

## An analysis of the 50 most cited articles on congenital spinal anomalies

Most-cited articles on congenital spinal anomalies

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### Abstract

**Aim:** In this study, we aimed to identify the 50 most cited articles on congenital spinal anomalies in the literature.

**Material and Methods:** 'Congenital spinal anomalies' and 'congenital spinal abnormalities' were used as search words in the Web of Science database. The 50 most cited articles were analyzed. The study was carried out in May 2020. The publications in the study covered the years between 1990-2020. For all the articles, the journal in which they were published, the number of citations, the year of publication, the country of origin for citations, the level of evidence, and the type of study were recorded.

**Results:** After searching in the Web of Science database, 1632 articles were found in the search results. The number of citations of the articles ranged from 35 to 391. The most cited article was by Bowman et al. titled 'Spina bifida outcome: 25- year prospective' published in Pediatric Neurosurgery in 2001. The most published journal was the 'Spine' journal. Twenty-six (52%) articles were conducted in the United States of America. The main focus of the articles was on congenital segmentation defects. Original research articles (n = 31) were the most common study type.

**Discussion:** Congenital spinal anomalies are difficult to diagnose and treat in spinal diseases. Analyzing the studies conducted in the literature will show, which topics are needed for more research and will guide the authors.

### Keywords

Congenital Spinal Anomalies, Spine Abnormalities, Most Cited, Anomaly

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### Introduction

Congenital spinal anomalies can be defined as the generality of many complex diseases such as intraspinal pathologies, segmentation defects, congenital spinal deformities, and tube defects. Diagnostic and treatment processes involve difficulties. Congenital spinal anomalies can be caused by developmental defects in the axial skeletal system and often progress with intraspinal anomalies and other organ and system anomalies [1,2]. Although the etiology of the factors that cause congenital vertebral anomaly still has not been elucidated, environmental, genetic and chemical factors are thought to play a role in the etiology [3]. The diagnosis rates of congenital anomalies, which have attracted attention from the past to the present, have increased due to the increased imaging methods [4]. The number of studies on congenital spinal anomalies has also increased due to increasing diagnosis rates. Previously, there have been many studies analyzing articles on spinal diseases [5- 10]. However, there are no studies in the literature analyzing published articles on congenital spinal anomalies. Our aim in this study is to perform a characteristic analysis of the 50 most cited articles on congenital spinal anomalies.

### Material and Methods

On May 20, 2020, the search was made using the terms ‘congenital spine abnormalities’ and ‘congenital spine anomalies’ using the ISI Web of Science platform. The publications obtained as a result of searches using these two keywords were analyzed. Publications were sorted from the most cited to the least cited. The study covered the years between 1990 and 2020. The 50 most cited articles were examined. Articles that were not in English and did not refer to congenital spinal anomalies in the search results were excluded from the study. The authors of the analyzed articles, the number of citations, the country in which they were published, the level of evidence, publication date, the journal in which they were published, and the type of study were evaluated. The focus topics of all articles were examined. In addition, among the 50 most cited articles, the most published journals and the countries where the publications were produced the most were analyzed. The study is a bibliometric analysis, therefore statistical analysis was not performed.

### Results

After searching, 1632 articles were found in the search results. The number of citations of the articles ranged from 35 to

**Table 1.** Articles and Citation Analysis

| Article  | Citations |
|--|-----------|
| Spina bifida outcome: A 25-year prospective  | 391       |
| CRANIOVERTEBRAL JUNCTION - NORMAL ANATOMY, CRANIOMETRY, AND CONGENITAL-ANOMALIES                                 | 179       |
| Natural history of congenital kyphosis and kyphoscoliosis - A study of one hundred and twelve patients           | 143       |
| Magnetically controlled growing rods for severe spinal curvature in young children: a prospective case series    | 125       |
| Klippel-Feil syndrome - Clinical features and current understanding of etiology                                  | 122       |
| Congenital-Defects Of The Posterior Arch Of The Atlas - A Report Of 7 Cases Including An Affected Mother And Son | 111       |
| Congenital spinal deformity - A comprehensive assessment at presentation   | 105       |

|   |     |
|---|-----|
| Mutations in GDF6 are associated with vertebral segmentation defects in Klippel-Feil syndrome   | 101 |
| INTRASPINAL ABNORMALITIES AND CONGENITAL SPINE DEFORMITIES - A RADIOGRAPHIC AND MRI STUDY   | 96  |
| Skin markers of occult spinal dysraphism in children - A review of 54 cases   | 94  |
| The clinical significance of lumbosacral transitional anomalies   | 84  |
| Microvascular anatomy of dural arteriovenous abnormalities of the spine: A microangiographic study  | 82  |
| Scoliosis and congenital anomalies associated with Klippel-Feil syndrome types I-III  | 80  |
| US of the spinal cord in newborns, spectrum of normal findings, variants, congenital anomalies, and acquired diseases   | 79  |
| Currarino triad: Anorectal malformation, sacral bony abnormality, and presacral mass - A review of 11 cases   | 76  |
| Spinal congenital dermal sinuses: A 30-year experience  | 73  |
| Sleep-disordered breathing in children with myelomeningocele  | 73  |
| Mouse models of neural tube defects: Investigating preventive mechanisms  | 71  |
| Congenital scoliosis caused by a unilateral failure of vertebral segmentation with contralateral hemivertebrae  | 67  |
| THE NATURE OF CONGENITAL POSTERIOR CERVICAL OR CERVICOTHORACIC MIDLINE CUTANEOUS MASS LESIONS - REPORT OF 8 CASES   | 66  |
| Congenital muscular dystrophy with rigid spine syndrome: A clinical, pathological, radiological, and genetic study  | 65  |
| Segmental spinal dysgenesis: Neuroradiologic findings with clinical and embryologic correlation   | 65  |
| Congenital anomalies of the cervical spine  | 63  |
| Skeletal Abnormalities in Neurofibromatosis Type 1: Approaches to Therapeutic Options   | 60  |
| Klippel-Feil Syndrome - Ct And Mr Of Acquired And Congenital-Abnormalities Of Cervical-Spine And Cord   | 60  |
| Segmentation Anomalies Of The Vertebrae And Ribs - A Developmental Field Defect - Epidemiologic Evidence  | 58  |
| Cervical myelopathy caused by hypoplasia of the atlas: Two case reports and review of the literature  | 58  |
| Congenital partial aplasia of the posterior arch of the atlas causing myelopathy: Case report and review of the literature  | 56  |
| Prevalence of neural axis abnormalities in patients with infantile idiopathic scoliosis   | 55  |
| Occipitalization of the atlas in children - Morphologic classification, associations, and clinical relevance  | 53  |
| Thoracolumbar hemivertebrae resection by double approach in a single procedure - Long-term follow-up  | 52  |
| Mr Of The Caudal Regression Syndrome - Embryologic Implications   | 51  |
| Hemivertebra: Prenatal diagnosis, incidence and characteristics   | 50  |
| Fetal intervention for myelomeningocele: Effect on postnatal bladder function   | 50  |
| DEVELOPMENTAL DISORDERS OF THE PEDIATRIC SPINE  | 48  |
| Diagnostic value of spinal US: Comparative study with MR imaging in pediatric patients  | 47  |
| Abnormalities Associated With Congenital Scoliosis A Retrospective Study of 226 Chinese Surgical Cases  | 45  |
| Congenital anomalies of the ribs and chest wall associated with congenital deformities of the spine   | 45  |
| Evaluating Congenital Spine Deformities For Intraspinal Anomalies With Magnetic Resonance Imaging   | 44  |
| Evaluation And Treatment Of Diastematomyelia  | 44  |
| The effect of mid-thoracic VEPTR opening wedge thoracostomy on cervical tilt associated with congenital thoracic scoliosis in patients with thoracic insufficiency syndrome | 43  |
| Spine Deformities in Rare Congenital Syndromes Clinical Issues  | 42  |
| Simultaneous surgical treatment in congenital scoliosis and/or kyphosis associated with intraspinal abnormalities   | 42  |
| Patterns and progression in congenital scoliosis  | 42  |
| Congenital And Acquired Orthopedic Abnormalities In Patients With Myelomeningocele  | 41  |
| Congenital scoliosis  | 41  |
| Congenital osseous anomalies of the upper and lower cervical spine in children  | 41  |
| Occult tethered cord syndrome: a survey of practice patterns  | 39  |
| Intraspinal anomalies associated with isolated congenital hemivertebra: The role of routine magnetic resonance imaging  | 39  |
| The value of ultrasonic examination of the lumbar spine in infants with specific reference to cutaneous markers of occult spinal dysraphism                                 | 35  |

**Table 2.** Countries of Origin

| Country  | Number of Articles % |
|----------|----------------------|
| USA      | 26 (52)              |
| England  | 3 (6)                |
| Canada   | 3 (6)                |
| China    | 2 (4)                |
| Scotland | 2 (4)                |
| France   | 2 (4)                |
| Holland  | 2 (4)                |
| Korea    | 2 (4)                |
| Germany  | 2 (4)                |
| Turkey   | 1 (2)                |
| Iran     | 1 (2)                |
| Austria  | 1 (2)                |
| Israel   | 1 (2)                |
| Spain    | 1 (2)                |
| Italy    | 1 (2)                |

**Table 3.** Number of articles by topic

| Topics                 | Number of Articles % |
|------------------------|----------------------|
| Segmentation anomalies | 16 (32)              |
| Deformity              | 14 (28)              |
| Spinal dysrafysm       | 12 (24)              |
| Klippel-feil Syndrom   | 4 (8)                |
| Radiologic studies     | 3 (6)                |
| Neurofibromatosis      | 1 (2)                |

391 (average 73.84) (Table 1). The total number of citations of fifty articles was 3692. Eight articles received more than 100 citations. The most cited article was by Bowman et al. titled ‘Spina bifida outcome: 25- year prospective’ published in Pediatric Neurosurgery in 2001 [11].

The articles were published in 30 different journals. Most of the articles were published in the Spine (n = 9) journal. This was followed by the Journal of Bone and Joint Surgery-American volume (n = 7). Three articles were published in the Journal Of Neurosurgery, 3 articles in the Journal Of Pediatric Orthopedics, and 2 articles in the Radiographics journal.

Most of the articles (26) were produced in the USA (52%). The second country was England with three articles (6%) and China with three articles (6%) (Table 2).

Thirty-one (62%) articles were original research articles, 14 (28%) were reviews, and 5 (10%) were case reports. There was only one article with a Level of evidence (LOE) 1 (2%). Seven articles (14%) were LOE II, 24 (48%) articles were LOE III, 11 (22%) articles were LOE IV, and 7 (14%) articles were LOE V.

All the articles in our study covered the years 1990-2020. The ten-year interval when the articles were published the most was between 2000 and 2010, with 30 articles. In addition, 19 (38%) articles were published in the 1990-2000 interval and 1 (2%) in the 2010-2020 interval. The oldest article published by Bradfod et al in January-February 1991 was titled ‘Intraspinal Abnormalities And Congenital Spine Deformities - A Radiographic And MRI Study ‘ [12].

Among the 50 most cited articles, the most published topic was

congenital segmentation defects of the spine (n = 16), followed by congenital spinal deformities (n = 14), followed by spinal dysraphism, radiological studies, and neurofibromatosis (Table 3).

**Discussion**

Congenital spinal anomalies are often accompanied by an increased incidence of internal and external spinal abnormalities [13,14]. Pathologies such as spinal dysraphisms, congenital spinal deformities, spinal cord malformations, segmentation anomalies are located in the parts of the congenital spinal anomalies that concern the spine. Studies in the literature have focused specifically on congenital spinal anomalies and the surgical treatment and outcomes of these problems [15-17]. In our study, we tried to reveal the literature analysis of articles on congenital spinal anomalies.

When we looked at our study, we found that the article that received the most citation was related to spina bifida. The study was carried out in 2001, and spina bifida disease was investigated sufficiently in the literature as it is a complex spinal disease that requires long- term follow-up and treatment. In a study conducted with 118 patients, it was shown that 75% of patients reached early adulthood after 25 years of follow-up [11].

Congenital spinal anomalies include many diseases. In our study, we found that the most cited articles were related to segmentation defects. Another topic of interest was congenital spinal anomalies. Considering that segmentation defects cause many spinal deformities, it can be thought that the relationship of spinal deformities with congenital anomalies attracts more attention.

Looking at the level of evidence of the articles, the majority was LoE II-III with 31 articles. There is only one study with the level of evidence I. In the literature, the LoE has been shown to affect clinical efficacy and study plans of the article [18]. In our analysis, the majority of the articles being LoE II-III may reflect a lower level of quality for those articles.

The most cited articles in our study were from the USA (52%). On the other hand, although there were studies in the Middle East and Europe and Far East countries, it is seen that the most research and citation is by far in the USA.

The articles were published in 30 different journals. Most of the articles were published in the Spine journal. The fact that vertebral surgery is performed by both orthopedists and neurosurgeons has led both branches to publish in major journals. In fact, this is an indication of the importance of congenital spinal anomalies and the importance of adding new data to the literature. Original research articles constituted 62% of the most cited studies. It can be clearly seen from the analysis that the original research articles were cited more.

When the dates of the most cited articles were analyzed, it was seen that there were 30 articles between 2000-2010. In articles published after 2010, there is only one article among the most cited. Although it is thought that articles close to our time will have a lower number of citations, for example, an article that was published newly, it can be understood that the subject attracted the most attention in the literature between 2000-2010 [19].

Our study has some limitations. Theoretically, the number of citations may have increased after May 20, 2020, when we conducted the study, and this may change the current situation. The other limitation is that the citation analysis can be influenced by many factors, including the publication date of the article, the subject of research, and the fact that a publication is highly cited does not indicate that it is superior to all other cited studies. Despite some limitations, citation analysis is the most ideal method to demonstrate the quality and effectiveness of publications and guides clinicians.

### Conclusion

Congenital spinal anomalies are difficult for clinicians as there are many points that still need to be clarified, and they will be of interest in the literature. This study is the first to analyze publications in the literature on congenital spinal anomalies and includes an analysis that we think may guide other clinicians in their studies.

### Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

### Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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### Conflict of interest

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