Hemivertebra Excision

1) **Indications** for hemivertebra resection:
   a) **Goals**:
      i) Realign spine and:
         1) Preserve maximum motion
         2) Allow continued growth
         3) Confine operation to short section of spine
   b) **Contraindications**:
      i) Unnecessary (no mal-alignment, no progression, no problem)
      ii) In situ fusion would work as well (balanced deformity)
      iii) Hemivertebra resection not enough – spine mal-alignment persists, deformity progressive
   c) **Beware**:
      i) Long, abnormal adjacent segments (bars) – may be progressive after hemivertebra excision
      ii) Post-operative imbalance from:
         1) Stiff lumbosacral junction below
         2) Stiff thoracic curve above
         3) Adjacent fused ribs
         4) Stiff lumbar curve below
         5) Major leg length discrepancy
         6) Hemi-metameric shift

2) **Preparation** for hemivertebra excision:
   a) **MRI**
      i) Minor tethered cord (tight filum, fatty filum) – consider simultaneous release
ii) Major anomaly (large lipoma, dermoid, diplomyelia)
   (1) If remote to hemivertebra
       (a) Release/repair in advance
   (2) If at same level as hemivertebra
       (a) Consider a different procedure - in situ fusion?
iii) If minor anomaly (tight filum)
   (a) Release at same time as hemi excision

b) 3-D CT
i) Easily obtained with present day software
   (1) Extremely helpful for identifying landmarks
   (2) Helps identify anchor points for fixation
ii) Identifies discordance between anterior and posterior
   (1) Anterior hemi-vertebral anatomy straightforward
   (2) Posterior elements may be quite different from anterior failure of
       formation
       (a) Missing posterior elements
       (b) Local fusions
       (c) Bifid or absent
       (d) Missing pedicles
c) Blood available
   i) Procedure can be almost bloodless but can also involve rapid, major blood loss

3) Procedure:
a) All are really anterior and posterior approaches.
b) Choosing the approach:
i) Surgeon experience, comfort with:
   (1) Anterior approach through limited incision
   (2) Posterior manipulation of dura, cord
   (3) Identification of roots
   (4) Control of epidural bleeding
c) Approach: Anterior and Posterior via:
i) Separate anterior and posterior incisions, separate positionings
   (1) Advantages:
      (a) Easiest
      (b) Most control of anterior bleeding
   (2) Disadvantages:
      (a) Slower
      (b) More incisions than posterior alone
      (c) Less adjustability
   (3) Tips: When in doubt, do it this way.

ii) Simultaneous anterior and posterior incisions, single patient positionings
   (1) Advantages:
      (a) Faster
      (b) Most adjustability (can go back and forth between front and back
taking more away)
      (c) Easier than posterior alone
      (d) Maximum correction achievable
      (i) (can go back and forth until enough removed for correction)
   (2) Disadvantages:
      (a) More incisions than posterior alone
      (b) Awkward for posterior
   (3) Tips:
      (a) Position patient at the edge of the table
      (b) Use a removable bolster for accentuation of curve, ease of access.
      Remove for correction.

iii) Posterior only incision:
   (1) Advantages:
      (a) Faster(?) – not faster than simultaneous A and P
      (b) Least incision
      (c) Best recovery
      (d) Easiest for kyphotic deformity?
   (2) Disadvantages:
(a) Requires significant cord retraction if full wedge resection done = most potential for direct neurologic injury.

(b) Potential for rapid bleeding from anterior vertebral body or epidural veins. Generally more total blood loss than A and P approaches

(c) No fall back position if insufficient correction achieved (can’t get at more of the anterior spine

(d) If bleeding briskly, procedure must be done ‘blind’ – experience needed?

(e) Can be difficult to completely excise ‘rubbery’ combination of disc and endplate material in the very young.

(3) Tips:

(a) If goal is only slight correction and fusion (basically a transpedicular epiphyseodesis), then this approach is easy

(b) Start with kyphotic cases – easier than lordotic.

(c) Where the hemi corresponds with a rib – excise the medial rib – a costo-transversectomy helps greatly with visualization, control

(d) Position and prep patient as for simultaneous A and P resection – if posterior alone too difficult or control lost, anterior is then still an option.

d) Excision:

i) Anterior

(1) If maximum correction desired, must include:

(a) Bony hemivertebra

(b) Disc above and below

(c) Cartilage endplate above and below

(d) Extend to the concave annulus (plan a wedge resection, not a hemivertebra excison

ii) Posterior

(1) Include:

(a) Hemilamina – 3-D CT may show that laminae are different segmentation than anteriorly
(b) Flavum at that level

**iii) Correction**

1. Safest correction is by manipulating the body and spine directly, not the instrumentation.
2. Watch for inadvertent canal stenosis created by leading edge of lamina below.
   a. Consider undercutting edges to prevent impingement.
3. Watch for root impingement on convexity.

**iv) Instrumentation**

1. Place instrumentation before posterior excision.
2. Try hard to restrict instrumentation to one level—adding extra levels above and below usually result in inadvertent extension of fusion = less motion, secondary deformity.
3. Bone is soft—perform correction by manipulating body, spine; use instrumentation to hold, not correct.

4) **Conclusion:**

a) **Goals and Indications:**
   i) Make sure hemivertebra excision is the best choice. It may be too little or too much.
   ii) Define how much correction desired.

b) **Procedure:**
   i) Choose approach according to anatomy, experience, preferences.
   ii) Make sure enough is resected to achieve the desired correction—think ‘wedge resection’, not hemi-vertebra resection.
   iii) When in doubt, back up with a body cast.
References: