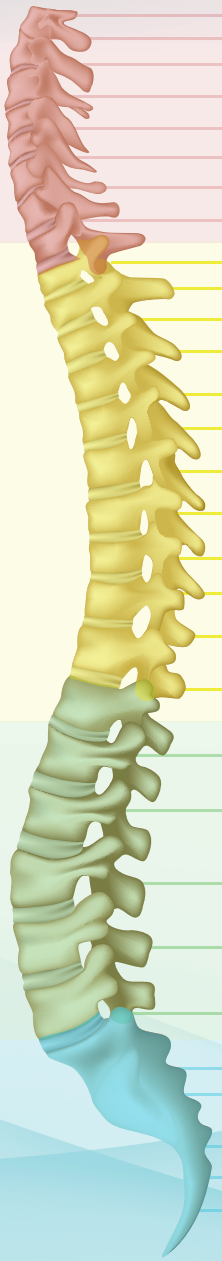
SBA National Resource Center:
800-621-3141

SPINA BIFIDA ASSOCIATION

Level of SB Function



CERVICAL REGION

- **C1**
- **C2**
- **C3**
- **C4**
- **C5** Elbow flexors: Partial upper extremity function
- **C6** Wrist extensors: Standing with stander/orthotics
- **C7** Elbow extensors
- **C8** Finger flexors

THORACIC REGION

- **T1**
- **T2** Complete upper extremity function
- **T3–T8** Standing with stander/orthotics
- **T4** Possible exercise ambulation
- **T5**
- **T6**
- **T7** Partial function of trunk muscles
- **T8**
- **T9–T12** Exercise ambulation
- **T10–L2** Bladder: Sympathetic input from hypogastric nerve
- **T11** Some function of trunk muscles
- **T12–S5** Sexual function varies

LUMBAR REGION

- **L1** Complete trunk function: exercise ambulation, sometimes household ambulation
- **L2** Hip flexor muscles present: exercise ambulation, household ambulation
- **L3** Knee extensors or Quadriceps muscles present: household ambulation, possible community ambulation
- **L4** Medial knee flexors present. Ankle dorsiflexors, 3/5 strength
- **L4–S5** Community ambulation
- **L5** May walk with or without crutches in home

SACRAL REGION

- **S1** Hip abductors, 3/5 strength
- **S2** Hip extensors, 4/5 strength. Ankle, plantarflexors, 3/5 strength. May walk with or without crutches
- **S2-S4** Bowel and bladder function varies. Bladder: parasympathetic input from the pelvic nerve. Somatic input from pudendal nerve to urethral sphincter
- **S3** All muscle activity may be within normal limits
- **S4**
- **S5 and above** Be aware of signs and symptoms of shunt malfunction and tethered spinal cord

Spine Level	Possible Muscle Function	Possible Orthopaedic Concerns	Possible Orthotics Needed	Possible Equipment for Functional Mobility	Possible Cognition, Executive Function
T6-9 **T9-12** **L1**	Upper trunk (abdominals) No LE function Abdominals + paraspinals = some pelvic control Complete trunk function Lower trunk (abdominals) Hip flexors (weak) 2/5	Kyphoscoliosis, Lumbar hyperlordosis Coxa valga–hip dislocation Decreased bone density Fractures **Contractures:** Hip: abduction, flexion, external rotation Knee: flexion, extension Foot: heelcord, clubfoot	TLSO Night splints: body, hip abduction, KAF, AF **Early:** Parapodium, (10 months of age and up to 2 years) **Later:** stander, RGO, HKAFO, KAFO **Caution:** Preserve UE function with level transfers, stable seated posture. Maintain strength + flexibility of shoulders/ arms.	**Community:** Wheelchair/ wheelchair cushion, transfer board **Home:** Walker/Crutches (for household or exercise walking), Raised, padded commode seat. Bath bench Mirror for skin checks Stander: 1 hour/day minimum starting at 10-12 months of age. Driving with hand controls Learn public transportation	**Executive function** impairments can impact educational, social and self help skills. **Cognitive function** can vary with the degree of hydrocephalus number of shunt infections, and the involvement of the nervous system. Function may not be related to level of lesion or ability to walk. Support early assessment of attention difficulties, sensorimotor integration, visual perception, visual motor ability, psychosocial development in addition to fine/gross motor + communication ability. **Independent living:** Occupational Therapy Goals: Basic activities of daily living **(BADLs)** or bathing, dressing, grooming, bowel/ bladder program, skin care, moving/transportation in your home/community. Instrumental activities of daily living **(IADLs).** Shopping, meal preparation, use of home appliances. Early learning/practice of all ADLs is vital. **Physical/ Occupational Therapy/ Gross Motor Goals:** 1. Achieve/maintain full ROM. 2. Achieve/maintain full strength in intact muscles for ADL's and mobility. 3. Locomotion activities including ambulation skills (falling down, getting up), walk on various terrains, transfer to various surfaces (chair, car, bed). 4. Achieve maximal sitting tolerance with skin intact. 5. Attain cardiovascular endurance for function. 6. Ability to perform or direct care including care + maintenance of orthotics + equipment. 7. Obtain recommendations re: home modifications. 8. Document medical appts, follow up, surgical history. **Transition to adult self care begins at birth.**
L2 **L3**	Hip flexors 3/5 Hip adductors 3/5 Knee extensors 3/5	Scoliosis, Overuse of UE's Lumbar hyperlordosis Hip subluxation Coxa valga–hip dislocation Decreased bone density Fractures **Contractures:** **Hip:** flexion **Knee:** flexion, extension **Foot:** Heelcord, clubfoot	Night hip abduction splint **Early:** Parapodium (10 months of age up to 2 years) **Later:** Stander, RGO, HKAFO, KAFO (if quads are less than 3/5 strength) L3-5 May be temporarily addressed by twister cables or derotations straps	**Community:** wheelchair + cushion **Home:** Stander: 1 hour/ day minimum **Early:** may use walker or crutches **Later:** wheelchair in home	
L4 **L5**	Medial knee flexors 3/5 Ankle dorsiflexor 3/5 Hip abductors (weak) 2/5 Lateral knee flexors 3/5 Ankle invertors 3/5 Long toe extensors (palpate at ankle)	Lumbar hyperlordosis Coxa valga **Contractures:** **Hip:** flexion **Knee:** flexion (avoid crouch gait) **Foot:** Progressive calcaneus (tight heelcord) Calcaneovalgus Equinovarus—Clubfoot Paralytic Vertical Talus	Night hip abduction splint **Early:** Parapodium **Later:** RGO, HKAFO, KAFO, AFO (L3-L4 CCAFO) L4-5 Toeing in gait and weak gluteals may be temporarily addressed by twister cables and/or rotation straps Consider shunt malfunction and/or tethered cord	**Community:** wheelchair, walker, crutches, cane Strong medial hamstring needed for community gait **Home:** early on may need no support Later: may require UE support	
S1 **S2**	Hip abductors 3/5 Hip extensors (weak) 2/5 Plantar flexors (weak) 2/5 Hip extensors 4/5 Plantar flexors 3/5 Toe flexors 3/5	Monitor hips closely **Contractures:** **Foot:** Calcaneus (tight heelcord) Calcaneovalgus Pes Cavus, Clubfoot Toe clawing (flexion) Heel/foot ulcers	AFO, SMO (supra malleolar orthotics), shoe inserts or no orthotics S1-2 Toeing out gait Use of crutches may decrease the valgus forces at the knee and also improve endurance	**Community:** walking with walker, crutches, cane. Gluteus lurch/ Trendelenburg gait aided by cane or crutches. Long distance alternative: lite weight wheelchair, bike, scooter **Home:** May need no support.	
S3-5	All muscle activity + bowel/ bladder function may be normal	None	None or shoe inserts	None	
Shunt malfunction and/or tethered cord: May cause deterioration of daily living skills, progressive weakness, muscle contractures or orthopaedic deformities of the legs, scoliosis, back pain at the site of closure, deterioration of gait, changes in bowel and/or bladder function.					

Muscle grades: **5** = normal, **4** = good, **3** = fair, **2** = poor, **1** = trace

Flexion = bend
Extension = straighten
Adduction = bring toward
Abduction = take away

Invert = move in
Evert = move out
Medial = inner
Lateral = outer

T = thoracic **L** = lumbar **S** = sacral **O** = orthosis
RGO = reciprocating gait orthosis
H = hip **K** = knee **A** = ankle **F** = foot
CC = crouch control **Gait** = walking style
Coxa = hip **Calcaneus** = heel bone **Talus** = ankle bone

UE = upper extremities/arms
LE = lower extremities/legs

Contributing Editors
Tim Brei, MD and Liz Kelly, PT