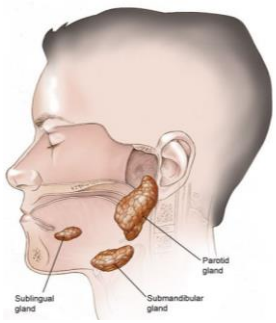
Salivary Control & Sialorrhea

Salivary Control	
Salivary glands	**Six salivary glands:** ▪ 2 parotid glands ▪ 2 sublingual glands ▪ 2 submandibular glands 
Innervation	1) **Facial nerve** (from superior salivary nucleus) innervates submandibular and sublingual glands 2) **Glossopharyngeal nerve** (from superior salivary nucleus) innervates parotid glands ○ Both are **parasympathetic**
Saliva secretion	Submandibular glands: Secrete **70-80%** of saliva Sublingual glands: Secrete **5-10%** of saliva ○ Submandibular and sublingual glands → **thick/mucousy secretions, mainly at rest** Parotid glands: Secrete **15-20%** of saliva ○ Parotid glands → **watery/serous secretions, mainly during eating/chewing**
Daily saliva secretion	500 – 1500 mL/day
Swallowing frequency (average)	350 times/daytime (rest), 200 times/daytime (eating/chewing), 50 times/nighttime (sleeping) = total 600 times/day
Functions of saliva	1) Protects teeth and gums 2) Prepares foods for chewing and swallowing 3) Initiates carbohydrate digestion 4) Lubricates tongue and lips for speech 5) Assists with oral hygiene 6) Regulates acidity 7) Facilitates taste

Sialorrhea	
Definition	Inability to manage oral secretions
Age	Drooling beyond **4 years of age** is ABNORMAL
Causes	**1) Hypersalivation** ▪ Dyskinetic CP ▪ Complex temporal lobe epilepsy ▪ Medications ○ Antipsychotics (e.g., risperidone) ○ Anticholinesterase inhibitors (e.g., neostigmine) ○ AEDs (e.g., benzodiazepines) ▪ Toxins (e.g., organophosphate poisoning) ▪ Esophageal disorders: ○ GERD ○ Obstructive/mechanical (e.g., NGT) ▪ Dental caries/tooth eruption **2) Dysfunctional oral-motor control** ▪ Neuromuscular disorders (e.g., spastic CP)

Prevalence in CP	**10-40%** ▪ Prevalence increases with increased severity of gross motor impairment in CP (GMFCS) ▪ Tends to improve over time ○ Possibly due to dental maturation
Predictors of sialorrhea in children with CP	**1) Head/body position** **2) Dental carries/malocclusion** **3) GERD** **4) Medications (see under "causes")** 5) Co-existing epilepsy 6) Poor or no speech 7) Intellectual disability 8) GMFCS IV or V The 1st 4 can be optimized when treating sialorrhea in children with CP
Types of Sialorrhea	**Anterior:** Saliva spilled from the mouth that is clearly visible **Posterior:** Saliva spilled into the pharynx possibly creating a risk of aspiration ○ Often both types exist together
Complications of sialorrhea	Anterior sialorrhea: ▪ **Skin irritation** ▪ Unpleasant odor ▪ Caregiver and teacher stress ▪ Social impact (e.g., isolation, rejection, poor self-esteem, shame, stigmatization) ▪ Damage to clothing/bibs/communication devices ▪ Interference with speech Posterior sialorrhea: ▪ Recurrent/chronic respiratory symptoms: Cough, wheeze, chocking ▪ **Aspiration pneumonia:** ○ Diagnosis of salivary aspiration through *radionucleotide salivagram* Anterior & posterior sialorrhea: ▪ **Leads to frequent suctioning → injury** ▪ **Dehydration**
Clinical assessment	**General:** Hydration assessment **MSK:** Head/body position **Skin:** Perioral skin assessment **ENT:** Oral health/dentation, mouth/tongue/jaw movements, swallowing assessment **Neuro:** Neurological examination **Resp:** Respiratory examination (to check for aspiration) **GI:** GERD control assessment **Meds:** Medication review OT & SLP can help with assessment
Methods to quantify sialorrhea	1) Drooling Impact Scale – found on the website www.pedcomplexcare.com 2) DQ5 Scale – found on the website www.pedcomplexcare.com 3) Drooling Frequency and Severity Scale (below) **Severity** 1 Dry – never drools 2 Mild – only wet on the lips 3 Moderate – wet on the lips and chin 4 Severe – drools to the extent that clothing becomes damp 5 Profuse – clothing, hands, tray and objects are wet **Frequency** 1 Never drools 2 Occasionally drools 3 Frequently drools 4 Constant drooling The drooling rankings from both scales are added together to make a combined drooling score *To be done on **regular basis** (e.g., q3-6 months) AND **before & after any intervention***

Management of sialorrhea

Indication

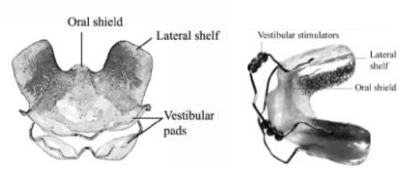
If no/minimal complications → no treatment indicated

Conservative

1) Assess/correct factors that may contribute to sialorrhea: **Positioning, medications, GERD, dental issues**
2) Bibs (dap NOT wipe), suctioning (gentile), oro-motor therapy (by OT/SLP), behavioral therapy (by psychologist), intra-oral appliances (be dentist), optimizing TF (lower acceptable TFI)

Intra-oral appliance (Innsbruck Sensory Motor Activator and Regulator – ISMAR):

- Stabilizes the jaw to facilitate lip and tongue movements
- Worn for short periods each day then overnight
- Evidence: Effective in some patients with CP
- Requires: Mature dentation (>6 Y/O), good cognitive function and motivation



Meds

Medication MoA

Reduction of saliva production (blocks parasympathetic innervation to glands)

Medication options

Atropine (PO drops)

- 1% ophthalmic solution (pharmacy can make 0.25% & 0.5% solutions)
- **DOSE:** 1-2 drops sublingually q4-6hr (can be given less frequently, i.e., daily, BID or TID)
- Make sure to dry mouth/suction before use
- Wash hands after use (causes dilated pupils if in contact with eyes)
- Inform parents that the container says "eye drops"
- Crosses BBB → more CNS side effects (e.g., sedation, poor seizure control)
- Causes more tachycardia than other anti-sialorrhea medications
- Can be delivered using a spoon to facilitate mouth opening

Scopolamine (patch)

- **DOSE** (1 patch = 1.5 mg scopolamine):
  - < 20 Kg = ¼ patch
  - 20-50 Kg = ½ patch
  - > 50 Kg = 1 patch
- Takes 24 hours to reach steady state; for acute symptoms other drugs should be used
- Do not break the matrix by cutting the patch in ½ or ¼ (see below for application)
- Apply the patch on the mastoid process behind the ear
- Change/rotate q24-72hr
- Crosses BBB → more CNS side effects
- Antiemetic
- Discontinue gradually over 2 weeks to prevent withdrawal symptoms
- Can cause local skin irritation (change application site regularly)

<u>Application of part of a patch</u>:

Can use **¼ or ½ of a patch**
Rotate patch q24-72hr
Make sure patient is **NOT allergic** to adhesive/patch

Glycopyrrolate (PO/GT/JT)

- **DOSE:** 0.02 mg/Kg/DOSE PO TID, titrate up every 5-7 days to 0.1 mg/Kg/DOSE PO TID (max 3 mg/DOSE)
- Can use the IV formulation orally
- Discontinue gradually over 2 weeks to prevent withdrawal symptoms
- May decrease gastric acid secretion
- Side effects are similar to atropine side effects in table below, except:
  - Less CNS side effects, as it does NOT cross BBB
  - Less mydriasis and cycloplegia
  - Less tachycardia
- Feeding tube:
  - Can be given via G-tube
  - No specific information on the jejunal administration of glycopyrrolate (monitor for loss of efficacy/side effects)

Others:

- Trihexyphenidyl (Artane):
  - For children >3 Y/O
  - Treats both sialorrhea and spasticity/dystonia
  - DOSE: Initial dose 1 mg BID x7 days, titrate up every 3 days by 1-2 mg/day, if daily dose >10 mg → div TID-QID (not BID), target dose (6-40 mg/day), max daily dose (100 mg/day)
  - Taper gradually to D/C

- Ipratropium bromide: 250-500mCg nebulization/MDI q4-6hr PRN

- Hyoscine butylbromide (Buscopan):
  - Antispasmodic (deceases GI and GU spasms)
  - Semi-synthetic derivative of scopolamine
  - Peripheral anticholinergic effect (does not cross BBB)
  - Dose: 1 month-2 years (300-500 mcg/Kg TID or QID PRN – max 5 mg/DOSE), 2-5 years (5 mg TID or QID PRN), 5-12 years (10 mg TID or QID PRN), 12-18 years (20 mg TID or QID PRN)

Side effects & contraindications

Side effects:

1) Constipation
2) Urinary retention
3) Tachycardia (MOST with atropine)
4) Hypertension
5) Vomiting
6) Behavioral changes/irritability
7) Over-drying of secretions
8) Facial flushing/impaired ability to sweat → risk of hyperthermia in hot environments
9) Sensitization
10) Seizure control
11) Mydriasis and cycloplegia
12) Sedation

Contraindications:

1) Glaucoma
2) Tachyarrhythmias
3) Paralytic ileus/GI obstruction
4) Urinary tract obstruction (check RFT and renal U/S before use, if available)
5) Hyperthyroidism
6) Pregnancy
7) Myasthenia graves

Caution with concurrent anticholinergic medications

Comparative Effects of Anticholinergics

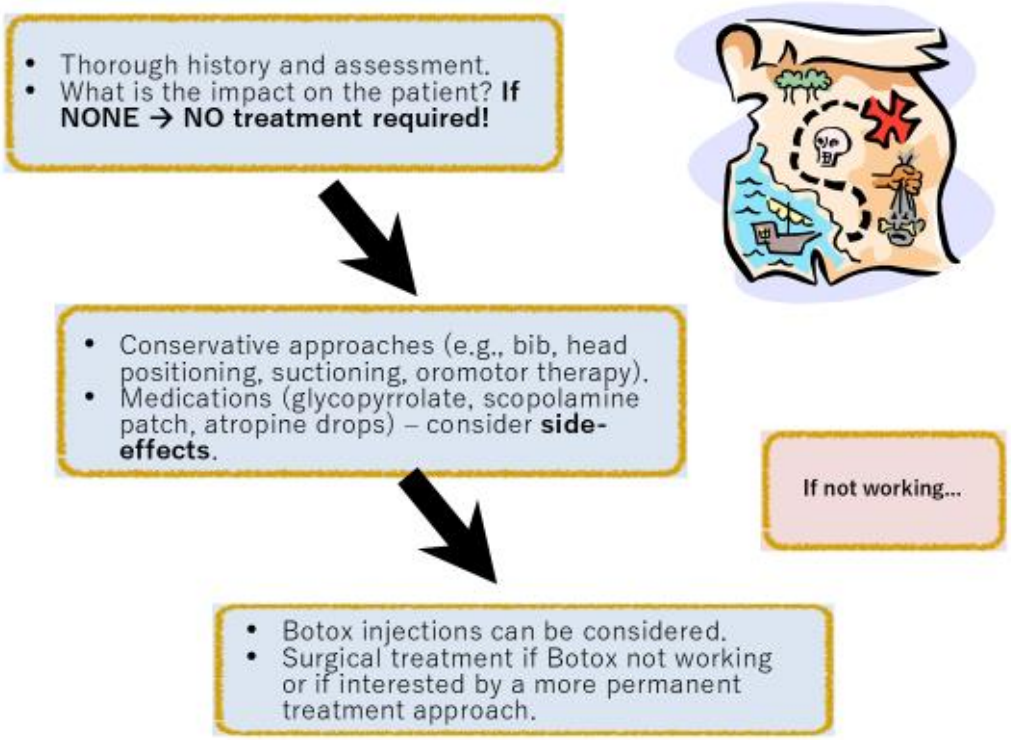
Effect	Atropine	Scopolamine	Glycopyrrolate
Heart rate	++	-/+	+
Mydriasis and cycloplegia	+	+++	-
Antisialagogue effect	+	+++	++
Sedative effect	+	+++	-
Increased gastric fluid pH	-	-	-/+
Central nervous system toxicity	+	++	-
Lower esophageal sphincter relaxation	++	++	++

Botox

- MOA: Reduction of saliva production
- Sites of injection: Inject submandibular and parotid glands
- **Timeline: Onset in 1-3 days, peaks at 2-3 weeks, lasts for 3-6 months**
- Done by ENT/IR, under local anesthesia/conscious sedation (rarely GA); requires U/S guidance; injects 2 submandibular glands + 2 parotid glands
- **DOSE:** 25-50 IU/gland (do NOT exceed 200 IU in total)
- Side-effects (less side-effects with the image-guided approach):
  - Saliva thickening
  - Pain, swelling and hematoma at injection site
  - Mild dysphagia in first 2 weeks

	○ Most significant reported problems are rare: **A.** Severe dysphagia in first 2 weeks (may require brief hospitalization and NG feeding) **B.** Aspiration pneumonia **C.** Loss of motor control of the head & neck
Surgical	▪ Duct ligation (parotid, submandibular or both); parents must be aware that it is irreversible, and the child **won't be able to feed orally after it's done** ▪ Bilateral submandibular gland excision ▪ Submandibular duct relocation ○ Done by ENT, under general anesthesia

Approach to sialorrhea:



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