Embryology of the Neck & Neck Masses

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Grand Rounds Presentation
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Neck Masses

- A mass in the neck is a common clinical finding.
- Benign Neoplasm
- Malignant Neoplasm
- Infectious
- Congenital
Neck Masses

An appreciation for the embryological development of the cervical structures must be made to competently understand and treat the disorders of the neck.
End of first month
4 weeks
6 weeks

- Nasomedical process
- Nasolateral process
- Nasolacrimal groove
- Maxillary process
- Mandible
- Hyomandibular cleft

- Nasomedical process
- Nasolateral process
- Nasolacrimal groove
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- Mandible
- Hyomandibular cleft
- Tubercle precursors of external ear
- Nasooptic furrow
8 weeks

- Nasolateral process
- Nasomedial processes merging
- Ear
- Ear tubercles
- Hyoid bone
- Laryngeal cartilages
Embryology and Anatomy

- Branchial System- 6 pairs of pharyngeal arches separated by endodermally lined pouches and ectodermally lined clefts.
- Each arch consists of a nerve, artery, and cartilaginous structures.
- The remaining neck musculature gains contributions from cervical somites.
Branchial system

- First Branchial arch
  - Maxillary and mandibular (Meckel’s) process regress to leave the malleus and incus.
  - Ossification around Meckel’s cartilage gives rise to the mandible, sphenomandibular ligament, and anterior malleolar ligaments.
  - Muscles- temporalis, masseter, pterygoids, mylohyoid, ant belly of digastric, tensor tympani, tensor veli palatini
Branchial system

- First Branchial Arch
- Pouch
  - Eust tube, mid ear
  - Temporal bone
- Cleft
  - EAC/TM
Branchial system

- Second Branchial Arch
  - Reichert’s cartilage contributes to the superstructure of the stapes, the upper body and lesser cornu of the hyoid, the styloid process and stylohyoid ligament.
  - Muscles- platysma, muscles of facial expression, posterior belly of digastric, stylohyoid, and stapedius
  - Nerve- 7th cranial nerve
  - Artery- stapedial artery
Branchial system

- Third Branchial Arch
  - Lower body of the hyoid and greater cornu.
  - Muscles- stylopharyngeus, superior and middle pharyngeal constrictors.
  - Nerve- 9\textsuperscript{th} cranial nerve
  - Artery- common carotid and proximal portions of the internal and external carotid.
Branchial system

- Third Branchial Pouch
  - Inferior parathyroids
  - Thymus gland and thymic duct
Branchial system

- Fourth and Sixth Branchial arches fuse to form the laryngeal cartilages.

- Fourth Arch
  - Muscles- cricothyroid, inferior pharyngeal constrictors
  - Nerve- Superior Laryngeal Nerve
  - Artery- Right Subclavian, Aortic arch

- Fourth Pouch- superior parathyroid glands and parafollicular thyroid cells
Branchial system

- Sixth Branchial Arch
  - Muscles- remaining/intrinsic laryngeal musculature
  - Nerve- *Recurrent Laryngeal Nerve*
  - Artery- Pulmonary Artery and ductus arteriosus
Branchial system

- Epipericardial ridge- mesodermal elements of the sternocleidomastoid, trapezius, and lingual and infrahyoid musculature.
  - Nerve- hypoglossal and spinal accessory nerve

- Cervical Sinus of His
Thyroid Gland

- Endoderm of the floor of mouth between the 1st and 2nd archs.
- Descends as a bilobed diverticulum from the foramen cecum around the 4th week to rest by the 7-8th week.
Oral Cavity
Neck Masses

- Midline Neck Masses
  - Thyroid nodules
  - Cervical Lymphadenopathy
  - Thyroglossal Duct cyst
  - Thymus gland anomalies
  - Plunging ranula

- Lateral Neck Masses
  - Branchial cleft anomalies
  - Laryngoceles
  - Dermoid and Teratoid Cysts
Midline Neck Masses

- Thyroid nodules
- Thyroglossal duct cyst
- Cervical Thymic Cyst
- Plunging ranula
Thyroid Nodules

- 4% of population
- 1/20 will harbor Cancer
- H&P combined with FNA is crucial for diagnosis
- FNA
  - Malignant
  - Suspicious
  - Benign
  - Indeterminate
Fine-Needle Aspiration Biopsy

Problems:

- Sampling error
  - Small (<1 cm)
  - Large (>4 cm)
- Hashimoto’s versus lymphoma
- Follicular neoplasms
- Fluid-only cysts
- Somewhat dependent on skill of cytopathologist
Thyroglossal Duct Cyst

- Most common congenital midline mass
- Asymptomatic mass at or below the hyoid bone that elevates with tongue protrusion.
- Ectopic thyroid tissue vs. thyroglossal duct cyst?
Thyroglossal Duct Cyst
Thyroglossal Duct Cyst

- 1-2% have Ectopic Thyroid glands so imaging is indicated to document presence of a normal or ectopic thyroid gland
- Simple Excision leads to high recurrence rate
- Sistrunk Procedure
- Patients at high risk for recurrence - Modified Sistrunk Procedure
TGDC Carcinoma

- Uncommon, 1%
  - 94% Thyroid- Papillary
  - 6% Squamous Cell

- TGDC Carcinoma or a Metastatic Cystic Thyroid Carcinoma in a Midline Lymph node?
TGDC Carcinoma

- Patel et al.

  “incidentally discovered, well-differentiated thyroid CA in a low risk patient (<45yrs, <4cm, no local/regional invasion) can be adequately managed by Sistrunk.

- In presence of a clinically/radiographically normal thyroid.

- Other Convincing evidence:
  - Lack of Lymph tissue
  - Presence of Columnar or Squamous epithelium

- Total thyroidectomy with or without neck dissection.
Ectopic Thyroid

- 90% are lingual
- 1/3rd are hypothyroid - elevated TSH - goiter
- Symptoms are of base of tongue obstruction, dysphagia
- Surgical Excision
Lateral Nonmalignant Thyroid Tissue

- True Embryologic rest of normal thyroid tissue as a result a migration error or is it a metastatic well differentiated thyroid carcinoma?

- ANY suspicious findings should favor a metastatic deposit rather than LNTT.

- Strict criteria must be followed for LNTT:
  - must be small, with only a few thyroid follicles
  - no atypical nuclear features of papillary carcinoma
  - should be present only in the capsular region of the node
Cervical Thymic Cysts

- Failure of involution of the cervical thymopharyngeal ducts.
- Firm, mobile masses found in the lower aspects of the neck.
- CXR, CT scan
- Surgical Excision - Inferior limit of dissection is the brachiocephalic v.
Plunging Ranula

- Simple ranula- unilateral oral cavity cystic lesion.
- Plunging ranula- pierce the mylohyoid to present as a paramedian or lateral neck mass.
- Cyst aspirate- high protein, amylase levels
- CT scan/MRI
- Treatment is intraoral excision to include the sublingual gland of origin.
Plunging Ranula
Lateral Neck Masses

- Branchial cleft anomalies
- Laryngoceles
- Dermoid and Teratoid Cysts
- Sternocleidomastoid Pseudotumor of Infancy
First Branchial Cleft Cysts

Type I

- Ectodermal Duplication anomaly of the EAC with squamous epithelium only.
- Parallel to the EAC
- Pretragal, post auricular
- Connection with TM or Malleus>Incus
- Surgical Excision
First Branchial Cleft Cysts

- Type II

- Squamous epithelium and other ectodermal components
- Anterior neck, superior to hyoid bone.
- Courses over the mandible and through the parotid in variable position to the Facial Nerve.
- Terminates near the EAC bony-cartilaginous junction.
- Surgical excision- superficial parotidectomy
First Branchial Cleft Cysts
Second Branchial Cleft Cysts

- Most Common (90%) branchial anomaly
- Painless, fluctuant mass in anterior triangle
- Inferior-middle 2/3 junction of SCM, deep to platysma, lateral to IX, X, XII, between the internal and external carotid and terminate in the tonsillar fossa
- Surgical treatment may include tonsillectomy
Second Branchial Cleft Cysts
Third Branchial Cleft Cysts

- Rare (<2%)
- Similar external presentation to 2\textsuperscript{nd} BCC
- Internal opening is at the pyriform sinus, then courses cephalad to the superior laryngeal nerve through the thyrohyoid membrane, medial to IX, lateral to X, XII, posterior to internal carotid
- Surgical approach must visualize recurrent laryngeal nerves- Thyroidectomy incision
Third Branchial Cleft Cysts
Fourth Branchial Cleft Cysts

- Courses from pyriform sinus apex caudal to superior laryngeal nerve, to emerge near the cricothyroid joint, and descend superficial to the recurrent laryngeal nerve.
Laryngoceles

- Congenitally from an enlarged laryngeal saccule.
- Classified as internal, external, or both

Internal
- Confined to larynx, usually involves the false cord and aryepiglottic fold.
- Hoarseness and respiratory distress vs. neck mass.
Laryngoceles

- External and Combined Laryngoceles
  - Soft, compressible, lateral neck mass that distends with increases in intralaryngeal pressures.
  - Through the thyrohyoid membrane at the entrance of the Superior Laryngeal Nerve.
  - CT scan
  - Asymptomatic vs Symptomatic laryngoceles.
Laryngoceles
Laryngoceles

- 1-3% of Laryngoceles will harbor an underlying laryngeal carcinoma
- ALL adult patients should undergo direct laryngoscopy at the time of surgical intervention.
Dermoid and Teratoid Cysts

- Developmental anomalies composed of different germ cell layers.
- Isolation of pluripotent stem cells or closure of germ cell layers within points of failed embryonic fusion lines.
- Classified according to composition.
Dermoid Cysts

- Mesoderm and Ectoderm
- Midline, paramedian, painless masses that usually do not elevate with tongue protrusion.
- Commonly misdiagnosed as Thyroglossal Duct Cysts.
- Treatment is simple surgical excision
Teratoid Cysts and Teratomas

- All three germ cell layers - Endoderm, mesoderm and ectoderm.
- Larger midline masses, present earlier in life.
- 20% associated maternal polyhydramnios
- Unlike adult teratomas, they rarely demonstrate malignant degeneration.
- Surgical excision.
Sternomastoid Tumor of Infancy (Psuedotumor)

- Firm mass of the SCM, chin turned away and head tilted toward the mass.
- Hematoma with subsequent fibrotic replacement.
- Ultrasound
- Physical therapy is very successful.
- Myoplasty of the SCM only if refractory to PT.
Sternomastoid Tumor of Infancy
Conclusions

- Neck masses are very common
- Approach with History and Physical exam will commonly lead to the correct diagnosis
- An understanding of cervical embryology is crucial in treatment of these masses