STRUCTURE OF SPINAL INJURIES IN CHILDREN IN REGIONS OF THE RUSSIAN FEDERATION

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Objective. To analyze statistical data on children with isolated spinal fractures and those combined with spinal cord injury, and to study the structure of injuries.
Material and Methods. Data on the number of children from 55 regions of the Russian Federation were studied, and the structure of spinal fractures and spinal column injuries combined with injuries of spinal cord and its elements was analyzed.
Results. The absolute number of spinal injuries varies between regions of the Russian Federation from 2075.20 ± 166.64 cases in the Novosibirsk region to the total absence of injuries in the Republic of Tyva. The average number of superficial injuries to the spine is 10.34 ± 11.55 cases, and of injuries of the spinal column – 6.05 ± 5.51 cases per 10 thousand children. On the average, 4.30 ± 3.90 compression fractures, and 0.20 ± 0.20 unstable and complicated spinal column injuries per 10 thousand children are observed.
Conclusion. On the territory of the Russian Federation, there is significant variation in the number of children with superficial injuries and spinal column injuries. The variety of data obtained indicates the difficulties in diagnosing and registration of patients with this type of traumatic injury.
Key Words: injuries, spinal fractures, children, regions of Russia.

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There are contradictory data on the incidence and profile of the spine and spinal cord injuries in Russian and international literature. According to different authors [1, 10, 15], the incidence of spinal injuries in children is 1–10 % and they occur in 1.9 to 19.9 cases per 1 million children. Spinal injuries account for 0.65% to 9.47 % of all musculoskeletal system injuries in children [3]. According to the data provided by pediatric hospitals in St. Petersburg during 2010–2013, spinal fractures accounted for 5–7 % of the total number of musculoskeletal system injuries per year [4]. Every year, 900 to 1,100 children suffer spinal fractures at different sites [5]. International researchers noted that the overall incidence of spinal injuries among US children is 7.41 per 100 000 children [14]. In another study, authors have reported that the incidence of spinal cord injuries in children in the United States is 18.1 injuries per 1 million children, which is nearly 1,300 cases per year [12].

Saunders et al. [16] observed a trend towards decrease in the incidence of spinal injury in children. Race stratification showed significant decrease in the incidence among the white population [16]. Many authors noted that traumatic spinal injuries are relatively rare in pediatric patients, however, they concluded that these injuries may contribute to significant disability and mortality among children [9].

According to most scientific publications, the incidence of spinal injuries in children increases. Thus, Mendoza-Lattes et al. [13] analyzed the prevalence of spinal injuries in children and adolescents and found increase from 77.07 cases per 1 million population in 1997 to 107.96 cases per 1 million population in 2009 [13]. According to the results of statistical studies in pediatric hospitals in St. Petersburg, the proportion of compression fractures of the vertebral bodies among all spinal injuries increased from 5 % in 2001 to 7 % in 2012 [5].

Analysis of the incidence of stable, unstable, and complicated spinal injuries and estimation of their proportion in the total profile of vertebral fractures at various sites is quite a challenging problem [8]. Some authors [2] claim that spinal injuries combined with spinal cord injuries are rare in children and account for 2–5 % of the total number of severe injuries of the spinal column. A retrospective study in St. Petersburg showed that spinal injuries accompanied by injuries to the spinal cord and its components accounted for 23 % of severe spine fractures, and unstable traumatic spinal injuries at various sites accounted for 77 % [6]. Other researchers [7, 11] noted that spinal column fractures accompanied by spinal cord injuries occur in 15 to 80 cases per 1 million population.

Therefore, the information on the number of children with isolated

fractures of the spine and fractures accompanied by spinal cord injuries, as well as the profile of these injuries, still remains a significant issue and requires further study.

The study was aimed at analyzing statistical data on children with isolated fractures of the spine and fractures accompanied by spinal cord injuries and studying injury profile.

Material and Methods

According to ICD-10, traumatic spinal injuries can be classified as superficial ones; dislocations, sprains and overexertion of the joints and ligaments; vertebral fractures; injuries to nerves and spinal cord at the level of the cervical, thoracic, and lumbar spine.

We developed an original form and send it to 85 regions of the Russian Federation to study the profile of spine and spinal cord injuries in children. The form included the following ICD-10 codes:

– superficial injuries (S10.8, S20.4, S20.8, S30.0.8);
– vertebral dislocations (S13.1, S23.1, S33.1);
– vertebral fractures (S12-S12.7, S22.0, S22.1);
– injured nerves and spinal cord (S14, S24, S34).

Vertebral fractures requiring surgical treatment were classified into separate group.

Data were collected in 2011–2015. The analysis included the absolute number of patients with spinal injuries and the number per 10 thousand children (0–17 years).

The data on the pediatric population and the profile of vertebral fractures and spinal column injuries combined with injury to the spinal cord and its elements were collected in 55 regions of the Russian Federation. Other regions could not provide information for the following reasons: the available statistical tools in the region do not include full details on the aforementioned nosological entities; there are common statistical accounting forms that does not include the requested ICD codes, the complexity of collecting data from all subordinate institutions, the inability to provide information according to the developed form.

Since compression vertebral fractures are the most common ones in children, while injuries to the nerves and the spinal cord are associated with unstable and complicated spinal column injuries, we identified the corresponding types of injuries.

Results and Discussion

The study showed significant variability in the absolute number of spinal injuries in various regions of the Russian Federation. In 2011–2015, the largest number of children with spinal fractures at different sites was observed in Novosibirsk region and averaged 2075.20 ± 166.64 cases. No pediatric patients with spinal fractures were observed in the Republic of Tyva. There was quite high level of spinal column injuries in the republics of Tatarstan, Bashkortostan, and Komi, Perm, and Primorsk Territory, Moscow, Ulyanovsk, Orel, Volgograd, and Voronezh Regions. This situation is due to the high pediatric population in some regions of the Russian Federation, such as the Republic of Tatarstan and Bashkortostan, Perm Territory, and Moscow Region. Superficial injuries to the spine are also the most common ones in these regions. The comparatively low absolute number of children with superficial injuries and spinal injuries were found in the republics of Dagestan, Ingushetia, Kabardino-Balkaria, Mari El, Stavropol Territory, Lipetsk, Murmansk, Rostov, and Sakhalin Regions. While in the Sakhalin Region this situation may be associated with a small number of children, in the Republic of Dagestan, Stavropol Territory,and Rostov Region, the number of children is quite high and comparable with the number of children under the age of 17 years in the regions, where the number of spinal injuries is high (Table 1).

The data on the absolute number of children with superficial traumatic injuries and spinal injuries in the regions of the Russian Federation can be explained by different child populations, urbanization of some regions, as well as the detectability of these injuries.

The analysis of statistical data on the superficial traumatic injuries and spinal injuries per 10 thousand children showed that the maximum number of cases was observed in the Novosibirsk region and the minimum number was observed in the Republic of Tyva. Regarding the superficial traumatic injuries and spinal injuries per 10 thousand children, we should mention high level of these injuries in the Republic of Altai, Komi, Tatarstan, Chuvashia, Perm and Primorsk Territories, Kaluga and Ulyanovsk Regions, and the Nenets Autonomous District. Despite the low absolute numbers of traumatic spinal injuries in children in some regions of the Russian Federation (Republic of Altai, Chuvashia, Kaluga Region, Nenets Autonomous District), the number of this injuries per 10 thousand children reaches high values. It is most likely due to a high level of examination of this category of patients. Superficial traumatic injuries to the spine are more often observed in the Republic of Komi and Novosibirsk region, while spinal column injuries are more common in Novosibirsk and Ulyanovsk regions. At the same time, it should be noted that the Republics of Ingushetia and Dagestan, Krasnodar and Stavropol Territories, Murmansk, Rostov, and Saratov Regions demonstrate lower levels of spinal injuries per 10 thousand children compared to other regions of the Russian Federation. Furthermore, it is important to emphasize that the pediatric population is quite high in the Republic of Dagestan, Krasnodar and Stavropol Territories, as well as in the Rostov Region. Taking into account this fact, we suggest that detectability of these spinal column injuries is insufficient and there are diagnostic problems in these regions (Table 2).

Data analysis showed that the average number of cases of superficial injuries to the spine was 10.34 ± 11.55, spinal injuries — 6.05 ± 5.51 per 10 thousand children. A ratio of superficial injuries to the spine and spinal column injuries averages 50.17 ± 24.09 % to 48.02 ±

23.97 %, respectively. The maximum percentage of superficial injuries was observed in the Yamalo-Nenets Autonomous District (89.5 %), no superficial injuries were observed in the Republic of Tyva and Murmansk region.

The highest numbers of compression fractures of the vertebral bodies per 10 thousand children were observed in the Novosibirsk and Orel regions, Republics of Altai, Tatarstan, Udmurtia, and Komi, the highest numbers of unstable and complicated fractures – in the Ulyanovsk Region, Perm and Krasnoyarsk Territories, Republics of Chuvashia and Udmurtiya (Table 3).

The incidence of compression fractures of the vertebrae averages 4.30 ± 3.90 cases, unstable and complicated spinal fractures – 0.20 ± 0.20 cases per 10 thousand children.

The highest percentage was observed for vertebral compression fractures and averaged 93.60 ± 7.88 % of all fractures per 10 thousand children. Unstable and complicated spinal fractures were observed only in 4.58 ± 5.36 % of cases.

Therefore, compression fractures of the vertebral bodies at various sites are the most common spine injuries in children in the Russian Federation. Severe spinal injuries necessitating surgery are much rarer. The maximum percentage of compression fractures is 100 % and it is observed in the Republic of Adygea, Altai, Dagestan, Ingushetia, Kabardino-Balkaria, Tatarstan, Zabaikalye, Kamchatka, and Stavropol Territories, Bryansk, Magadan, Pskov, and Sakhalin Regions, and Nenets Autonomous District, i.e. no cases of severe spinal injuries were observed in these regions. In some regions, this peculiarity of spinal injuries can be associated with low pediatric population and the lack of urban areas. It should be emphasized that almost no cases of severe spinal column injuries requiring surgical treatment were observed in some regions (the Republics of Tatarstan, Dagestan, Stavropol Territory) having developed infrastructure and high pediatric population. However, the highest percentage of complicated and unstable fractures of the spine (39.5 %) was observed in the Ulyanovsk Region. It should be noted that severe spinal injuries accompanied by spinal cord injury account for more than 20 % of all types of spinal column fractures in the Krasnodar and Krasnoyarsk Territories, Murmansk and Rostov Regions. At the same time, most of these regions in Russian Federation demonstrate moderate level of compression fractures of the vertebral bodies despite the large number of children, which may be indicative of the lack of proper attention of specialists and low diagnostic level for this type of spinal column injuries.

Conclusion

Significant variability of the number of children with superficial injuries and spinal column injuries is observed within the Russian Federation. On average, 10.34 ± 11.55 cases of superficial injuries to the spine, 4.30 ± 3.90 cases of compression fractures, 0.20 ± 0.20 cases of unstable and complicated injuries to the spine per 10 thousand children are observed. The diversity of these data suggests that diagnosis and accounting for patients with traumatic injuries is a challenging problem.

Table 1

Spinal injuries in the overall profile of the musculoskeletal injuries in children in the regions of the Russian Federation in 2011—2015, n (M ± m)

Regions of the Russian Federation	Child population (0—17 years)	Superficial traumatic injuries close to the spine	Spinal injuries	Total number of injuries
Republic of Adygea	90683.40 ± 1147.28	52.20 ± 5.04	135.60 ± 18.48	187.80 ± 22.64
Republic of Altai	14854.00 ± 582.00	35.00 ± 2.40	22.80 ± 3.44	57.80 ± 5.84
Republic of Bashkortostan	857134.20 ± 13006.64	866.60 ± 35.28	775.20 ± 40.16	1641.80 ± 51.04
Republic of Dagestan	868341.20 ± 28298.88	2.40 ± 0.88	2.40 ± 0.88	4.80 ± 1.76
Republic of Ingushetia	141834.20 ± 5896.32	0.80 ± 0.32	0.40 ± 0.48	1.20 ± 0.64
Republic of Kabardino-Balkaria	203303.60 ± 1548.32	22.20 ± 1.84	7.60 ± 1.28	29.80 ± 1.76
Republic of Komi	182720.80 ± 1638.64	1647.40 ± 282.32	221.60 ± 12.48	1869.00 ± 277.20
Republic of Mari-El	137391.00 ± 3356.40	6.40 ± 1.12	7.80 ± 2.56	14.20 ± 3.44
Republic of Mordovia	136338.20 ± 527.84	337.00 ± 22.00	69.00 ± 12.80	406.00 ± 32.40
Republic of Tatarstan	746739.60 ± 17122.72	1168.60 ± 48.32	1901.00 ± 223.20	3069.60 ± 245.92
Republic of Tyva	111220.40 ± 2642.88	0	0	0
Republic of Udmurtia	321375.80 ± 7936.56	105.00 ± 27.60	511.80 ± 148.64	616.80 ± 163.84
Republic of Khakassia	115447.80 ± 3337.44	115.60 ± 16.72	23.80 ± 2.16	139.40 ± 17.28
Republic of Chechnya	463003.40 ± 13498.72	37.00 ± 3.60	11.00 ± 1.60	48.00 ± 5.20
Republic of Chuvashia	243810.20 ± 3275.04	672.00 ± 30.00	149.00 ± 42.00	821.00 ± 46.40
Zabaikalye Territory	264088.60 ± 2472.08	7.40 ± 3.92	90.40 ± 17.92	97.80 ± 19.44
Kamchatka Territory	65637.20 ± 127.84	9.80 ± 1.84	10.60 ± 3.52	20.40 ± 3.12
KrasnodarTerritory	1013732.20 ± 27186.24	30.60 ± 1.12	45.60 ± 3.52	76.20 ± 3.76
KrasnoyarskTerritory	566965.40 ± 12217.68	55.00 ± 4.40	55.40 ± 3.68	110.40 ± 2.72
PermTerritory	535453.80 ± 12712.16	1454.00 ± 90.80	459.40 ± 28.48	1913.40 ± 66.08
PrimorskTerritory	348440.00 ± 4292.40	1158.20 ± 63.76	249.60 ± 36.32	1407.80 ± 86.96
Stavropol Territory	555400.00 ± 1600.00	11.60 ± 1.68	5.00 ± 0.80	16.60 ± 2.32
Harabovsk Territory	246067.40 ± 5113.68	0.60 ± 0.48	69.60 ± 14.08	70.20 ± 14.16
Amur Region	177588.80 ± 1675.52	13.80 ± 5.84	19.80 ± 4.96	33.60 ± 10.32
Astrakhan region	209839.80 ± 2217.36	36.40 ± 9.28	57.00 ± 16.00	93.40 ± 16.88
BelgorodRegion	269393.20 ± 4663.04	5.00 ± 2.80	58.60 ± 10.32	63.60 ± 12.32
Bryansk Region	187040.00 ± 2728.00	202.00 ± 50.40	41.40 ± 7.28	243.40 ± 54.32
Volgograd Region	464615.20 ± 1614.24	272.40 ± 21.52	262.80 ± 19.44	535.20 ± 23.44
Vologda Region	226957.40 ± 4298.48	9.20 ± 1.36	95.80 ± 7.84	105.00 ± 8.00
Voronezh Region	374372.00 ± 3759.60	227.80 ± 75.76	280.60 ± 17.04	508.40 ± 85.28
Kaliningrad Region	172400.00 ± 5616.00	70.60 ± 13.92	125.40 ± 14.72	196.00 ± 22.00
Kaluga Region	166603.80 ± 1658.16	413.00 ± 28.00	125.60 ± 10.72	538.60 ± 30.32
Kostroma Region	121240.00 ± 2394.00	106.60 ± 20.48	60.40 ± 13.68	167.00 ± 32.00
Kurgan Region	172479.60 ± 2188.32	10.40 ± 4.88	134.40 ± 65.12	144.80 ± 62.96
Leningrad Region	272306.00 ± 6017.20	201.80 ± 9.76	60.80 ± 8.64	262.60 ± 11.52
Lipetsk Region	203539.60 ± 2024.32	67.60 ± 13.12	9.40 ± 2.88	77.00 ± 13.20
Magadan Region	28684.80 ± 477.68	44.80 ± 6.24	10.60 ± 3.28	55.40 ± 7.68
Moscow Region	1194000.40 ± 38652.08	1347.20 ± 96.16	399.20 ± 32.64	1746.40 ± 93.28
Murmansk Region	146579.40 ± 1572.72	0	3.40 ± 0.88	3.40 ± 0.88
Novgorod Region	555244.40 ± 8105.68	9.40 ± 1.12	55.60 ± 6.72	65.00 ± 6.40
Novosibirsk Region	487766.80 ± 17853.76	3964.60 ± 704.08	2075.20 ± 166.64	6039.80 ± 813.84
Orel Region	133202.20 ± 378.64	33.60 ± 12.48	290.20 ± 45.36	323.80 ± 57.84
Penza Region	227139.60 ± 2042.16	17.80 ± 6.64	90.00 ± 16.00	107.80 ± 16.96
Pskov Region	110620.20 ± 1297.44	28.40 ± 7.12	41.20 ± 9.36	69.60 ± 11.52
Rostov Region	748331.00 ± 9568.40	20.00 ± 6.40	9.40 ± 3.28	29.40 ± 7.68
Samara Region	550173.80 ± 9796.96	70.20 ± 5.04	428.0 ± 53.2	498.20 ± 58.24
Saratov Region	437460.00 ± 3712.00	24.80 ± 3.04	15.80 ± 4.56	40.60 ± 4.96

Table 1. Continued

Regions of the Russian Federation	Child population (0—17 years)	Superficial traumatic injuries close to the spine	Spinal injuries	Total number of injuries
Sakhalin Region	95255.00 ± 1480.80	22.00 ± 2.00	5.60 ± 2.32	27.60 ± 2.08
Sverdlov Region	841000.00 ± 7333.33	6.00 ± 3.33	169.67 ± 2.22	175.67 ± 4.89
Tambov Region	172705.00 ± 1856.40	30.60 ± 1.92	18.40 ± 2.32	49.00 ± 4.00
Tula Region	248631.80 ± 2047.76	44.20 ± 21.84	91.00 ± 12.80	135.20 ± 27.36
Tyumen Region	302070.80 ± 14687.36	239.20 ± 22.64	84.60 ± 8.88	323.80 ± 31.44
Ulyanovsk region	214658.30 ± 1411.78	698.30 ± 47.56	650.00 ± 58.00	1348.33 ± 88.44
Nenets Autonomous District	11101.40 ± 131.92	38.60 ± 2.88	14.60 ± 1.92	53.20 ± 2.56
Yamalo-Nenets Autonomous District	129435.20 ± 2118.64	254.20 ± 22.24	29.80 ± 6.56	284.00 ± 23.60

Table 2

The profile of superficial and spinal injuries per 10 thousand children in the regions of the Russian Federation in 2011—2015 (average value), n (%)

Regions of the Russian Federation	Superficial traumatic injuries close to the spine	Spinal injuries	Total
Republic of Adygea	5.76 (27.8)	14.95 (72.2)	20.71 (100.0)
Republic of Altai	23.50 (60.6)	15.35 (39.4)	38.91 (100.0)
Republic of Bashkortostan	10.11 (52.8)	9.04 (47.2)	19.15 (100.0)
Republic of Dagestan	0.03 (50.0)	0.03 (50.0)	0.06 (100.0)
Republic of Ingushetia	0.06 (66.7)	0.03 (33.3)	0.08 (100.0)
Republic of Kabardino-Balkaria	1.09 (74.5)	0.37 (25.5)	1.47 (100.0)
Republic of Komi	90.16 (88.1)	12.13 (11.9)	102.29 (100.0)
Republic of Mari-El	0.47 (45.1)	0.57 (54.9)	1.03 (100.0)
Republic of Mordovia	24.72 (83.0)	5.06 (17.0)	29.78 (100.0)
Republic of Tatarstan	15.65 (38.1)	25.46 (61.9)	41.11 (100.0)
Republic of Tyva	0.00 (0.0)	0.00 (0.0)	0.00 (100.0)
Republic of Udmurtia	3.27 (17.0)	15.93 (83.0)	19.19 (100.0)
Republic of Khakassia	10.01 (82.9)	2.06 (17.1)	12.07 (100.0)
Republic of Chechnya	0.80 (77.1)	0.24 (22.9)	1.04 (100.0)
Republic of Chuvashia	27.56 (81.9)	6.11 (18.1)	33.67 (100.0)
Zabaikalye Territory	0.28 (7.6)	3.42 (92.4)	3.70 (100.0)
Kamchatka Territory	1.49 (48.0)	1.61 (52.0)	3.11 (100.0)
KrasnodarTerritory	0.30 (40.2)	0.45 (59.8)	0.75 (100.0)
KrasnoyarskTerritory	0.97 (49.8)	0.98 (50.2)	1.95 (100.0)
Perm Territory	27.15 (76.0)	8.58 (24.0)	35.73 (100.0)
Primorsk Territory	33.24 (82.3)	7.16 (17.7)	40.40 (100.0)
Stavropol Territory	0.21 (69.9)	0.09 (30.1)	0.30 (100.0)
Harabovsk Territory	0.02 (0.9)	2.83 (99.1)	2.85 (100.0)
Amur Region	0.78 (41.1)	1.11 (58.9)	1.89 (100.0)
Astrakhan region	1.73 (39.0)	2.72 (61.0)	4.45 (100.0)
Belgorod Region	0.19 (7.9)	2.18 (92.1)	2.36 (100.0)
Bryansk Region	10.80 (83.0)	2.21 (17.0)	13.01 (100.0)
Volgograd Region	5.86 (50.9)	5.66 (49.1)	11.52 (100.0)
Vologda Region	0.41 (8.8)	4.22 (91.2)	4.63 (100.0)
Voronezh Region	6.08 (44.8)	7.50 (55.2)	13.58 (100.0)
Kaliningrad Region	4.10 (36.0)	7.27 (64.0)	11.37 (100.0)
Kaluga Region	24.79 (76.7)	7.54 (23.3)	32.33 (100.0)
Kostroma Region	8.79 (63.8)	4.98 (36.2)	13.77 (100.0)

Table 2. Continued

Regions of the Russian Federation	Superficial traumatic injuries close to the spine	Spinal injuries	Total
Kurgan Region	0.60 (7.2)	7.79 (92.8)	8.40 (100.0)
Leningrad Region	7.41 (76.8)	2.23 (23.2)	9.64 (100.0)
Lipetsk Region	3.32 (87.8)	0.46 (12.2)	3.78 (100.0)
Magadan Region	15.62 (80.9)	3.70 (19.1)	19.31 (100.0)
Moscow Region	11.28 (77.1)	3.34 (22.9)	14.63 (100.0)
Murmansk Region	0.00 (0.0)	0.23 (100.0)	0.23 (100.0)
Novgorod Region	0.17 (14.5)	1.00 (85.5)	1.17 (100.0)
Novosibirsk Region	81.28 (65.6)	42.54 (34.4)	123.83 (100.0)
Orel Region	2.52 (10.4)	21.79 (89.6)	24.31 (100.0)
Penza Region	0.78 (16.5)	3.96 (83.5)	4.75 (100.0)
Pskov Region	2.57 (40.8)	3.72 (59.2)	6.29 (100.0)
Rostov Region	0.27 (68.0)	0.13 (32.0)	0.39 (100.0)
Samara Region	1.28 (14.1)	7.78 (85.9)	9.06 (100.0)
Saratov Region	0.57 (61.1)	0.36 (38.9)	0.93 (100.0)
Sakhalin Region	2.31 (79.7)	0.59 (20.3)	2.90 (100.0)
Sverdlov Region	0.07 (3.4)	2.02 (96.6)	2.09 (100.0)
Tambov Region	1.77 (62.4)	1.07 (37.6)	2.84 (100.0)
Tula Region	1.78 (32.7)	3.66 (67.3)	5.44 (100.0)
Tyumen Region	7.92 (73.9)	2.80 (26.1)	10.72 (100.0)
Ulyanovsk region	32.53 (51.8)	30.28 (48.2)	62.81 (100.0)
Nenets Autonomous District	34.77 (72.6)	13.15 (27.4)	47.92 (100.0)
Yamalo-Nenets Autonomous District	19.64 (89.5)	2.30 (10.5)	21.94 (100.0)

Table 3

Spinal fractures per 10 thousand children in the regions of the Russian Federation in 2011—2015 (average value), n (%)

Regions of the Russian Federation	Compression vertebral fractures	Unstable and complicated vertebral fractures	Total
Republic of Adygea	5.91 (100.0)	0.00 (0.0)	5.91 (100.0)
Republic of Altai	15.35 (100.0)	0.00 (0.0)	15.35 (100.0)
Republic of Bashkortostan	8.38 (99.7)	0.03 (0.3)	8.41 (100.0)
Republic of Dagestan	0.03 (100.0)	0.00 (0.0)	0.03 (100.0)
Republic of Ingushetia	0.03 (100.0)	0.00 (0.0)	0.03 (100.0)
Republic of Kabardino-Balkaria	0.37 (100.0)	0.00 (0.0)	0.37 (100.0)
Republic of Komi	10.85 (98.9)	0.12 (1.1)	10.97 (100.0)
Republic of Mariy-El	0.51 (94.6)	0.03 (5.4)	0.54 (100.0)
Republic of Mordovia	3.14 (99.5)	0.01 (0.5)	3.15 (100.0)
Republic of Tatarstan	16.18 (100.0)	0.01 (0.0)	16.19 (100.0)
Republic of Tyva	0.00 (0.0)	0.00 (0.0)	0.00 (100.0)
Republic of Udmurtia	13.11 (97.6)	0.32 (2.4)	13.42 (100.0)
Republic of Khakassia	1.58 (92.9)	0.12 (7.1)	1.70 (100.0)
Republic of Chechnya	0.13 (96.7)	0.00 (3.3)	0.13 (100.0)
Republic of Chuvashia	3.76 (90.5)	0.39 (9.5)	4.15 (100.0)
Zabaikalye Territory	1.86 (100.0)	0.00 (0.0)	1.86 (100.0)
Kamchatka Territory	0.76 (100.0)	0.00 (0.0)	0.76 (100.0)
KrasnodarTerritory	0.32 (74.5)	0.11 (25.5)	0.43 (100.0)
KrasnoyarskTerritory	0.66 (68.1)	0.31 (31.9)	0.96 (100.0)
PermTerritory	5.16 (86.2)	0.83 (13.8)	5.99 (100.0)

Table 3. Continued

Regions of the Russian Federation	Compression vertebral fractures	Unstable and complicated vertebral fractures	Total
Primorsk Territory	2.33 (94.4)	0.14 (5.6)	2.47 (100.0)
Stavropol Territory	0.09 (100.0)	0.00 (0.0)	0.09 (100.0)
Harabovsk Territory	2.24 (99.6)	0.01 (0.4)	2.25 (100.0)
Amur Region	0.82 (92.4)	0.07 (7.6)	0.89 (100.0)
Astrakhan region	2.68 (98.6)	0.04 (1.4)	2.72 (100.0)
Belgorod Region	1.74 (98.7)	0.02 (1.3)	1.77 (100.0)
Bryansk Region	2.21 (100.0)	0.00 (0.0)	2.21 (100.0)
Volgograd Region	1.26 (96.1)	0.05 (3.9)	1.31 (100.0)
Vologda Region	4.21 (99.8)	0.01 (0.2)	4.22 (100.0)
Voronezh Region	6.51 (99.7)	0.02 (0.3)	6.53 (100.0)
Kaliningrad Region	7.10 (97.6)	0.17 (2.4)	7.27 (100.0)
Kaluga Region	7.17 (99.2)	0.06 (0.8)	7.23 (100.0)
Kostroma Region	3.98 (95.3)	0.20 (4.7)	4.17 (100.0)
Kurgan Region	3.07 (97.8)	0.70 (2.2)	3.14 (100.0)
Leningrad Region	1.82 (99.6)	0.01 (0.4)	1.83 (100.0)
Lipetsk Region	0.42 (91.5)	0.04 (8.5)	0.46 (100.0)
Magadan Region	0.49 (100.0)	0.00 (0.0)	0.49 (100.0)
Moscow Region	2.53 (92.5)	0.20 (7.5)	2.73 (100.0)
Murmansk Region	0.16 (80.0)	0.04 (20.0)	0.20 (100.0)
Novgorod Region	0.87 (94.9)	0.05 (5.1)	0.91 (100.0)
Novosibirsk Region	38.36 (99.8)	0.08 (0.2)	38.44 (100.0)
Orel Region	21.73 (99.7)	0.06 (0.3)	21.79 (100.0)
Penza Region	3.49 (99.0)	0.04 (1.0)	3.52 (100.0)
Pskov Region	3.72 (100.0)	0.00 (0.0)	3.72 (100.0)
Rostov Region	0.10 (78.7)	0.03 (21.3)	0.13 (100.0)
Samara Region	6.26 (98.1)	0.12 (1.9)	6.38 (100.0)
Saratov Region	0.22 (98.0)	0.00 (2.0)	0.22 (100.0)
Sakhalin Region	0.57 (100.0)	0.00 (0.0)	0.57 (100.0)
Sverdlov Region	2.01 (99.8)	0.00 (0.2)	2.01 (100.0)
Tambov Region	1.50 (98.9)	0.01 (1.1)	1.07 (100.0)
Tula Region	3.64 (99.6)	0.02 (0.4)	3.66 (100.0)
Tyumen Region	1.73 (96.7)	0.06 (3.3)	1.79 (100.0)
Ulyanovsk region	6.71 (60.5)	4.38 (39.5)	11.09 (100.0)
Nenets Autonomous District	4.50 (100.0)	0.00 (0.0)	4.50 (100.0)
Yamalo-Nenets Autonomous District	1.68 (92.4)	0.14 (7.6)	1.82 (100.0)

References

1. **Aganesov AG, Meskhi KT, Nikolaev AP, Kostiv EP.** Surgical treatment of complicated spinal injury in acute period. Journal of Traumatology and Orthopedics. Priorov. 2003; (3):48–52. In Russian.
2. **Baindurashvili AG, Solokhina IYu, Kokushin DN, Belyanchikov SM.** Analysis of the influence of various factors on the course of neurological disorders in children with spinal cord injury. Pediatric Traumatology, Orthopaedics and Reconstructive Surgery. 2015;3(4):12–21. In Russian.
3. **Baindurashvili AG, Vissarionov SV, Aleksandrovich YuS, Pshenisnov KV.** Spine and Spinal Cord Injury in Children. St. Petersburg, 2016. In Russian.
4. **Vissarionov SV, Belyanchikov SM, Solokhina IY, Ikoeva GA, Kokushin DN.** Pattern of neurological disorders before and after surgery in children with complicated thoracic and lumbar spinal injuries. Hir. Pozvonoc. 2014;(3):8–21. In Russian. DOI: http://dx.doi.org/10.14531/ss2014.3.8-21.
5. **Vissarionov SV.** Stable and Unstable Damage to the Thoracic and Lumbar Spine in Children (Clinical Picture, Diagnosis, Treatment): A Guide for Physicians. St. Petersburg, 2010. In Russian.
6. **Vissarionov SV, Belyanchikov SM.** The surgical treatment of children with complicated fractures of thoracic and lumbar vertebrae. Travmatologiya i ortopediya Rossii. 2010; (2):48–50. In Russian.
7. **Leontiev MA.** Epidemiology of spinal trauma and incidence of complete anatomical lesion of the spinal cord. In: Topical Problems of Disabled Patients' Rehabilitation. Novokuznetsk, 2003:37–38. In Russian.
8. **Sarukhanyan OO, Teleshov VV.** Epidemiology and statistics of uncomplicated compression fractures of the spine in children (a literature review). Neotlozhnaya meditsinskaya pomoshch. 2013;(3):35–38. In Russian.
9. **Cirak B, Ziegfeld S, Knight VM, Chang D, Avellino AM, Paidas CN.** Spinal injuries in children. J Pediatr Surg. 2004;39:607–612. DOI: 10.1016/j.jpedsurg.2003.12.011.
10. **Chien L, Wu JC, Chen YC, Liu L, Huang WC, Chen TJ, Thien PF, Lo SS, Cheng H.** Age, sex, and socio-economic status affect the incidence of pediatric spinal cord injury: an eleven-year national cohort study. PLoS One. 2012;7(6):e39264. DOI: 10.1371/journal.pone.0039264.
11. **DeVivo MJ.** Epidemiology of traumatic spinal cord injury: trends and future implications. Spinal Cord. 2012;50:365–372. DOI: 10.1038/sc.2011.178.
12. **Kokoska ER, Keller MS, Rallo MC, Weber TR.** Characteristics of pediatric cervical spine injuries. J Pediatr Surg. 2001;36:100–105.
13. **Mendoza-Lattes S, Besomi J, O'Sullivan C, Ries Z, Gnanapradeep G, Nash R, Gao Y, Weinstein S.** Pediatric Spine Trauma in the United States –- Analysis of the HCUP Kid'S Inpatient Database (KID) 1997–2009. Iowa Orthop J. 2015;35:135–139.
14. **McGrory BJ, Klassen RA, Chao EY, Staeheli JW, Weaver AL.** Acute fractures and dislocations of the cervical spine in children and adolescents. J Bone Joint. Surg Am. 1993;75:988–995.
15. **Puisto V, Kaariainen S, Impinen A, Parkkila T, Vartiainen E, Jalanko T, Pakarinen MP, Helenius I.** Incidence of spinal and spinal cord injuries and their surgical treatment in children and adolescents: a population-based study. Spine. 2010;35:104–107. DOI: 10.1097/BRS.0b013e3181c64423.
16. **Saunders LL, Selassie A, Cao Y, Zebracki K, Vogel LC.** Epidemiology of pediatric traumatic spinal cord injury in a population-based cohort, 1998–2012. Top Spinal Cord Inj Rehabil. 2015;21(4):325–32. DOI: 10.1310/sci2104-325.

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