery rather than those treated late: improvement of cord functions was observed during first days after surgery. Canal compromise was the main reason for this and early removal of fractured fragments led to restoration of function prevention of further edema, vascular disturbances and secondary cord injury.

Significantly less amount of traumatic stenosis in patients from second group was accompanied by less pronounced neurological deficit. Only two patients were classified as A and two classified as D according ASIA.

Two patients graded A according ASIA showed no improvement after surgery due to the significant compression of the cord (87% mean) as a primary traumatic factor.

Two kids with D level of injury showed benefit even though were surgically treated later than usually necessary. But it should be mentioned that speed of their restoration was not as high as in first group. Probably class D played the major role same as the level of injury (thoracolumbar) – both of these are prognostic positive for the patients.

Patients treated as long as two weeks after trauma according to CT evaluation had distinct size of stenosis at thoracic (up to 100%) and thoracolumbar (approx. 54%) areas – later was the least amongst all patients who took part in this study. These patients showed following distribution according to the type of neurologic injury: ASIA - A in 2 patients, ASIA - B in 2 patients and ASIA - C in 4 patients. Absence of neurological improvement same as aforementioned amount of class A and B patients in this group can be connected to the fact of delay for the surgical procedure. Provided later than in first and second groups surgical treatment led to improvement of neurologic deficit in patients with class B (2 patients) and C (4 patients) but began later (5-7 post-op day) and with lower rate. There were no improvement in neurological function 5 years after surgery despite the fact of surgery in D graded patients.

Patients who treated late had the least marked cord stenosis from all of the groups both at the thoracic (63%) and thoracolumbar (60%). Interestingly those patients despite the fact of less canal compromise had very marked neurological deficit: 10 patients graded as A (complete loss of function) and 6 graded as B (sensory function preserved). This made us to conclude that primary damage to the cord and secondary changes which took place in later period were responsible for this phenomenon. Mostly due to this secondary changes which passed the phase of active resolution surgical treatment aimed to restore the alignment and stabilize the segment was ineffective.

Unfortunately no patients graded A according ASIA showed any benefit mostly due to the fact of severe spinal cord injury. Very insignificant improvement of sensation with limits can be probably explained by child's nerve tissue ability to regenerate in some manner.

Conclusion. Particular study confirmed the commonly accepted thesis that thoracic region is most vulnerable for the development of neurological deficit in trauma patients. Another significant factor which influenced on the clinical picture was percentage of traumatic stenosis. One of the biggest issues in treatment of these patients is time passed between trauma and surgery – it can be logistically very difficult to follow the rule of performing decompression no later than 12 hours but this is crucial for restoration of neurological status. Early and adequate decompression of the cord and its roots may allow a patient to get better recovery and stabilization of an injured segment using pedicle instrumentation creates an ability to mobilize patient early and provide more effective rehabilitation.

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ХИРУРГИЯЛЫҚ ЕМДЕУДЕН КЕЙІН ОМЫРТҚАСЫ ЗАҚЫМДАНҒАН БАЛАЛАРДАҒЫ НЕВРОЛОГИЯЛЫҚ БҰЗЫЛУДЫ КӨПФАКТОРЛЫ ТАЛДАУ

Жұмыста омыртқа бағанының кеуде және кеуде-бел бөлігінің омыртқалық-жұлындық жарақаты бар балаларда неврологиялық тапшылықтың динамикасын бағалаудың көп ықпалды талдауы ұсынылады. Жарақат кезінен бастап жүргізілген операциялық араласулар мерзімдерінің әсері, сондай-ақ жұлын мен оның элементтерінің бұзылу ауырлығы жете зерделенді. Омыртқа бағаны сүйегінің зақымдануларын бағалау мақсатында Magerl жіктемесі пайдаланылды, неврологиялық бұзылыстар ASIA халықаралық шкаласына сәйкес бағаланды.

Омыртқа бағанының кеуде және бел бөліктерінің тұрақсыз асқынған сынулары бар балалардағы неврологиялық өзгерістерінің динамикасына әртүрлі факторларының әсерін бағалау- осы жұмыстың мақсаты.

Әртүрлі дәрежеде неврологиялық бұзылыстармен асқынған омыртқа бағанының кеуде және кеуде-бел бөліктерінің сынулары бар 3-тен 17 жасқа дейінгі 36 пациентті хирургиялық емдеудің нәтижелеріне талдау жүргізілді. Нәтижелерді бағалау үшін толық неврологиялық бағалауды, рентгенографиялық өлшемдерді, компьютерлік томографияны (КТ) және магнитті-резонанстық томографияны (МРТ) қосқанда, клиникалық зерттеу әдістері пайдаланылды.

Омыртқа каналының стеноз санын азайту, омыртқа бағаны сегменттерінің түзелуін қалпына келтіру және зақымдалған аймақты тұрақтандыру үшін барлық пациенттерге хирургиялық ем жүргізілді. 36 пациент ішінен 8 пациентке жарақаттан кейін 12 сағаттан кешіктірмей операция жасалды. Пациенттердің жартысына жуығына екі апта өткен соң операция жасалды. Қалғандары 0,5-3 күннен 14 күнге дейінгі мерзімде емделді.

Өткізілген зерттеу кеуде бөлігінде оқшауланған жарақаттарда ең ауыр неврологиялық тапшылық болғанын көрсетті. Кеуде бөлігіндегі зақымдануларда кеуде-бел бөлігімен салыстырғанда неврологиялық нашарлау едәуір жиі болғаны байқалды. Осы деңгейдегі жарақаты бар пациенттердің 16-нан 12-і ASIA сәйкес, А класы ретінде (толық параплегия) және 4-і В класы ретінде (сезу функцияның сақталуы) жіктелді. Жарақаттың деңгейі ғана емес, каналдың зақымдану дәрежесі мен жарақат пен декомпрессияға дейінгі кезеңі де емнің соңғы нәтижесіне қатты әсер етеді. I-топтағы пациенттерде неврологиялық функцияның жақсаруы хирургиялық декомпрессиядан кейін 1-2 тәулік емдеген соң, II-топта – 2-3 тәулік, III-топта - 5-7 тәулік, IV топта – 4-5 ай өткен соң болды. Жағдайдың ең тез жақсаруы жарақаттан кейін 6-12 сағат ішінде ем алған ASIA сәйкес В класты I-топтағы пациенттерде байқалды.

Бір пациентті емдеудің орташа мерзімі 24 күнді құрады. Пациенттің неврологиялық мәртебесінің мониторингісі күн сайын операциядан кейінгі бірінші апта ішінде және одан кейін әр 2-3 күн сайын өткізілді. Шығарылған соң пациенттер неврологиялық бағасы ұсынылуымен және нәтижелердің сақталуымен әр 6 ай сайын қарап-тексерілді. Операциядан кейінгі ең ұзақ бақылау кезеңі 5 жыл. Бақылаудың алыс кезеңінде (5 жыл) хирургиялық емдеуден кейін 1-топтағы пациенттер қозғалыс функциялары бойынша 71 балға және сезу функциясы бойынша 85 балға бағаланды. II-топтағы пациенттерде қозғауыштық функцияның орташа көрсеткіштері 73 балды құрады, сезу функциясының орташа көрсеткіштері 95 балл. III-топтағы пациенттердің қозғауыштық функциясын бағалаудың алыс кезеңінде орташа 77 балды, сезу функциясы орташа 91 балды көрсетті. IV топта қозғауыштық функциясының орташа балы -59, сезу функциясы – 67 балға бағаланды.

Омыртқа бағанының асқынған сынуларымен балаларда неврологиялық функциясының толыққанды қалпына келуі зақымдалған кезінен бірінші 6-12 сағатта хирургиялық ем жүргізілгенде байқалатыны зерттеу барысында анықталды, бұл ретте, неврологиялық тапшылықтың негізгі себебі жұлынның қысылуымен байланысты.

Омыртқа бағанының кеуде және бел бөліктерінің асқынған тұрақсыз сынуларымен педиатриялық пациенттерде соңғы нәтижелерге едәуір әсер ететін негізгі факторлар: жарақат деңгейі, каналдың компрометация дәрежесі, жұлынның декомпрессиясына дейінгі уақыт.

Түйін сөздер: омыртқа бағанының жарақаты, жұлынның зақымдалуы, АЗИЯ, балалар, омыртқа бағанының хирургиясы.

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МНОГОФАКТОРНЫЙ АНАЛИЗ НЕВРОЛОГИЧЕСКИХ НАРУШЕНИЙ У ДЕТЕЙ С ТРАВМОЙ ПОЗВОНОЧНИКА ПОСЛЕ ХИРУРГИЧЕСКОГО ЛЕЧЕНИЯ

В работе представлен мультифакторный анализ оценки динамики неврологического дефицита у пациентов детского возраста с позвоночно-спинномозговой травмой грудного и грудопоясничного отделов позвоночника. Детально изучено влияние сроков оперативного вмешательства, прошедших от момента травмы, а также тяжести самого повреждения спинного мозга и его элементов. С целью оценки костных повреждений позвоночника использовали классификацию Magerl, неврологические нарушения оценивали согласно международной шкале ASIA.

Целью данной работы было оценка влияния различных факторов на динамику неврологических изменений у детей с нестабильно осложненными переломами грудного и поясничного отделов позвоночника.

Проведен анализ результатов хирургического лечения 36 пациентов в возрасте от 3 до 17 лет с переломами грудного отдела позвоночного столба и грудопоясничного перехода, осложненных неврологическими нарушениями различной степени выраженности. Использованы методы клинического исследования, включая полную неврологическую оценку, рентгенографические измерения, компьютерную томографию (КТ) и магнитно-резонансную томографию (МРТ) для оценки результатов.

Все пациенты были подвергнуты хирургическому лечению, чтобы уменьшить количество стенозов позвоночного канала, восстановить выравнивание сегментов позвоночника и стабилизировать поврежденную область. Из 36 пациентов 8 пациентов были прооперированы не позднее, чем через 12 часов после травмы. Почти половина пациентов были оперированы позже, чем через две недели. Все остальные лечились в сроки от 0,5-3 дней до 14 дней.

Проведенное исследование показало, что наиболее тяжелый неврологический дефицит сопровождался травмами, локализованными в грудном отделе. Повреждения в грудном отделе значительно чаще сопровождались неврологическим ухудшением по сравнению с грудным поясничным. Из 16 пациентов с травмой на этом уровне 12 были классифицированы как класс А (полная параплегия) и 4 как класс В (сохраненная сенсорная функция) согласно ASIA. Не только уровень самой травмы, но и степень поражения канала и период, прошедший от травмы до декомпрессии, оказывают сильное влияние на конечный результат лечения. У пациентов I группы улучшение неврологической функции после хирургической декомпрессии произошло на 1-2 сутки после лечения, во II группе - на 2-3 сутки, во III группе - на 5-7 сутки, в IV группе - после 4-5 месяцев. Наиболее быстрое улучшение наблюдалось у пациентов из I группы с ASIA класса В, получавших лечение в течении 6-12 часов после травмы.

Средний срок лечения одного пациента составил 24 дня. Мониторинг неврологического статуса пациента проводился ежедневно в течение первой послеоперационной недели и каждые 2-3 дня после. После выписки пациенты осматривались каждые 6 месяцев с предоставлением неврологической оценки и сохранением результатов. Самый длительный период наблюдения после операции составил 5 лет. В отдаленном периоде наблюдения (5 лет) после хирургического лечения пациенты из I группы оценивались как 71 балл по двигательной функции и 85 баллов по сенсорной функции. У пациентов II группы средние показатели моторной функции составляли 73 баллов, а средние показатели сенсорной функции - 95 баллов. В отдаленном периоде оценки моторной функции пациентов III группы были в среднем 77 баллов, а сенсорная функция - в среднем 91 баллов. В IV группе средний балл моторной функции оценивался как 59 баллов, а сенсорная функция - 67 баллов.

В ходе исследования установлено, что полноценное восстановление неврологических функции у детей с осложненными переломами позвоночника отмечается при выполнении хирургического лечения в первые

6-12 часов от момента повреждения, при этом, основная причина неврологического дефицита связана со сдавлением спинного мозга.

Основные факторы оказывающие существенное влияние на конечный результат у педиатрических пациентов с осложненными нестабильными переломами грудного и поясничного отделов позвоночника: уровень травмы, степень компрометации канала, время до декомпрессии спинного мозга.

Ключевые слова: травма позвоночника, повреждение спинного мозга, АЗИЯ, дети, хирургия позвоночника.

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