

Author, Year Country Research Design Total Sample size Level of Evidence	Method	Results
Costacurta et al. (2010) Brazil Case Series N=106 Level of evidence: 4	Reviewed cases of 106 patients 16 years of age or younger who were admitted with SCI to a Brazilian Rehabilitation Medical Center between April 2002 and June 2008	67 boys (63.2%) and the mean age of 8.6 years. In all, 50.9% of the SCI have traumatic etiology. - The most frequent causes were gunshot 42.6%, traffic accident 38.9%, diving 9.3% and fall 3.7%. - Non-traumatic etiologies corresponded to 49.1% of the total patients - tumor (36.5%) and infection (19.2%) were the most frequent cause of spinal injuries. - Average time between SCI event and arrival at the rehabilitation medical center was 27 months. - Majority of patients were paraplegic (76.4%)
Kumar et al. (2017) USA Case Series N=124 Level of evidence: 4	Reviewed retrospectively all children requiring neurosurgical consultation for dog bite at a regional Level 1 pediatric trauma center over a 15-year period	17 children (13.7%) incurred injuries requiring neurosurgical consultation. 53% of victims were female. - The mean age at the time of attack was 30 months. - Twelve (71%) of the attacks were perpetrated by the family pet, and 13 (76%) occurred at the patient's home. - Spinal fracture with complete spinal cord injury in 1 child.
van Adrichem et al. (2019) Tanzania Case Study N=1 Level of evidence: 5	Reviewed the case of a 17-year-old male bird hunter admitted to Kilimanjaro Christian Medical Centre (KCMC) in northern Tanzania with a penetrating neck injury	- Hunter received an arrowhead to neck wound while hunting. - Resulted in incomplete spinal cord injury.
Feldman et al. (2008) USA Case Series N=5 Level of evidence: 4	Reviewed 5 cases of infants and toddlers who sustained cervical spinal cord injury as the result of child abuse	- Five infants and toddlers who sustained cervical spinal cord injury as the result of child abuse, 4 children had spinal cord injury without (or with minimal) radiological abnormality. - The 3 children presenting to our hospital with cord injury represent 1% of the estimated cases of inflicted head injury seen during a 23-year period.
Jauregui et al. (2019) USA N=5 Case Series Level of evidence: 4	Reviewed the cases of 5 infants and toddlers who sustained cervical spinal cord injury as the result of child abuse are described	- Most common type of abuse was physical. - Abused patients were more likely to be below 2 years of age, female, and nonwhite. - Abused patients also presented with an increased risk of thoracic and lumbar vertebral column fractures.
Apple et al. (1995) USA Case Series N=1770 Level of evidence: 4	Reviewed a database of 1,770 traumatic SCI patients	Violent etiologies, predominantly gunshots, accounted for a disproportionate share of injuries to preteens (19%) and African-Americans (28%), as compared with adults (12%) and Caucasians (7%)
Chu et al. (2016) USA Case Series N=8317 Level of evidence: 4	Reviewed the National Trauma Databank (2007-2010) to identify patients with mandibular fractures	- There were statistically significant lower rates of associated CSI in pediatric patients than adults (3.5% versus 7.3%, $P < 0.01$). - Predictors of associated CSI in mandible fractures for both adults and

		children were older age, lower Glasgow Coma Scale, thoracic injuries, firearm or motor vehicle accident mechanisms, and symphyseal fractures. 3. In the pediatric cohort, body, ramus, and subcondylar fractures were significantly associated with CSI.
Adams et al. (1988) Canada Case Series N=8 Level of evidence: 4	Reviewed of cases of 8 neonates who presented with the clinical features of spinal cord injury	1. Most cases involved difficult delivery, absent respiration, flaccid paralysis, sensory level, and neurogenic bladder. 2. Myelography revealed that 7 patients had the early changes of swollen cord and 1 patient had the late changes of cord atrophy.
Vialle et al. (2008) France Case Series N=9 Level of evidence: 4	Reviewed medical charts of nine patients identified by a questionnaire sent to the members of the French Society of Paediatric Orthopaedics (SOFOP)	1. Fetal presentation was cephalic in three cases, a breech presentation in four cases, and a face presentation in two cases.
Polk-Williams et al. (2008) USA N=95,654 Case Series Level of evidence: 4	Reviewed the National Trauma Data Bank (NTDB) for the period January 2001 to December 2005 for patients younger than 3 years of age with a blunt CSI	1. Most patients with a CSI were injured in motor vehicle crash (MVC) (66%) or falls (15%). 2. Injured patients without CSI were also most likely to be injured in a MVC (32%) or via a fall (27%). 3. MVCs remained the most common mechanism of injury, whether cord-injured, column-injured, or both. Similarly, falls remained the second most common cause of all 3 types of c-spine injury. 4. Slightly fewer than half of CSI patients with a cord injury sustained such injuries in an MVC (45.6%), whereas significantly more than half of both column-injured patients and column and cord-injured patients sustained their injuries in an MVC (69.1% and 64.7%, respectively). 5. An assault was more likely to cause an isolated cord injury than an isolated column injury or a column injury with cord injury.
Babu et al. (2016) India Case Series N=84 Level of evidence: 4	Retrospectively reviewed 84 consecutive pediatric spine injuries treated at an institute from January 2002 to December 2011	1. The mean age was 14.7 years. 2. There were 18 patients (21%) in group A (0-12 years) and 66 patients (79%) in group B (13-18 years). 3. Overall, injury was more common in boys (ratio of 6:1). 4. Trivial fall was the predominant cause in group A and fall from height in group B. There were 30 children (36%) with injuries of the upper cervical spine, 53 (63%) with injuries of the lower cervical spine and 1 patient (1%) with a combined injury of upper cervical spine and thoracic spine. 5. Overall, 22% of the group A children and 67% of the group B patients had more severe injuries
Cheshire (1977) USA Case Series N=3 Level of evidence: 4	Reviewed 3 case histories	1. The majority of children the spinal paralysis is complete and this would appear to be particularly true in those children in whom the onset of the paralysis is immediate.

Zhang et al. (2015) China Case Series N=6 Level of evidence: 4	Reviewed retrospectively 6 pediatric patients with os odontoideum who suffered acute traumatic cervical cord injury between 2012 and 2013	1. There were 2 male and 4 female subjects ranging in age from 4 to 18 years (mean 11.8 years). 2. In children aged 4 - 18, Falls were the most common injury (n = 5), followed by a minor motor vehicle accident (n = 1) 3. Asymptomatic or myelopathic atlantoaxial instability secondary to os odontoideum ahead of fall. 4. Atlantoaxial instability and cord compression were presented in all cases with dynamic cervical lateral radiographs and magnetic resonance imaging. 5. Most patients presented with spinal cord thinning and hyperintensity on T2-weighted sequences in magnetic resonance imaging. 6. Two patients were classified as ASIA B, 1 as ASIA C, and 3 as ASIA D category on admission.
Schwartz et al. (1997) USA Case Series N=8 Level of evidence: 4	Reviewed retrospectively the medical records of children younger than 6 years old with the diagnosis of cervical vertebral fracture or cervical spinal cord injury after a fall of less than 5 feet. Data from medical records over an average time span of 11 years at four large children's hospitals were compiled.	1. Children ranged in age from 9 to 68 months. 2. Three had rotary subluxation of C1, and three had subluxation of C1-C2. 3. One of the children in the latter group also had an odontoid fracture. 4. Two children had a fracture of C2. 5. All the children had limited range of motion of the neck or neck pain.
Mukhida et al. (2006) Nepal Case Series N=352 Level of evidence: 4	Reviewed clinical records of patients <or=18 years who presented to Tribhuvan University Teaching Hospital between April 1, 2001 and April 1, 2004 with acute neurological trauma and were admitted to hospital	1. Spinal injuries were relatively rare (4%) compared to head injuries (96%). 2. Falls were the most common cause of injuries (61%).
Cirak et al. (2004) USA Case Series N=206 Level of evidence: 4	Reviewed retrospectively all children younger than 14 years with TSI, treated at a level I pediatric trauma center between 1991 and 2002 (n = 406, 4% total registry)	1. Mean age was 9.48 ± 3.81 years. 2. The most common overall mechanism of injury was motor vehicle crash (MVC; 29%) and ranked highest for infants. 3. Falls ranked highest for ages 2 to 9 years. 4. Sports ranked highest in the 10 to 14 year age group. 5. Paravertebral soft tissue injuries were 68%. 6. The most common injury level was the high cervical spine (O-C4). 7. The incidence of spinal cord injury without radiologic abnormality (SCIWORA) was 6%
Canosa-Hermida et al. (2019) Spain Case Series N=68	Reviewed data from the internal registry of the Spinal Cord Injury Unit and the patient's medical	1. The mean age was 14.4 years (median: 16). 2. Only 25% were younger than 15. 3. Male patients accounted for 73.5% of the total.

Level of evidence: 4	records, between March 1988 and December 2014	4. Main cause of injury was traffic accidents (60.3%; n = 41), being higher (77.8%) in children ≤ 10 years. 5. Other etiologies included falls (19.1%), diving accidents (16.2%) and other causes (4.4%)
Ruge et al. (1988) USA Case Series N=71 Level of evidence: 4	Reviewed clinical data from 71 children aged 12 years or younger of 2598 spinal cord-injured patients admitted to the authors' institutions from June, 1972, to June, 1986	1. The 47 children with traumatic spinal cord injury averaged 6.9 years of age and included 20 girls (43%). 2. The etiology of the pediatric injuries differed from that of adult injuries in that falls were the most common causative factor (38%) followed by automobile-related injuries (20%). 3. Ten children (21.3%) had spinal cord injury without radiographic abnormality (SCIWORA), whereas 27 (57%) had evidence of neurological injury. 4. Complete neurological injury was seen in 19% of all traumatic pediatric spinal cord injuries and in 40% of those with SCIWORA.
German et al. (2007) USA Case Series N=73 Level of evidence: 4	Reviewed retrospectively the University of New Mexico Hospital trauma registry of data compiled over a 7-year period	1. 53 children (73%) had sustained neurological injuries. 2. Among these 53 children, 64% sustained isolated head injuries, 15% isolated spine injuries, 9.4% combined spine and head injuries, 2% combined peripheral nerve, spine, and head injuries, 4% isolated peripheral nerve injuries, and 5.6% concussive events. 3. In 53.4% of patients with neurological injuries the results of computed tomography (CT) examination were abnormal
Turgut et al. (1996) Turkey Case Series N=82 Level of evidence: 4	Reviewed 82 children with spinal cord and/or vertebral column injury treated in department between 1968 and 1993	1. The cause of pediatric injuries differed from that of adult injuries in that falls were the most common causative factor (56%) followed by vehicular accidents (23%). 2. The most frequent level of spinal injury was in the cervical region (57%, 47 patients) followed by the lumbar region (16.5%, 13 patients). 3. 18% of the patients had complete injury and the overall mortality rate was 3.6%. 4. 11 children (13%) had spinal cord injury without radiographic abnormality (SCIWORA), whereas 39 (47%) had evidence of neurological injury
Galvin et al. (2013) Australia Case Series N=103 Level of evidence: 4	Reviewed consecutive admissions with SCD using the International Classification of Diseases and Related Health Problems, 10th Edition, Australian Modification. Potential cases admitted to RCH between January 1, 2000, and June 30, 2010, were identified and the RCH Trauma Registry was cross-checked to improve accuracy of case attainment	1. Most patients (n = 68, 66%) had a non-traumatic SCD and were male (n = 68, 66%). 2. Of the 68 patients who sustained non-traumatic spinal injuries, the majority (n = 40, 59%) were a result of neoplasm or transverse myelitis (n = 15, 22%) or other diseases of the spinal cord (n = 12, 18%). 3. 35 children were admitted after traumatic injury and more than half of these (n = 19, 54%) were involved in motor vehicle accidents, followed by sporting injuries (n = 8, 23%), falls from height (n = 7, 20%) and assault (n = 1, 3%).

Viccellio et al. (2001) USA Observational N=3065 Level of evidence: 5	A prospective, multicenter study to evaluate pediatric blunt trauma victims	30 patients (0.98%) sustained a CSI. - Included in the study were 88 children who were younger than 2, 817 who were between 2 and 8, and 2160 who were 8 to 17. - Fractures of the lower cervical vertebrae (C5-C7) accounted for 45.9% of pediatric CSIs. - No case of spinal cord injury without radiographic abnormality was reported in any child in this study, although 22 cases were reported in adults. - Only 4 of the 30 injured children were younger than 9 years, and none was younger than 2 years.
Mangano et al. (2006) USA Case Series N=185 Level of evidence: 4	Reviewed retrospective data obtained in all patients admitted to the St. Louis Children's Hospital between 1993 and 2003.	- Sixty-two patients (33.5%) suffered neurological injuries - There were 42 male and 20 female patients whose age ranged from 2 to 17 years. - Most common injuries included skull fracture (37 cases) and closed head injury (30 cases). - There were 39 cases of intracranial hemorrhage and 11 of spinal fracture. 2 patients had sustained spinal cord injury, and three procedures were performed for spinal decompression or stabilization.
Sneed et al. (1986) USA Case Series N=5 Level of evidence: 4	Reviewed 5 reports of all-terrain vehicle accidents in childhood from the US Consumer Product Safety Committee	- Age range of victims was from 7 to 18 years. - Of the five cases of spinal cord injury, three resulted in quadriplegia and two in paraplegia.
Noffsinger et al. (2008) USA Case Series N=181 Level of evidence: 4	Reviewed of 181 children with sledding related-trauma at a Midwest pediatric level I trauma center and affiliated urgent care centers from 2006 – 2007	- A 15-year-old boy sledding head first on a body board when his head struck the bumper of a trailer. - He sustained vertebral body compression fractures of cervical vertebrae 4–7 and spinal cord injury. - The most frequent mechanism of injury was collision with an object or a person.
Polites et al. (2014) USA Case Series N=155 Level of evidence: 4	Reviewed cases of children under 18 years of age who presented to our institution from July 1997 to July 2013 with injuries sustained while participating in ice hockey	- Injuries to the spine were most common in younger children (≤ 14 years old) and girls, - Most injuries resulted from intentional contact.
Furnival et al. (1999) USA Case Series N=724 Level of evidence: 4	Reviewed retrospectively medical records of all PTI patients presenting to the pediatric ED from November 1990 through November 1997	- Spinal injuries were common (12%), including 7 patients with cervical or thoracic fractures, and 1 with C7 paraplegia. - Fractures were more frequently associated with falls off the trampoline, whereas spinal injuries more frequently occurred on the trampoline. - The annual number of PTI nearly tripled during the study period, from 51 in 1991 to a peak of 148 in 1996. - PTI patients were 53% female, with a median age of 7 years; 37% were <6 years of age. - Privately owned trampolines accounted for 99% of PTI. Most injuries (66%) occurred on the

		trampoline, 28% resulted from falls off, and 4% from imaginative mechanisms. 6. One hundred eleven patients (15%) suffered severe injury (1990 Abbreviated Injury Scale value ≥ 3), usually of an extremity (89 out of 111). Fractures occurred in 324 patients (45%).
Kasmire et al. (2016) USA Case Series N=8263 Level of evidence: 4	Reviewed data on trampoline injuries from the National Electronic Injury Surveillance System from 2010 to 2014	1. TPIs resulting in hospital admission included open leg fractures ($n = 4$), a skull fracture ($n = 1$), and cervical spine fractures with spinal cord injury ($n = 2$). 2. Both patients with spinal cord injuries (ages 17 and 20 years old) sustained the injury performing a flip, with 1 landing on his head on a bar and the other jumping into a foam pit.
Babcock et al. (2018) USA Case Series N=176 Level of evidence: 4	A secondary analysis of a multicenter retrospective case-control study involving children younger than 16 years who presented to emergency departments after blunt trauma and underwent cervical spine radiography	1. Children with sport and recreational activity-related trauma had increased odds of cervical spine injury if they had focal neurologic findings (odds ratio [OR], 5.7; 95% confidence interval [CI], 3.5–9.4), had complaints of neck pain (OR, 3.1; 95% CI, 1.9–5.0), were injured diving (OR, 43.5; 95% CI, 5.9–321.3), or sustained axial loading impacts (OR, 2.2; 95% CI, 1.3–3.5). 2. Football (22%), diving (20%), and bicycle crashes (11%) were the leading activities associated with cervical spine injury.
Kokoska et al. (2001) USA Case Series N=408 Level of evidence: 4	Reviewed the National Pediatric Trauma Registry between April 1994 and March 1999 and identified (by ICD-9 criteria) all cases of blunt trauma victims with cervical fractures, dislocations, and spinal cord injuries without radiographic abnormality (SCIWORA)	1. INCIDENCE of spinal cord injury is relatively low (1% to 2%) among pediatric trauma victims, 60% to 80% of all pediatric vertebral injuries are in the cervical (C) spine. 2. Data were sorted by International Classification of Diseases, 9th revision, Clinical Modification (ICD · 9 · CM) diagnosis as follows: fractures (805.00 to 805.19, 806.00 to 806.19), dislocations (839.00 to 839.18), and spinal cord injury without radiographic abnormality (SCIWORA; 952.00 to 952.09).
Baker et al. (1999) USA Case Series N=72 Level of evidence: 4	Reviewed retrospectively patients who were diagnosed with CSI	1. 72 children, ages from 1 month to 15 years (median age, 9 yrs), were included in the study. 2. Sports-related injuries were the most common. 3. Forty patients had RESCI and 32 had SCIWORA.
DeVivo & Vogel (2004) USA Case Series N=35,080 Level of evidence: 4	Reviewed persons with SCI enrolled in either the Shriners Hospitals for Children SCI database or the National SCI Statistical Center database from 1973 through 2002	1. Among children and adolescents (under the age of 22), the proportion of SCI due to motor vehicle crashes was higher than in adults (22+ years). 2. Sports, violence, and medical or surgical complications also accounted for a significantly greater proportion of SCI in teenagers (13–21 years) than in adults. 3. Violence has become the leading cause of SCI among African American and Hispanic teenage males (13–21 years). 4. SCI was much more likely to be neurologically complete in younger persons.

Astur et al. (2013) USA Case Series N=14 Level of evidence: 4	Reviewed cases of patients ranging in age from newborn to sixteen years old who had a diagnosis of atlanto-occipital dislocation from 1991 through 2011	1. Half of the patients were male, and the mean age at the time of the accident was 5.2 years (range, one to ten years). 2. A motor-vehicle accident was the mechanism of injury for all patients: eleven were injured while riding in an automobile, two patients were struck by an automobile, and one fell from an all-terrain vehicle. 3. Five of the eleven patients who were injured while riding in an automobile had been unrestrained and were ejected from the vehicle.
Nadarajah et al. (2018) USA Case Series N=587,084 Level of evidence: 4	Reviewed and analyzed the data sets of the Healthcare Cost and Utilization Project (HCUP) Kids' Inpatient Database (KID) from 2000-2012	1. Of our study population, 0.8% had a documented diagnosis of spinal cord injury (SCI). 2. The most common documented external cause of injury code was motor vehicle accidents, representing roughly half of all cases in patients 0-9 years-old ($p = 0.001$). 3. PSCI due to sports as an external cause of injury was more prevalent in patients 10-17 years old, and was especially prevalent in the 10-13 year-old age category in which sports-related PSCI reached a high of 25.6%. 4. Risk factors for traumatic PSCI after a sports-related external cause included being of older age, male, and white.
Ribeiro da Silva et al. (2016) Portugal Case Series N=75 Level of evidence: 4	Reviewed clinical records of pediatric trauma patients admitted to a level 1 trauma center between 1991 and 2009	1. Patients were stratified by age into two groups: group A with patients aged eight or less, and group B with patients from nine to 16 years, based on previous studies, with group A representing patients with younger, immature spine, and group B the ones closer to the adult. 2. Lesions resulted mostly from motor-vehicle crashes in both groups ($p < 0.001$), but other mechanisms of injuries were also observed as: pedestrian, falls, and sports or leisure-related injuries (including jumps into shallow water) (Fig. 1). 3. Patients of group A were mostly injured in car or motorcycle crashes, whereas patients of group B were more often injured in car accidents, during sports or leisure activities.
Poorman et al. (2019) USA Case Series N=11,196 Level of evidence: 4	Reviewed the Kids' Inpatient Database (KID) for trauma cases from 2003 to 2012	1. Most common etiology was motor vehicle accidents (50.5%). 2. Infants and children frequently fractured at C2 (closed: 43.1%, 32.9%); adolescents and young adults frequently fractured at C7 (closed: 23.9%, 26.5%). 3. Upper cervical SCI was less common (5.8%) than lower cervical SCI (10.9%). 4. Lower cervical unspecified-SCI, anterior cord syndrome, and other specified SCIs significantly decreased since 2003. 5. Predictors of SCI included sports injury and CCI.
Leonard et al. (2014) USA	5-year retrospective review of children <16 years old with CSIs at 17	1. CSI level was associated with both age and mechanism of injury.

Case Series N=540 Level of evidence: 4	Pediatric Emergency Care Applied Research Network hospitals	- For children <2 and 2 to 7 years old, motor vehicle crash (MVC) was the most common injury mechanism (56%, 37%). - Children in these age groups more commonly injured the axial (occiput–C2) region (74%, 78%). - In children 8 to 15 years old, sports accounted for as many injuries as MVCs (23%, 23%), and 53% of injuries were subaxial (C3–7). - CSIs often necessitated surgical intervention (axial, 39%; subaxial, 30%) and often resulted in neurologic deficits (21%) and death (7%)
Dogan et al. (2006) USA Case Series N=51 Level of evidence: 4	Reviewed patients with sub-axial cervical spine injuries retrospectively	- Motor vehicle accidents (MVAs) were the most common cause of injury. - Overall, 12% presented with a dislocation, 63% with a fracture, 19% with a fracture–dislocation, and 6% with a ligamentous injury. - The most frequently injured level was C6–7 (33%); C3–4 (6%) was least frequently involved. - Sixty-four percent of patients were neurologically intact, 16% had incomplete spinal cord injuries (SCIs), 14% had complete SCIs, and three patients (6%) died after admission and before assessment.
Eleraky et al. (2000) USA Case Series N=102 Level of evidence: 4	Retrospective clinical study of 102 cases of pediatric cervical spine injuries treated in the last decade	- Patients were divided into two age groups–birth to 9 years (Group 1) and 10 to 16 years of age (Group 2). - Motor vehicle accidents were the most common cause of injury, and 40% were associated with head injury. - Patients in the younger-age group (Group 1) sustained more neurological injuries than the older patients in Group 2, and most injuries were in the upper cervical spine. - Of the 38 children in Group 1, in 39% a subluxation was present and in 29% a fracture or fracture/subluxation was demonstrated. - Of the patients in Group 2, 80% had sustained fractures or fracture/subluxations. - Vertebral fractures were the most common radiological findings (32%)
Finch and Barnes (1998) New Zealand Case Series N=32 Level of evidence: 4	Population-based study of pediatric cervical spine trauma in the Auckland region over 7 years starting in March 1989	32 children younger than 15 years of age who had sustained a fracture, dislocation, or major ligamentous injury to the cervical spine including SCIWORA. 21 patients were injured during sport or recreational activities and 11 in motor vehicle accidents. - Children in the younger age group were mostly injured in motor vehicle accidents, whereas older children were more often injured during sport or recreation ($p < 0.001$).
Carr et al. (2004) USA Case Series N=238 Level of evidence: 4	Retrospectively reviewed cases of patients who were admitted to the Jon Michael Moore Trauma Center at the West Virginia University School	- One-third of victims (75 of 238 victims) were in the pediatric population, and only 21% were wearing helmets. - Only 15% of victims less than 16 years of age were wearing helmets.

	of Medicine after all-terrain vehicle crashes, between January 1991 and December 2000	
Knox et al. (2014) USA Case Series N=206 Level of evidence: 4	Reviewed all patients treated for spinal injury at a single large level I pediatric trauma center between 2003 and 2011	1. 57 patients were between 0 and 3 years of age and 149 were between 4 and 9 years old. 2. Although motor vehicle collision was the most common cause of injury in both the groups, non-accidental trauma was responsible for 19% of spine trauma among patients aged 0 to 3 years. 3. Cervical spine injuries were much more common in the youngest patients ($P<0.05$) with injuries primarily in the upper cervical spine.
Santschi et al. (2005) Canada Case Series N=8 Level of evidence: 4	Reviewed case of injuries sustained by 8 children, including 2 sets of twins, in 3 different motor vehicle crashes	1. All children were rear seat passengers wearing lap or 3-point restraints. 2. All had abdominal lap-belt ecchymosis and multiple abdominal injuries due to the common mechanism of seat-belt compression with hyperflexion and distraction during deceleration. 3. 5 of the children had lumbar spine fractures and 4 remained permanently paraplegic.
Achildi et al. (2007) USA Case Series N=250,000 Level of evidence: 4	Reviewed current literature on lapbelt injuries, seatbelt syndrome, and pediatric SCI using PubMed	1. Approximately 250,000 patients are presently living with spinal cord injury (SCI) in the United States. 2. Approximately 20% of patients with SCI are less than 20 years old, and 15% are less than 15 years old. 3. The most common cause of pediatric SCI is a motor vehicle collision (MVC; ~ 40 %); lapbelt injuries and the seatbelt syndrome are seen more often in children involved in MVCs. 4. Children involved in MVCs who are improperly restrained are at higher risk of sustaining injuries.
Hoy and Cole (1993) Australia Case Series N=541 Level of evidence: 4	Reviewed 541 children with injuries sustained as passengers in motor vehicle accidents over a 9-year period	1. Of these, seven (1.3 per cent) had the cervical seat belt syndrome. 2. 5 children had fractures or fracture-subluxations of the proximal cervical spine, while two had injuries of the lower cervical spine.
Zuckerbraun et al. (2004) USA Case Series N=5117 Level of evidence: 4	Data on children (<18 years, 1997 to 2002) admitted to a level I pediatric trauma center were prospectively collected and retrospectively reviewed	1. Those with C-spine injuries caused by MVC were extracted and divided into 2 groups: young (0 to 8 years) and old (9 to 18 years). 2. 94 had C-spine injuries with a mean age of 11 ± 5 years, 66% of which were boys. 3. Among 1,124 patients who had sustained MVC there were 27 C-spine injuries (2.4% incidence), of which, 12 were less than 8 and 15 were older than 8 years. 4. Restraint devices were utilized at least as frequently in younger children (young, 58% v. old, 43%; not significant). 5. Younger children had an increased incidence of permanent cord deficit (young, 57% v. old, 13%; $P < .05$) and closed head injury (young, 50% v.

		old, 7%; $P < .05$) even while wearing restraint devices, suggesting that restraint devices are inadequate or improperly used in younger patients.
Dauleac et al. (2019) France Case Series N=73 Level of evidence: 4	Retrospective review of all patients admitted to our pediatric trauma center for spine traumas that required surgical management, between 2005 and 2016	1. Mean age was 14.1 years. 2. Spinal injuries were more common in the teenage group (14–18 years). 3. The predominant etiology of spine injuries was motor vehicle collision (36%). 4. The spinal level of injury varied according to the age group: young children presented more cervical traumas ($P < 0.01$), while teenagers presented more lumbar traumas. 5. There were more fractures alone in the teenage group ($P < 0.005$), while there were more luxations alone in the school-age group ($P < 0.05$)
Hamilton and Myles (1992) Canada Case Series N=174 Level of evidence: 4	Method: Reviewed 174 pediatric patients	1. Spinal cord injury was present in 45% of patients. 2. The younger patients, while less likely to have spinal injury, had a higher incidence of neurological injury, in addition to a higher frequency of both spinal cord injury without radiological abnormality and upper cervical cord injury. 3. Younger patients with spinal cord injury and no radiological abnormality were more likely to have complete or severe cord injury.
Odetola and Gebremariam (2016) USA Case Series N=2317 Level of evidence: 4	Secondary analysis of a national database on injured children 0-20 years evaluated at U.S. EDs and either hospitalized or released, in 2009-2012	1. Majority (87%) of children evaluated for SCI were under 6 years of age, and boys comprised 73% of the visits. 2. Injuries were caused mainly by motor vehicle accidents, falls, non-transport-related accidents, and firearms. 3. The South census region had the most ED visits and hospitalizations.
Kim et al. (2016) Canada Case Series N=275 Level of evidence: 4	Retrospectively reviewed the cases of children with spinal injuries treated at a level 1 pediatric trauma center between 1990 and 2013	1. The mean age at admission was 12 ± 4.5 years, and the male:female ratio was 1.4:1. 2. Spinal injuries were more common in children of ages 12–16 years, with most injuries among ages 15–16 years. 3. The top 3 mechanisms of spinal injury were motor vehicle-related trauma (53%), sports (28%) and falls (13%). 4. Myelopathy occurred in 12% and SCIWORA occurred in 6%. 5. The most common spine levels injured were L2–sacrum, followed by O–C2.
Bilston and Brown (2007) Australia Case Series N=340 Level of evidence: 4	Reviewed all children up to age 16 who sustained spinal trauma, as defined by ICD10 codes, at 2 pediatric trauma hospitals in Sydney, Australia	1. Traffic-related incidents accounted for approximately one third of all spinal trauma and half of serious injuries. 2. The cervical spine was the most frequently injured region, with thoracic and lumbar spine injuries becoming more common with age. 3. The upper cervical spine was more commonly seriously injured in young children, and the lower cervical spine was involved more often in older children

Marshall et al. (1998) USA Case Series N=68 Level of evidence: 4	Retrospectively evaluated the available autopsy and imaging studies in 11 such cases not previously reported in the medical literature, in addition to three published case studies	1. As of November 1, 1997, automotive air-bag deployments occurring in low-speed collisions had resulted in the deaths of 49 children and in the serious injuries of 19 children in the United States. 2. The cause of death or serious injury in every case was the direct result of neurologic injury. 3. Injury patterns differed according to the child's age and type of restraint used at the time of collision. 4. Crush injury to the skull predominated in infant victims traveling in rear-facing child safety seats, and both cranial and cervical spine trauma occurred in older children traveling restrained, improperly restrained, or unrestrained in the vehicle's front passenger seat.
Pieretti-Vanmarcke et al. (2009) Case Series USA N=12,537 Level of evidence: 4	Reviewed the trauma registries from 22 level I or II trauma centers were reviewed for the 10-year period (January 1995 to January 2005)	1. Of 12,537 patients younger than 3 years, CSI was identified in 83 patients (0.66%); 2. 8 had spinal cord injury
Chan et al. (2013) Canada Case Series N=365 Level of evidence: 4	Retrospective review of 365 pediatric severe trauma patients (0-17 years), defined as an Injury Severity Score (ISS)≥12, admitted to the pediatric intensive care unit (PICU)	1. Clinically significant CS injuries were identified in 5% (n¼ 18/365) of trauma patients. 2. No CS injuries were identified in trauma patients with intentional injuries (n¼ 25), of which the vast majority were under 1 year of age, and diagnosed with shaken baby syndrome. 3. In patients with CS injuries, motor vehicle collisions were the predominant mechanism of injury, and TBI was the primary injury. 4. The incidence of CS injuries increased to 9% in severe TBI patients (n¼ 13/149).
Meyer et al. (2005) France Case Series N=831 Level of evidence: 4	Children with HSCI surviving inaugural cardiac arrest/apnea were selected for a retrospective analysis of a trauma data bank	1. 13 patients had cervical spine lesions above the C3 level with inaugural cardiac and/or respiratory arrest were identified. 2. In children with HSCI, the mean age was 4.7 F 2.9 years (range, 10 months to 8 years) and the male-to-female ratio was 1.6:1. 3. Victims sustained a witnessed high-energy distracting injury, more than 50% being pedestrian struck by vehicles and 38% being passengers of moving vehicles (vs 33% and 15%, respectively, in the rest of the population).
Nitecki and Moir (1994) USA Case Series N=227 Level of evidence: 4	Uncommon traumatic cervical spine fractures and dislocations were studied in 227 consecutively treated children	1. The mean patient age was 14 years (range, 1 to 17 years), and the male:female ratio was 2.4:1 (161 boys, 66 girls). 2. 38 patients (17%) were under 8 years of age; 21 were boys (55%), and 17 were girls (45%). 3. The male preponderance was most marked in patients aged 9 to 17 years (male:female ratio, 2.9:1).

		- For children under 8 years of age, motor vehicle accidents were the leading cause of injury, followed by falls. - Among older children, sports accidents were the leading cause of injury. - Lower cervical spine fractures or dislocations (C-3 to C-7) affected 73% of all patients. - A C-7 injury was the single most common spinal injury, occurring in 22% of patients (51 patients), followed by C-2 (in 15%). - Children with a higher-level injury were younger than those with a lower-level injury.
Brown and Bilston (2009) Australia Case Series N=72 Level of evidence: 4	Retrospective review of data from all motor vehicle passengers aged 0–16 years treated at two major children’s hospitals from 1999 to 2004 with ICD-10 codes for spinal trauma	- Age <12 years was found to be significantly associated with serious spinal injury. - Compared to older children, children aged less than 12 years were more likely to sustain serious spinal injury (OR 7.1, 95% CI 1.2 to 42.9). - This age breakpoint may reflect the adequacy of seat belt fit, and use of adult seatbelts alone before age 12 may increase a child’s risk of serious spinal injury.
Anissipour et al. (2017) USA Case Series N=21 Level of evidence: 4	Reviewed 21 patients of age 12–17 years that were treated for unilateral or bilateral facet dislocations between January 2004 and September 2014	- The mean age at presentation was 14.9 years; (range 12–17). Male:female ratio was 15:6. - Mechanisms of injury included 13 motor vehicle accidents, five diving injuries, two assaults, and one fall from height.
Smith et al. (2017) Ireland Case Series N=48 Level of evidence: 4	Retrospective review of prospectively gathered data in the Patient Administration System of the National Rehabilitation Hospital of patients age 15 years or younger at the time of SCI onset	- Since 2000, 22 children have sustained TSCI and 26 have sustained NTSCI. - Median (IQR) age at TSCI onset was 6.3 (4.4) years, and at NTSCI onset it was 7.3 (8.1) years. - Most common TSCI etiology was transportation ($n = 10$; 45.5%), followed by surgical complications ($n = 8$; 36.4%); most common injury type was complete paraplegia ($n = 12$; 54.5%) followed by incomplete paraplegia ($n = 5$; 22.7%). - Most common NTSCI etiology was transverse myelitis ($n = 11$; 42.3%) followed by vascular ($n = 5$; 20%); most common injury type was incomplete paraplegia ($n = 17$; 65.4%) followed by incomplete tetraplegia ($n = 6$; 24%).
Mohseni et al. (2011) USA Case Series N=240,647 Level of evidence: 4	Retrospective review of the National Trauma Data Bank was conducted for the period of January 2002 through December 2006 to identify pediatric patients admitted following blunt trauma	- Patients were stratified into 4 developmental age groups: infants/toddlers (age 0-3 years), preschool/young children (age 4-9 years), preadolescents (age 10-13 years), and adolescents (age 14-17 years). - Of these, 1.3% ($n = 3,035$) sustained a CSI. - The incidence of CSI in the stratified age groups was 0.4% in infants/toddlers, 0.4% in preschool/young children, 0.8% in preadolescents, and 2.6% in adolescents. - The level of CSI (upper [C1-C4] vs lower [C5-C7]) according to the age groups was as follows: infants and toddlers, 70% vs 25%; preschool/young children, 74% vs 17%;

		preadolescents, 52% vs 37%; and adolescents, 40% vs 45%, respectively. 5. Motor vehicle accident as the mechanism of injury carried the highest risk for CSI (OR = 3.0; 95% CI, 2.8-3.3; P b .001)
Brown et al. (2001) USA Case Series N=103 Level of evidence: 4	Retrospective analysis of 103 consecutive C-spine injuries treated at a level 1 pediatric trauma center over a 9(1/2)-year period (January 1991 through August 2000)	1. The mean age was 10.3 ± 5.2 years, and the male-to-female ratio was 1.6:1. 2. The most common mechanism of injury was motor vehicle related (52%), followed by sporting injuries (27%). 3. Football injuries accounted for 29% of all sports-related injuries. 4. 68 percent of all children sustained injuries to C1 to C4; 25% to C5 to C7; and 7% to both. 5. Spinal cord injury without radiographic abnormality (SCIWORA) occurred in 38%. 6. 5 patients had complete cord lesions involving the lower C-spine (C4 to C7); 4 of these were motor vehicle related, and all 4 patients died. Isolated C-spine injuries occurred in 43%.
Lee et al. (2009) South Korea Case Series N=48 Level of evidence: 4	Reviewed clinical characteristics of 48 patients who experienced SCI during childhood and adolescence and who underwent rehabilitation treatment	1. Clinical characteristics were compared in patients under 4 years old (group A), 4–12 years old (group B), and 13–18 years old (group C) at SCI onset. 2. The overall male:female ratio was 3:2, with SCI due to non-traumatic causes more frequent overall. 3. Of traumatic causes of SCI, vehicle accident was the most frequent. 4. Of non-traumatic causes, congenital anomaly was most frequent in group A, but tumors became dominant as age increased. 5. Overall, thoracic cord level of injury was most frequent. SCI without radiologic abnormalities (SCIWORA) was predominant in group A, but none was observed in group C. Spinal fractures with or without subluxation accounted for >60% of group C SCI.
Mortazavi et al. (2011) USA Case Series N=183 Level of evidence: 4	Patients with pediatric spine injury (183) were retrospectively reviewed	1. 7 patients (14.5%) were between 3 and 9 years of age, and 41 patients (85.5%) were between 9 and 16 years of age. 2. 30 patients (62.5%) were at contiguous levels and 18 (37.5%) were at noncontiguous. 3. A total of 126 injured vertebrae were diagnosed. 4. The cervical region alone was most frequently (31.2%) involved, and the thoracic region alone was the least frequently involved (12.5%). 5. Overall, 73% of patients were neurologically intact, 4.1% had incomplete spinal cord injury (SCI), and 8.3% had complete SCI. 6. The predominant mechanism of multilevel spine injury was motor vehicle accidents (MVA, 52%), followed by sports-related activities (18.7%), fall-related injuries (16.7%), and motor vehicle versus pedestrian accidents (12.6%).

		7. Of the cases involving MVAs, 72% were unrestrained at the time of the accident (18 patients).
Leonard et al. (2007) Ireland Case Series N=40 Level of evidence: 4	A 10-year (1995-2004) retrospective study was undertaken of all patients treated for a spinal injury at the Department of Orthopedics, The Children's University Hospital in Dublin, Ireland	1. The patients ranged in age from 2 to 15 years (mean age 10 years). 25 of the patients were male. 2. The most common mechanism of injury was MVA (16/40). Nine were vehicle occupants, five were pedestrians and two were cyclists when they were injured. 3. The rest of the patients were injured as a result of falls (14/40) sporting injuries (7/40) and assaults (3/40).
Vander Have et al. (2009) USA Case Series N=37 Level of evidence: 4	Reviewed all pediatric patients who sustained thoracic or lumbar burst fractures at 2 institutions between 1991 and 2005	1. The mean age at the time of injury was 14.6 years (range, 6 to 18y). 2. There were 17 male patients and 20 female patients. 3. The mechanism of injury was a motor vehicle accident in 19 children, a fall in 7, an all-terrain vehicle accident in 5, a snowmobile accident in 4, and a snow-sledding injury in 2.
Khanna and El-Khoury (2007) USA Case Series N=122 Level of evidence: 4	Reviewed patterns of common pediatric cervical spine injuries	1. While pedestrian-automobile accidents and falls are the most common etiology in young children (less than 8 years of age), older children are more often injured as passengers in motor vehicle accidents or in sports injuries, such as football, diving and wrestling. 2. Other less common causes of cervical injury include birth trauma in breech delivery and non-accidental trauma.
Lewis et al. (1986) USA Case Series N=643 Level of evidence: 4	Reviewed newly diagnosed patients with systemic cancer younger than 18 years of age during a 40-month period	1. In 4% of newly diagnosed patients with systemic cancer younger than 18 years of age (range: 3 months to 17 years) spinal cord disease developed. 2. Patients with spinal cord disease included 21 children with metastatic spinal cord compression, two with treatment-related transverse myelopathies, and one with an anterior spinal artery stroke. 3. Spinal cord disease occurred in 13 of 102 children (12%) with sarcomas, six of 82 (7%) with neuroblastomas, and four of 94 (4%) with lymphomas.
De Martino et al. (2019) Italy Case Series N=44 Level of evidence: 4	Reviewed children under 18 admitted and assessed for MSCC since 2007	1. The leading cause of MSCC was extramedullary tumors (63.6%), in particular neuroblastoma (27.2%) followed by Ewing sarcomas (15.9%).
Lo (2010) Singapore Case Series N=2 Level of evidence: 4	Reviewed two cases of acute spinal cord injury resulting from spontaneous spinal epidural hematoma	1. Both cases of epidural hematoma had a cavernous vascular malformation origin. 2. Both spontaneous spinal epidural hematoma and intramedullary cavernous malformation are rare in children.
Messacar et al. (2016) USA Case Series	Reviewed clinical features of the increasing cases of acute flaccid paralysis associated with	1. AFM predominantly affected older children (median age: 7.1 years) with a slight male predominance.

N=120 Level of evidence: 4	anterior myelitis noted in the United States from 2012 to 2015	- Despite a wide age range (5 months–73 years) reported from CDPH surveillance (which did not include age restrictions in the case definition), only 9 patients (15%) were over 21 years of age. - There were no identified ethnic or racial predispositions. - The majority of affected patients were previously healthy, with asthma being the most commonly identified underlying illness. 6 immunocompromised patients with AFM, including 2 with solid organ transplantation (cardiac, renal), 1 with chronic lymphocytic leukemia, 1 with acquired immune deficiency syndrome, 1 with diabetes mellitus type 1, and 1 on pharmacological immunosuppression with systemic lupus erythematosus, have been reported. - Of 37 cases with vaccine status reported from the CDPH, CHCO, and PCH cohorts, 34 (92%) had received all recommended vaccines and 3 (8%) were unvaccinated because of personal belief exemptions. - No common-source environmental exposures or common travel risk factors were identified.
Sarmast et al. (2019) India Case Series N=9 Level of evidence: 4	Reviewed the clinical presentation, laboratory findings, management and outcome of children with AFM	- All cases presented with prodromal symptoms followed by acute onset asymmetrical limb weakness. - Maximum weakness is reached within 4 days from the day of onset. - Cerebrospinal fluid analysis shows that pleocytosis with viral markers for arboviruses and enteroviruses was negative. - Electrophysiological study revealed decreased muscle action potential in all. MRI of the spinal cord showed predominantly grey matter involvement.
Pruszczyński et al. (2015) Poland Case Series N=2 Level of evidence: 4	Retrospective review of two patients with skeletal dysplasia who had paraplegia develop after extremity surgery	- Spinal cord injury is a rare complication after lower extremity surgery in children with skeletal dysplasia and thoracic kyphosis. - We encountered two patients who had this complication, from among 51 (39 from Nemours/Alfred I. duPont Hospital for Children and 12 from Seattle Children's Hospital) who underwent lower extremity surgery during an 8.5-year period (June 2004 to December 2012)
Youlo et al. (2013) USA Case Series N=2 Level of evidence: 4	Reviewed the clinical histories of 2 adolescent females undergoing posterior spinal fusion with subsequent cervical spinal cord injuries	- Spinal cord injury is an uncommon but well-documented complication associated with spinal deformity surgery. - The mid-thoracic spinal cord is most vulnerable to these presumed vascular insults. - Injuries above the level of instrumentation are rare. 2 adolescent females undergoing posterior spinal fusion with subsequent cervical spinal cord injuries.
Samson et al. (2012) Canada	Reviewed a case of spinal cord injury with spinal	Two weeks after an infant with a hypoplastic left ventricle underwent a cardiac transplant, an

N=1 Case Report Level of evidence: 5	subdural hematoma after chest compressions	episode of asystole and ventricular fibrillation of unknown origin occurred. 2. His resuscitation included a 10-minute period of chest compressions. 3. After sedation was discontinued, the patient was found to be paraplegic. 4. Spinal magnetic resonance imaging showed a subdural hematoma and a hemorrhagic medullary contusion extending from T4 to T10 with a subarachnoid hemorrhage extending from T10 to S2. 5. Adequate compression to ensure support of circulation is life-saving but pediatricians must be aware of the potential risk of spinal cord injury after chest compressions.
Boese et al. (2015) Germany Systematic Review N=114	Reviewed MEDLINE, Cochrane Central Register of Controlled Trials, and Google Scholar for studies on SCIWORA in children	1. The age distribution was homogenous, and the male-to-female ratio of 2.05:1 concurred with previously reported ratios. 2. In the very young, the sex ratio was approximately 1:1, with a male predominance in older individuals, which more closely reflects the ratio of 4.5:1 reported in adults. 3. The most common mechanisms of injury were road traffic accidents, followed by sports injuries and falls—there was an excess of road traffic accidents in the youngest and sports-related injuries in adolescents.
Brauge et al. (2020) France Case Series N=37 Level of evidence: 4	Reviewed files of 37 patients with confirmed spinal cord injury between January 1988 and June 2017	1. SCIWORA ($n = 30$), myelopathy associated with severe cranial trauma ($n = 2$), and obstetric trauma ($n = 5$). Causes comprised 17 road accidents, 11 sports accidents, 5 obstetric lesions and 4 falls.
Carroll et al. (2015) USA Systematic Review N=433	Systematic review and meta-analysis of the databases of PubMed and OvidSP	1. A total of 433 pediatric patients were identified with SCIWORA. 2. The most prevalent mechanism of injury was sports-related injury cases (39.83%) followed by fall (24.18%) and motor vehicle-related (23.18%) injuries. 3. The most common mechanism of injury was sports-related and cervical injury, which occurred more frequently than other levels.
Pang and Pollack (1989) USA N=55 Case Series Level of evidence: 4	Report of clinical profiles of 55 children with spinal cord injury without radiographic abnormalities (SCIWORA)	1. Of patients with SCIWORA, no patient had vertebral fracture or dislocation on plain films and tomographies. 2. There were ten upper cervical (C1-C4), 33 lower cervical (C5-C8), and 12 thoracic cord injuries; of these, 22 were complete or severe lesions and 33 were mild lesions. 3. The mechanism of the neural injury probably relates to the inherent elasticity of the juvenile spine, which permits self-reducing but significant intersegmental displacements when subjected to flexion, extension, and distraction forces. 4. The spinal cord is therefore vulnerable to injury even though the vertebral column is spared from disruption, and this vulnerability is most evident in children younger than 8 years.

		5. All but one of the 22 children with profound neurologic injuries were younger than 8 years ($p < 0.000001$), whereas 24 of 33 children with mild injuries were older. 6. Younger children were also more likely to have severe upper cervical lesions ($p < 0.05$); lower cervical lesions were distributed evenly through the ages of 6 months to 16 years. 7. Thoracic injuries most commonly resulted from distraction or crushing. Distraction invariably involved violent forces, and crush injuries were usually caused by children being run over while lying prone, when the spinal column was acutely bowed toward the spongy abdominal and thoracic cavities.
Ren et al. (2017) China N=12 Case Series Level of evidence: 4	Retrospective case series from September 2007 to August 2016. The study was conducted at a tertiary medical center in Beijing, China (Xuanwu Hospital, China International Neuroscience Institute [China-INI], Capital Medical University)	1. 11 patients (91.7%) were younger than 8 years old. 2. The mean age of the patients was 6.6 years. 3. All patients had a clear traumatic history of severe thoracic spinal cord injury after performing back bend movements. 4. Back bend movements performed during dance practice may cause pediatric thoracic SCIWORA, particularly in children younger than 8 years old. 5. We suggest that the mechanism of primary injury is the longitudinal distraction of the thoracic spine during back bend movements, which leads to violent distraction of the spinal cord and blunt injury of nerve axons, nerve cells, and small vessels.
Trigylidas et al. (2011) Canada N=39 Case Series Level of evidence: 4	Retrospectively reviewed medical charts of 578 children with vertebral trauma at the Children's Hospital of Eastern Ontario and the Hospital for Sick Children	1. Patients with traumatic myelopathy were divided into 2 categories: 36 had radiologically evident SCI, and 3 had SCIWORA. 2. The radiologically evident population was further subdivided into those that presented with vertebral fractures (30/39; 77%) and those with other associated vertebral abnormalities (6/39; 15%). 3. Sports-related injuries (SRI) were the most frequent type of injury (51%), followed by motor vehicle accidents (MVA; 36%) and falls (13%). The 3 SCIWORA cases were a result of 2 MVA and 1 SRI. 4. Both patients with MVA had permanent deficits and the SRI patient recovered with no long-term issues. 5. Vertebral fractures were caused by 11 MVA, 15 SRI and 4 falls. 6. Other associated vertebral abnormalities were a result of 1 MVA, 4 SRI and 1 fall.
Mulligan et al. (2007) UK N=1 Case Report	A case was described of a 4-year-old girl sustaining multiple injuries from blunt trauma including	1. A 4-year-old girl was standing in front of a car when it was started and jumped forward pinning her against a wall for several seconds.

Level of evidence: 5	spinal cord injury without radiographic abnormality.	2. A child sustaining multiple injuries from blunt trauma including SCIWORA.
Carreon et al. (2004) USA N=137 Case Series Level of evidence: 4	Reviewed the cases of 137 children with spine injuries were seen over 10 years	1. There were 36 patients aged 0-9, 49 aged 10-14, and 52 aged 15-17. Spine injury incidence increased with age. 2. Motor vehicular accidents were the most common cause in this series. 3. There were 36% cervical, 34% thoracic, 29% lumbar, 34% multilevel contiguous, and 7% multilevel noncontiguous involvement. 4. 19% had spinal cord injury. 13 of 21 complete neurologic injuries and all 3 incomplete injuries improved. 5. Cord injury was more common in the 0-9 age group. 6. 4 of 5 patients with spinal cord injury without radiographic abnormality (SCIWORA) were in the 0-9 age group and had complete neurologic injuries. 7. Young children with cervical injuries were more likely to die than older children.
Hwang et al. (2003) USA Case Series N=143 Level of evidence: 4	Retrospective medical chart review of patients at an urban tertiary care pediatric facility over a 10-year period	1. Of these, 95 (66.4%) were male. 2. Median age was 3.8 years, and 30 (23.4%) of 128 had preexisting conditions. 3. Site of drowning was the pool (70.6%), the bathtub (19.0%), or natural water (10.4%). 4. The prevalence of traumatic injury was 4.9% (95% confidence interval, 0%-28%). 5. The predominant mechanism of injury was diving, and all injuries were to the cervical spine. 6. Patients with injury were more likely to be older (mean age, 13.5 vs 5.1 years; $P<.001$) and to have a history of diving (85.7% vs 2.2%; $P<.001$).