Practical Neurosurgery for Practicing Pediatricians

Daniel A. Donoho, MD

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(BACK TO THE) **FUTURE OF PEDIATRICS**

Disclosures

No conflicts to disclose:

- No financial or business interest, arrangement or affiliation that could be perceived as a real or apparent conflict of interest in the subject (content) of their presentation.
- No unapproved or investigational use of any drugs, commercial products or devices.

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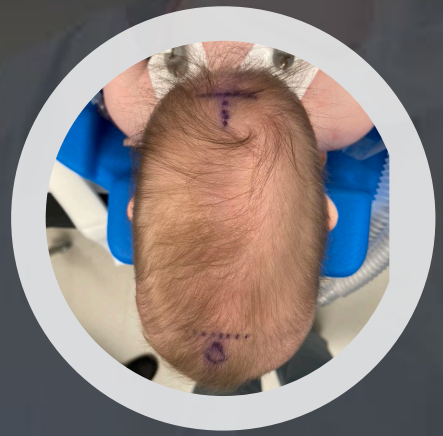
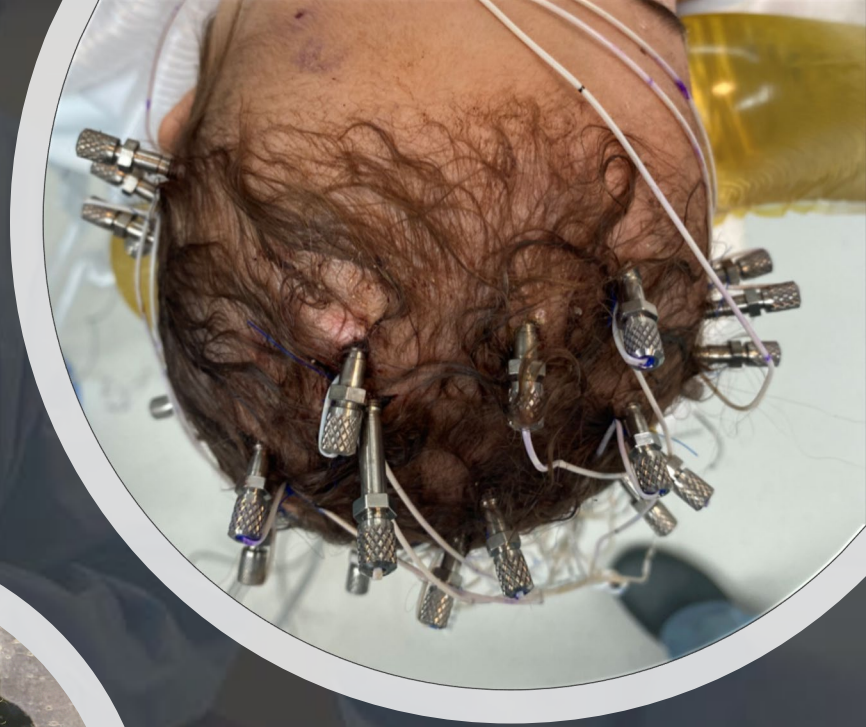
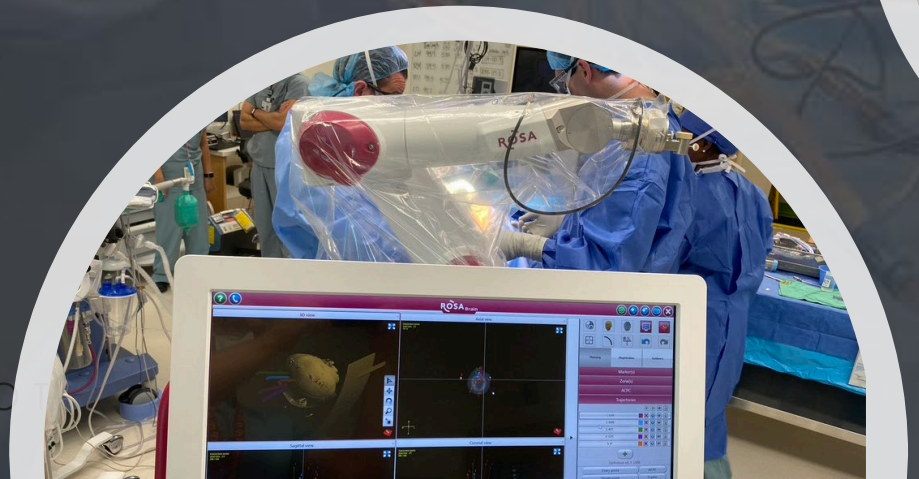
Complete Team Approach to Neurosurgical Care

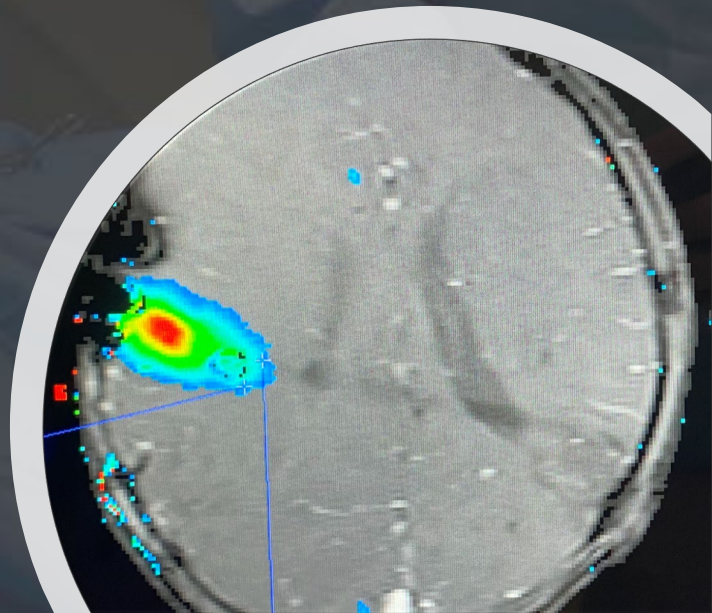
It’s not (just) brain surgery

- **Epilepsy** (laser, minimally disruptive, neurostimulation)
- **Neuro-Oncology**
- **Neuromodulation & Movement Disorders**
- **Spine** (tumor, trauma, congenital, Chiari)
- **Craniofacial** (craniosynostosis)
- **Cerebrovascular** (AVM, aneurysm, embolization)
- **Brachial Plexus** and peripheral nerve









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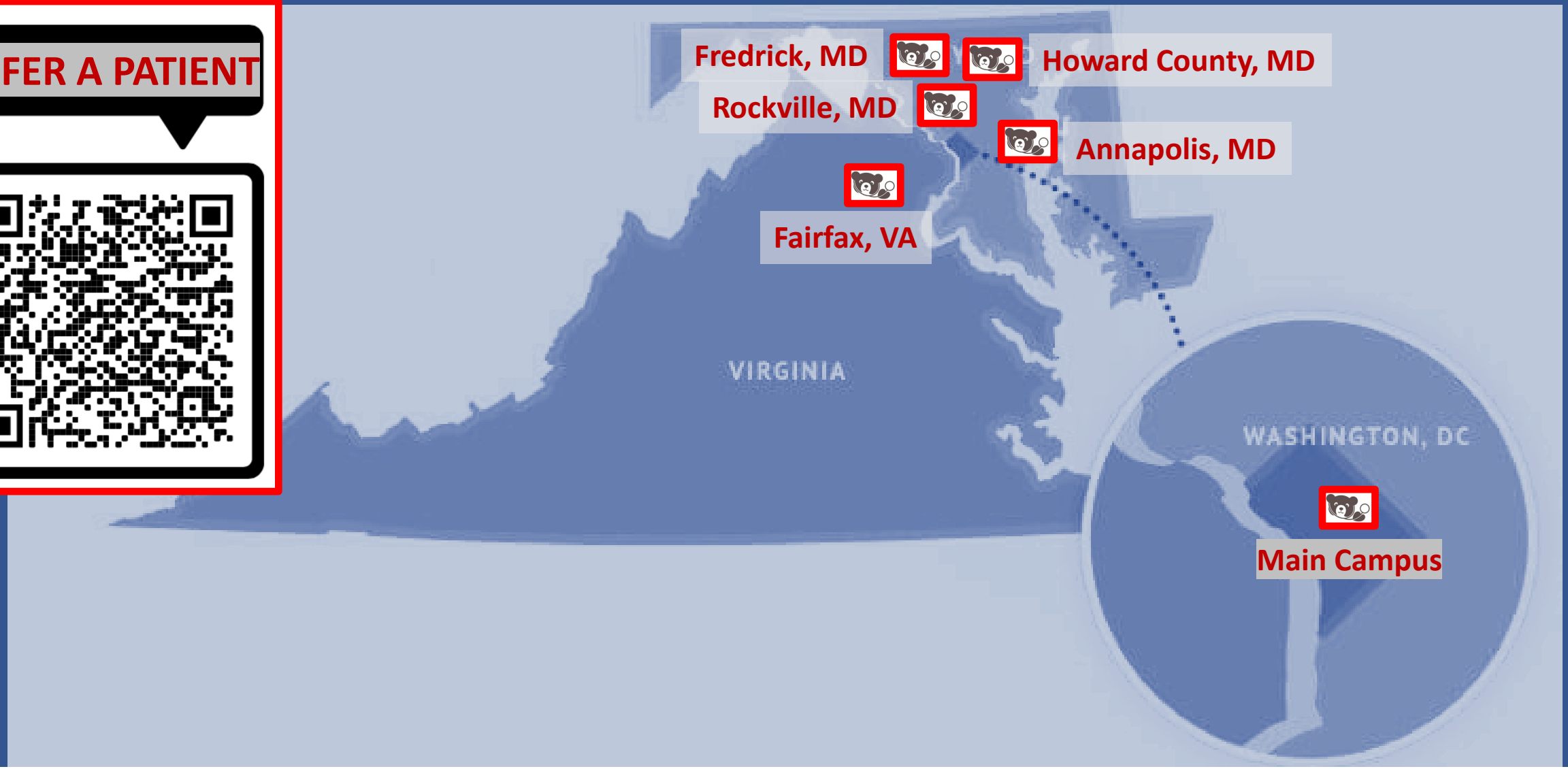
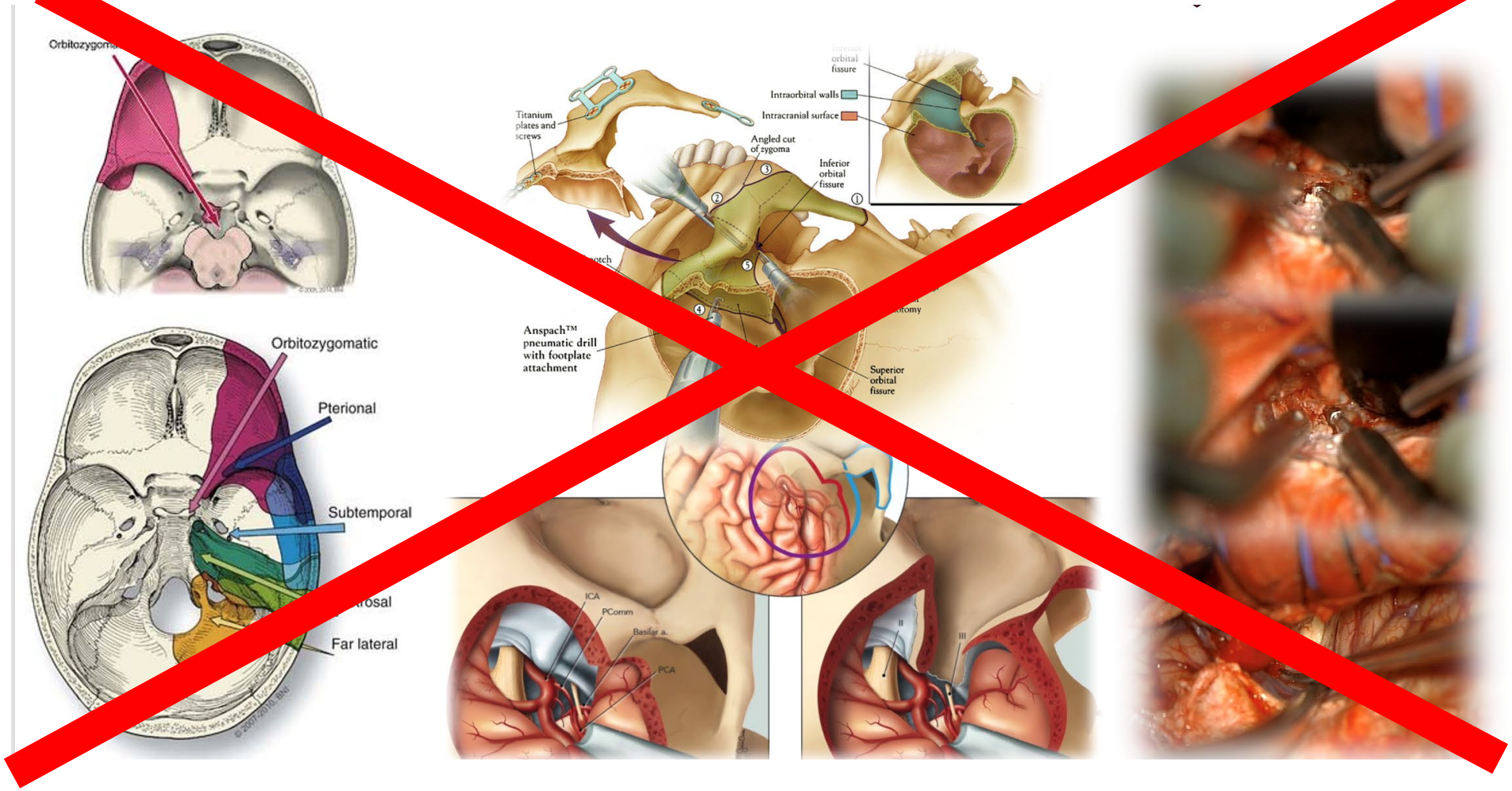
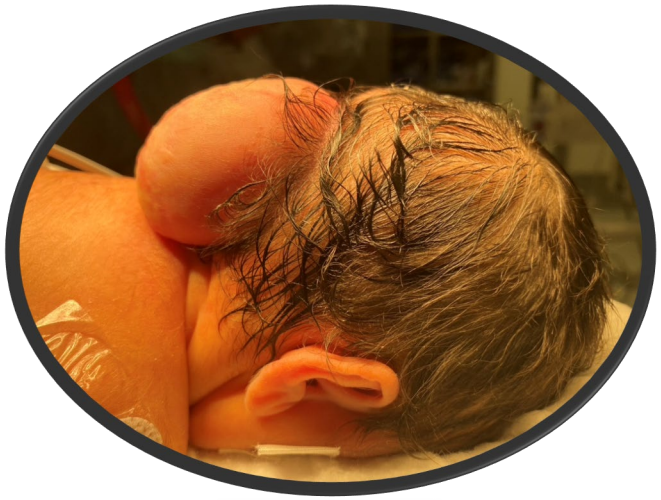


Children's National®

Agenda for today



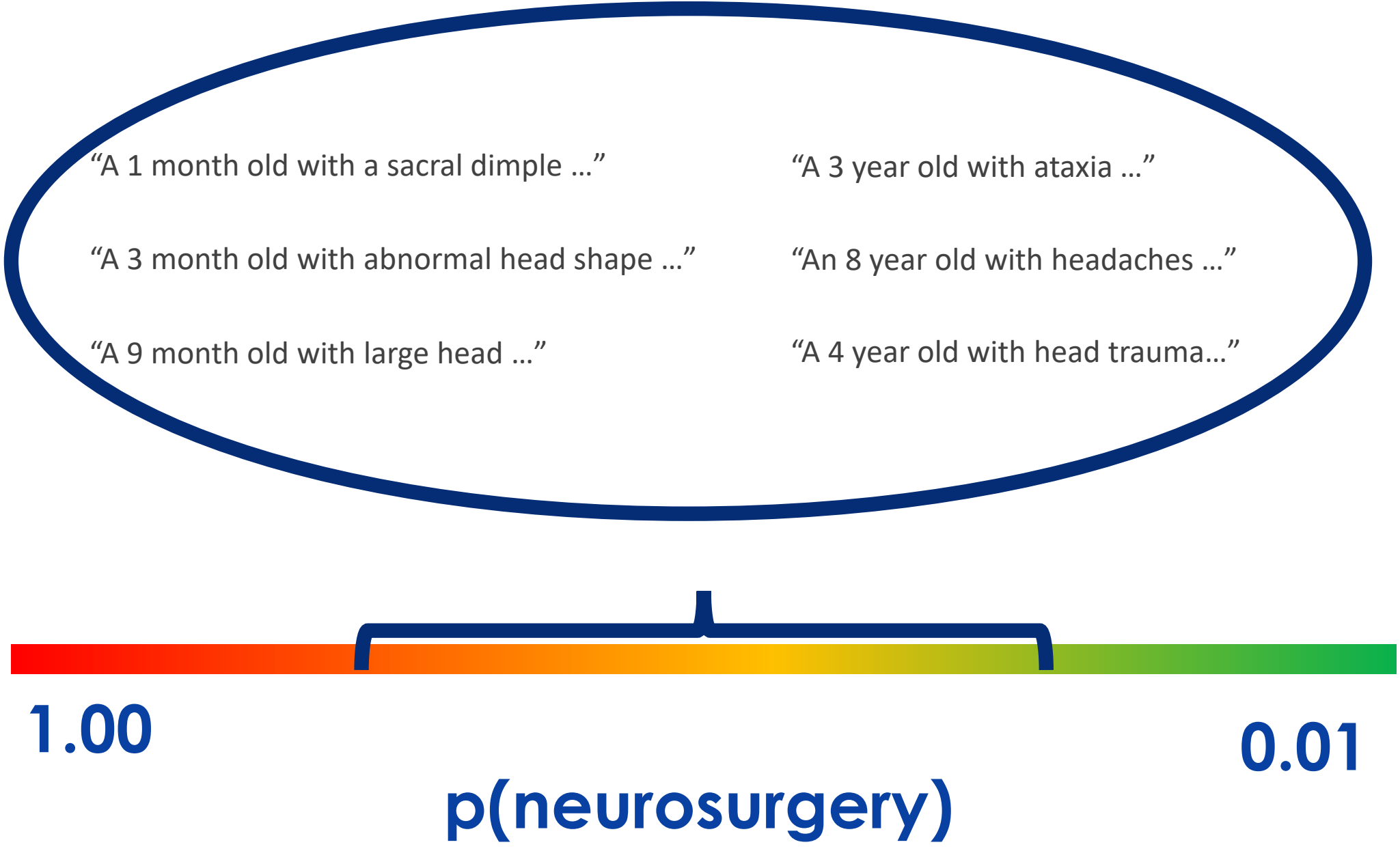


Today

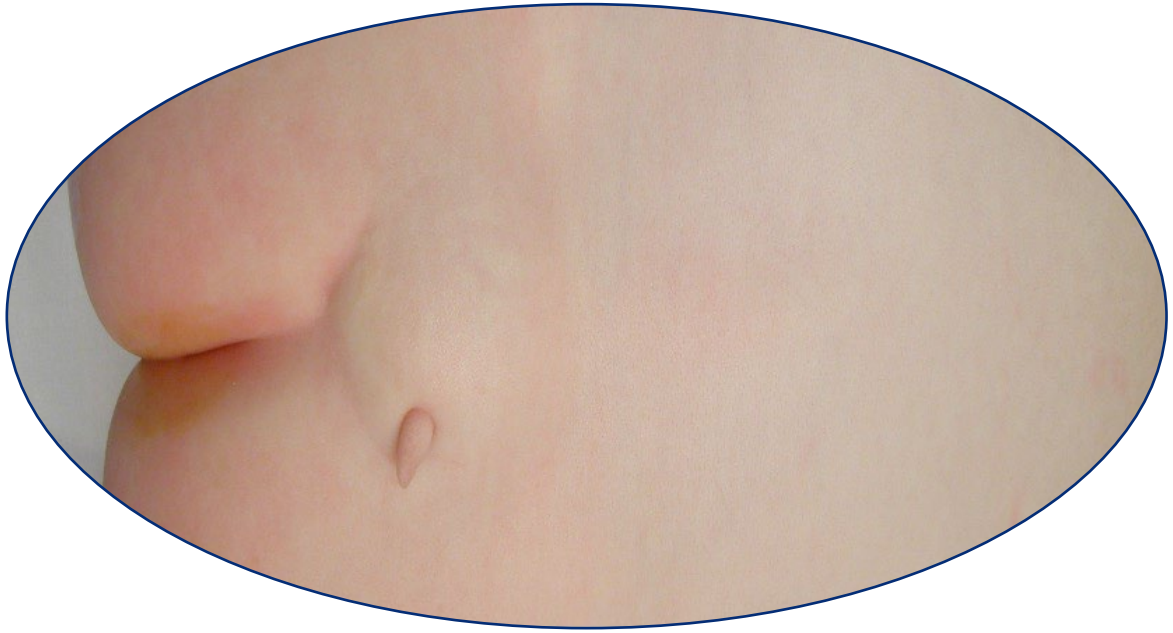
1.00

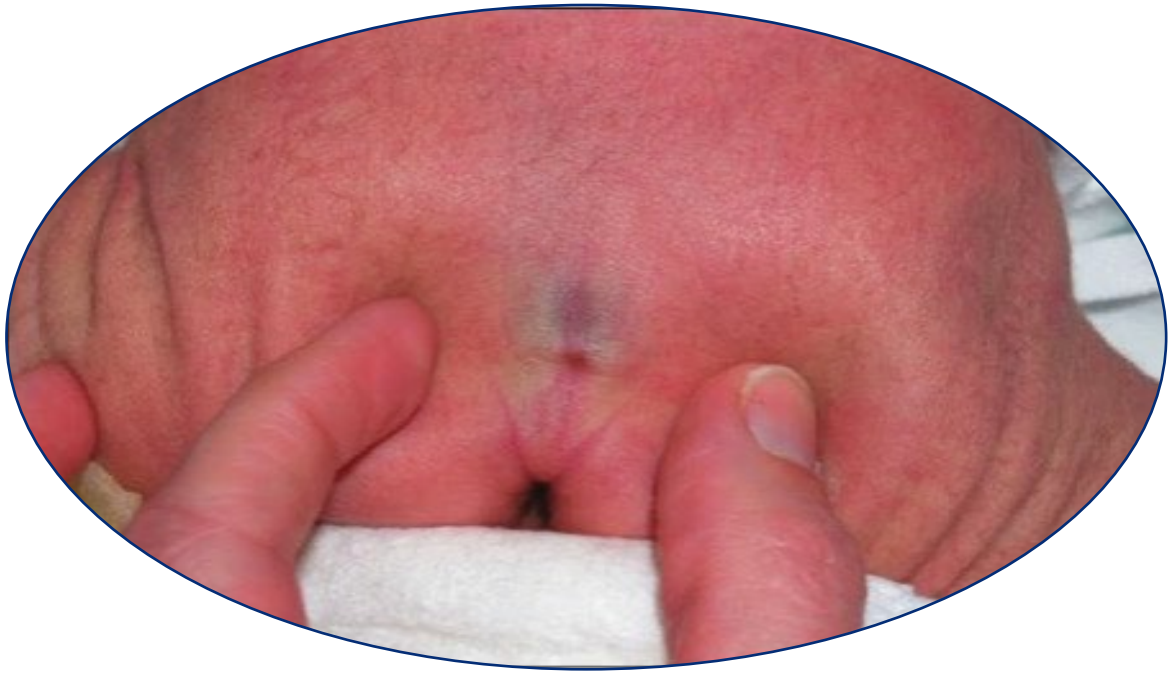
0.01

p(neurosurgery)


"A 1 month old with a sacral dimple …"
"A 3 month old with abnormal head shape …"
"A 9 month old with large head …"
"A 3 year old with ataxia …"
"An 8 year old with headaches …"
"A 4 year old with head trauma…"
1.00
0.01
p(neurosurgery)

Newborn with a sacral dimple





1.00 **p(neurosurgery)** **0.01**

Newborn with a sacral dimple – what's at stake?

Clinical examination (**looking for…**)

MRI spine with and without contrast

Strongly consider sedation if > 1 month (**dx early**…)

91% of <1 yr need anaesthesia

We found no significant association between the number of sedated MRI scans and cognitive outcome at 4.6 y in our cohort after adjustment for confounding variables, including

Impaired cognitive performance in premature newborns with two or more surgeries prior to term-equivalent age

Dawn Gano[1], Sarah K. Andersen[2], Hannah C. Glass[1,3], Elizabeth E. Rogers[1], David V. Glidden[4], A. James Barkovich[1,3,5] and Donna M. Ferriero[1,3]

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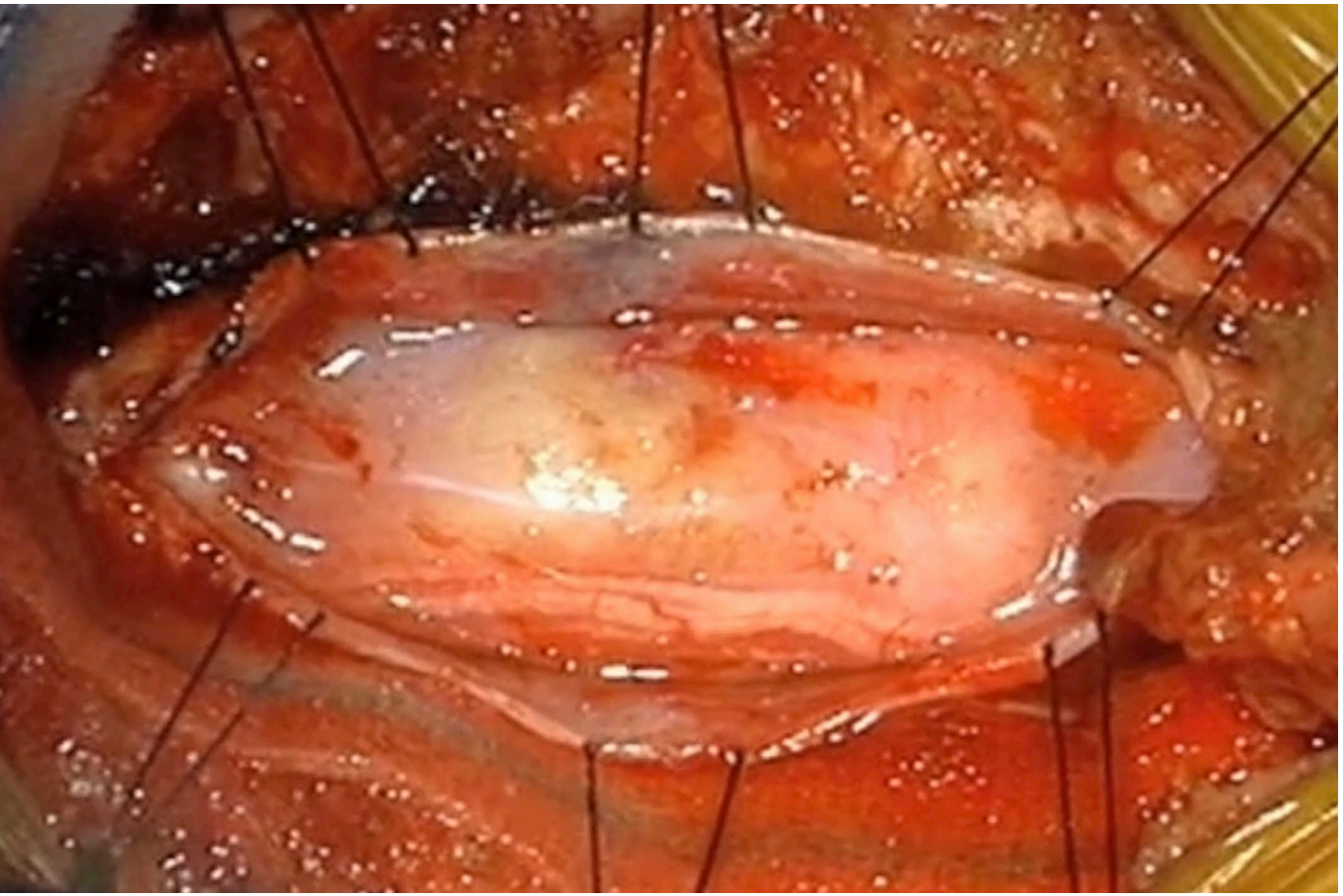
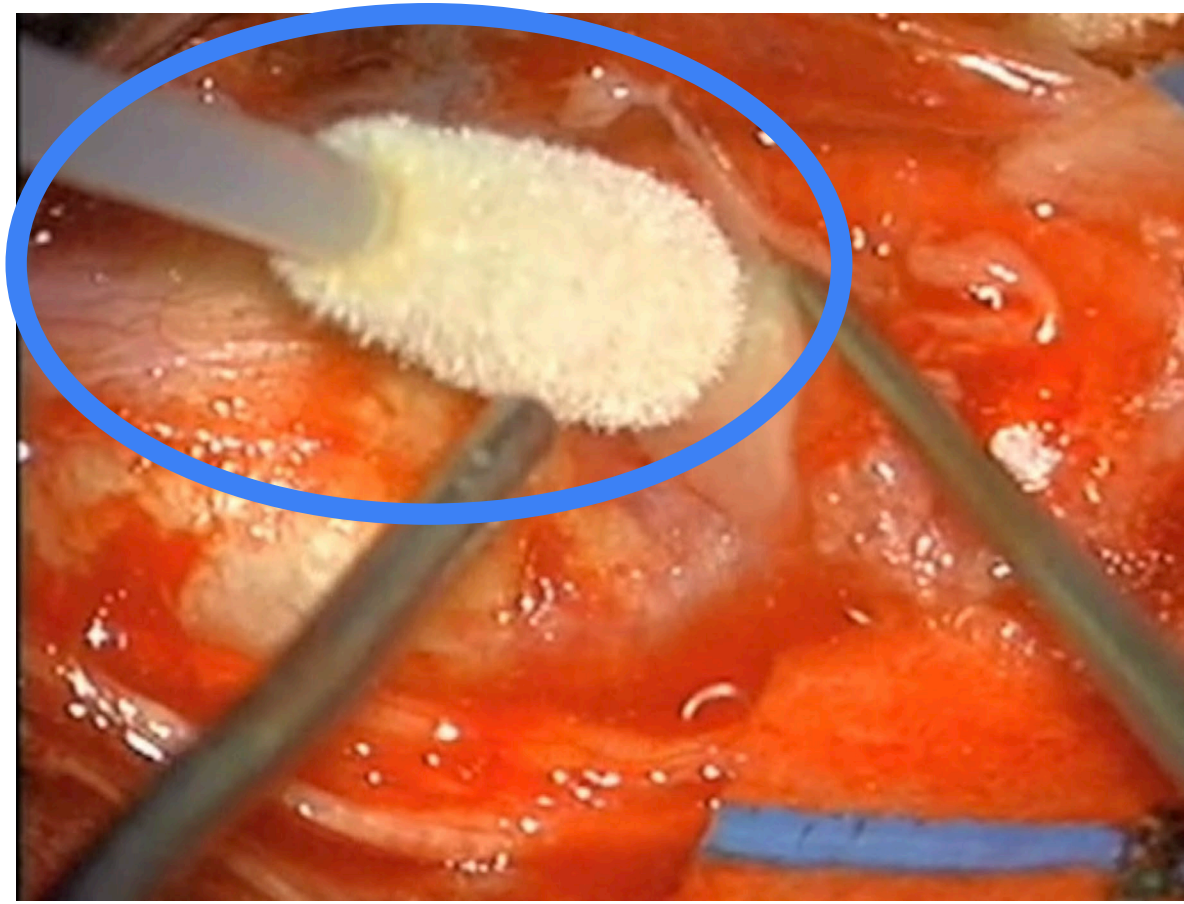
Refer to neurosurgery (**ok to refer prior to ordering imaging**)

Newborn with a sacral dimple – what's at stake?





Which Sacral Dimples are Dangerous?

Generations of physicians have been taught that a dimple is innocent if its base can be visualized and abnormal if its bottom cannot be seen; *this teaching is incorrect*. The presence or absence of a "bottom" to the dimple has little to do with its pathologic nature. Rather, *it is the location of the dimple along the craniocaudal axis* that is the most important feature. As the name implies, the innocent *coccygeal* dimple is more caudally located than the pathologic *lumbosacral* DST. It

CLINICAL REPORT Guidance for the Clinician in Rendering Pediatric Care

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Congenital Brain and Spinal Cord Malformations and Their Associated Cutaneous Markers

Mark Dias, MD, FAANS, FAAP, Michael Partington, MD, FAANS, FAAP, the SECTION ON NEUROLOGIC SURGERY

SCAN ME

"SIMPLE DIMPLE RULES" FOR SACRAL DIMPLES[6]

The following parameters define which sacral dimples are high risk:[6,7]

- Larger than 0.5 cm in size.
- Located more than 2.5 cm cephalad to the anal verge.
- Associated with overlying cutaneous markers:
  - True hypertrichosis, or hairs within the dimple (distinctly different than the mild hairiness seen in **Figure 6**).
  - Skin tags.
  - Telangiectasia or hemangioma (**Figure 7**).
  - Subcutaneous mass or lump.
  - Apparent aplasia cutis.
  - Abnormal pigmentation.
- Bifurcation (fork) or asymmetry of the superior gluteal crease (**Figure 8**).

ANY of these

The Enigmatic Sacro-Coccygeal Dimple: To Ignore or Explore?

Stan L. Block, MD, FAAP

PEDIATRIC ANNALS 43:3 | **MARCH 2014**

Spinal DSTs may be investigated using spinal ultrasonography and/or MRI, although it is important to point out that the decision to treat is made *solely on the presence of the pathologic dimple*, regardless of imaging findings. The DST may not be visualized, and the spinal cord is not always radiographically tethered (ie, below the mid-body of L2); even high-resolution MRI may miss as many as 50% of DSTs.[21] The value of neuroimaging is, therefore, largely to look for associated anomalies or the presence of dermoid or epidermoid cyst(s) as part of surgical planning.

All spinal DSTs should be repaired regardless of imaging studies,

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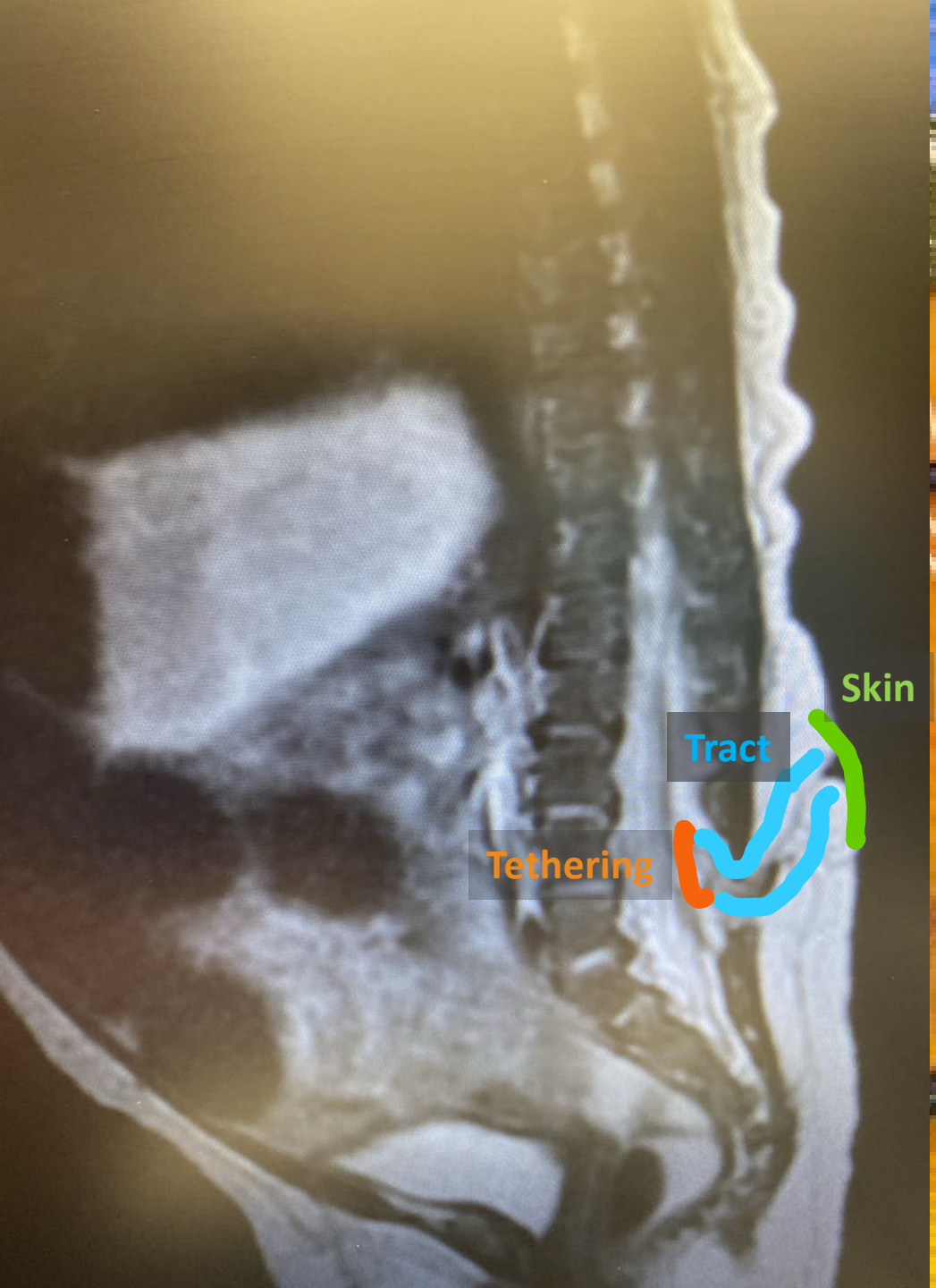
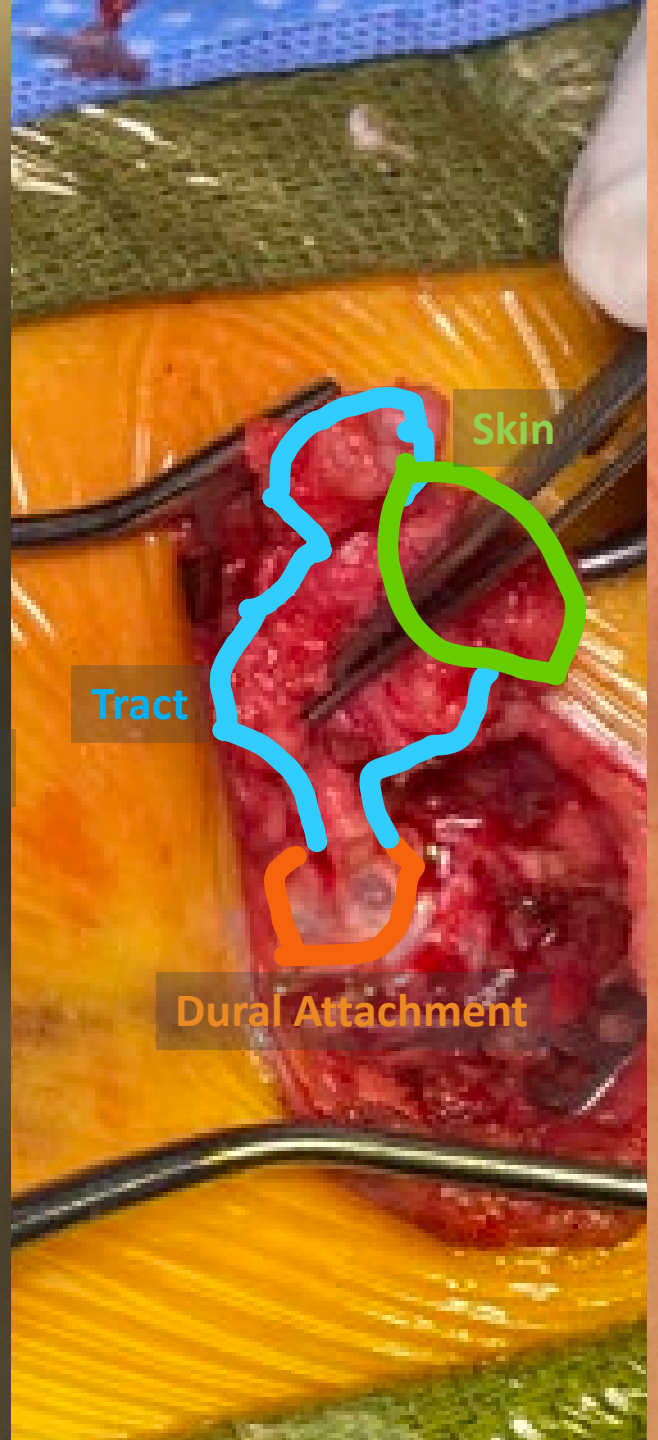
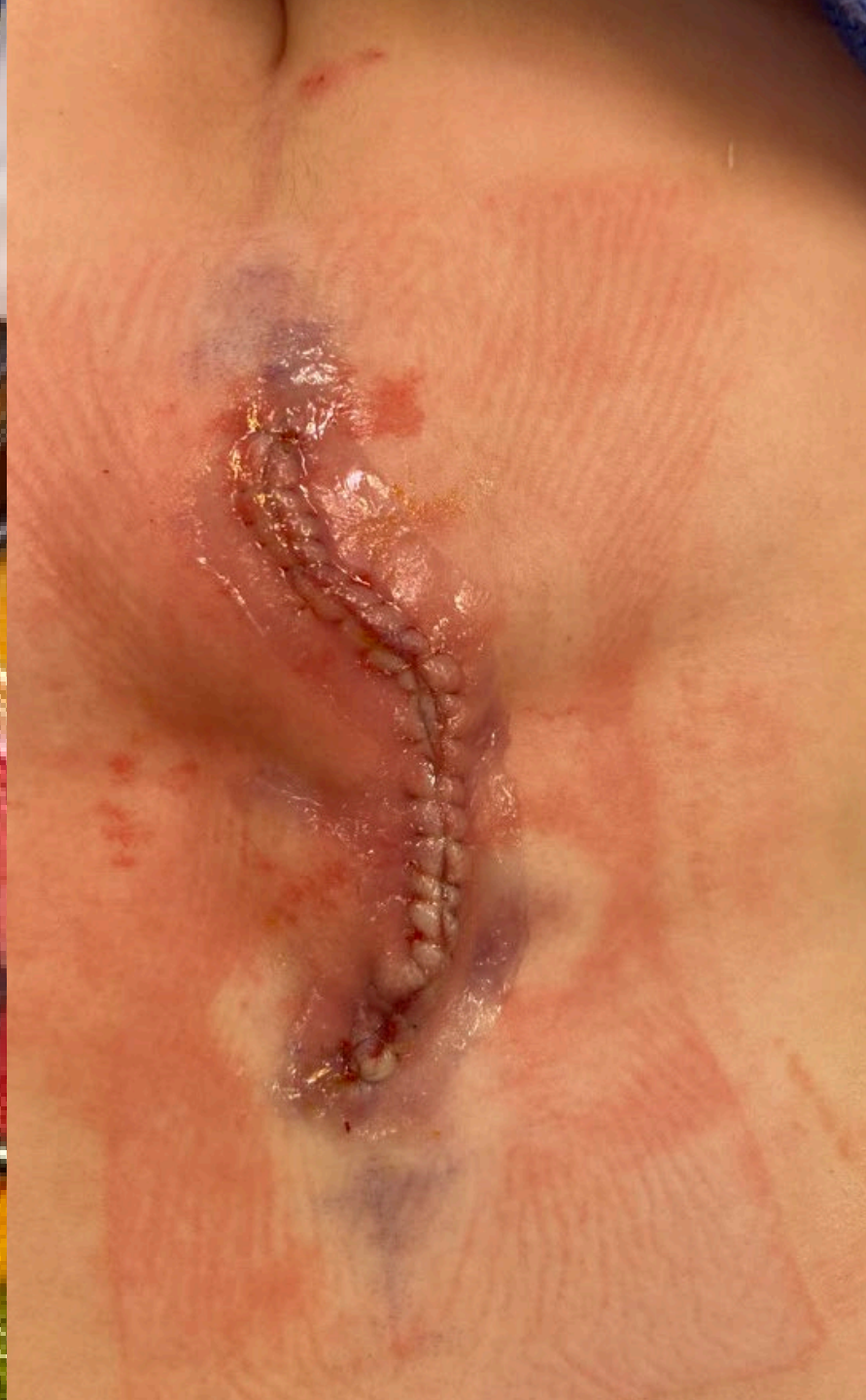
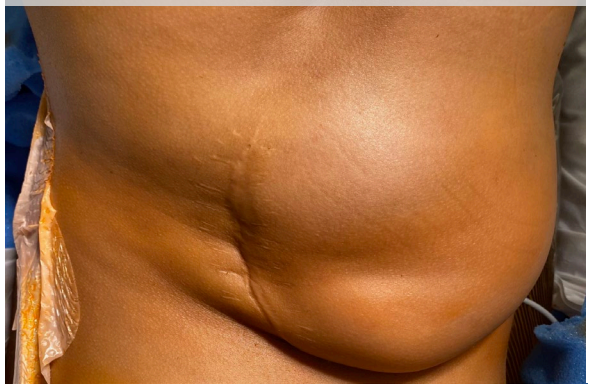

Skin
Tract
Tethering

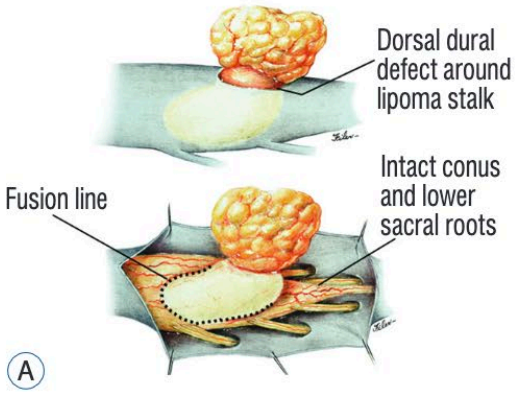

Skin
Tract
Dural Attachment

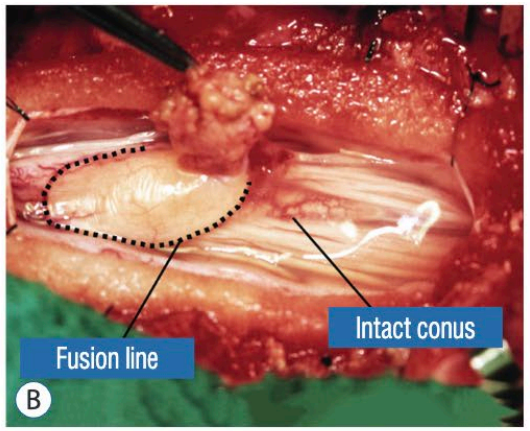


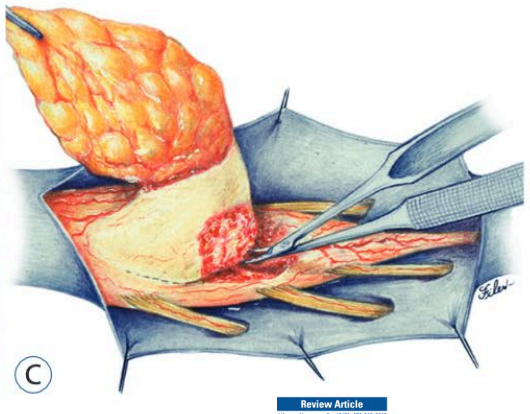
Many Spinal Malformations Follow These Ideas

Lipomatous Malformation







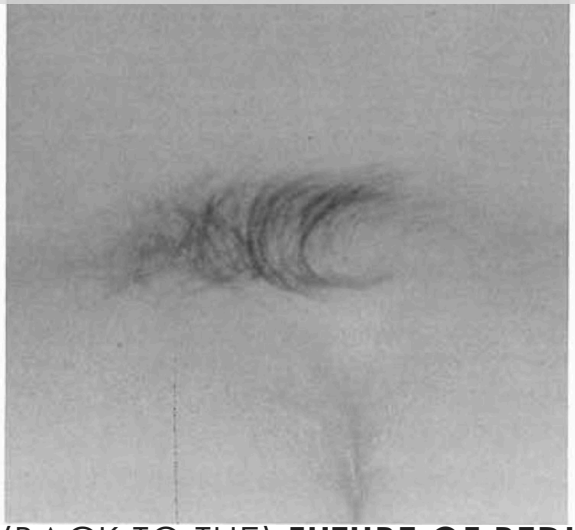


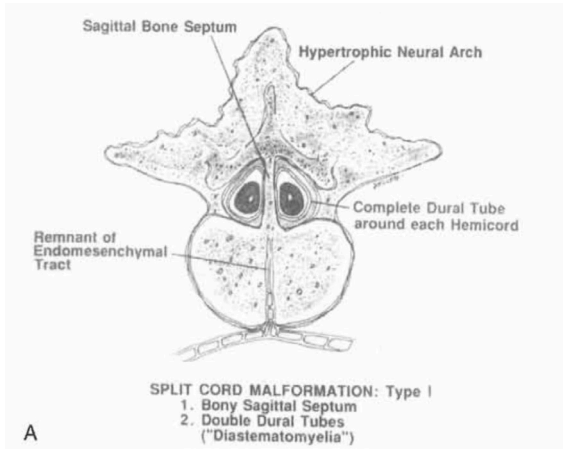
Surgical Management of Complex Spinal Cord Lipomas : A New Perspective

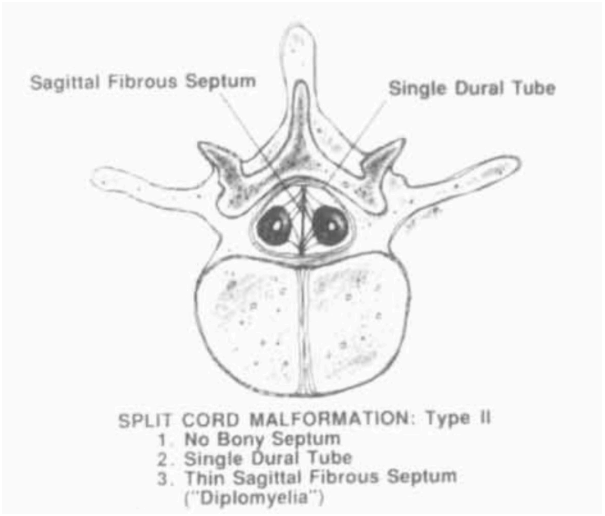
Dachling Pang[1,2]

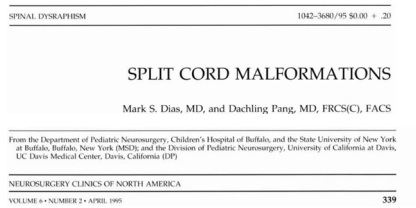
[1]Department of Paediatric Neurosurgery, Great Ormond Street Hospital for Children, NHS Trust, London, UK
[2]Department of Paediatric Neurosurgery, University of California, Davis, CA, USA

Split Cord Malformation

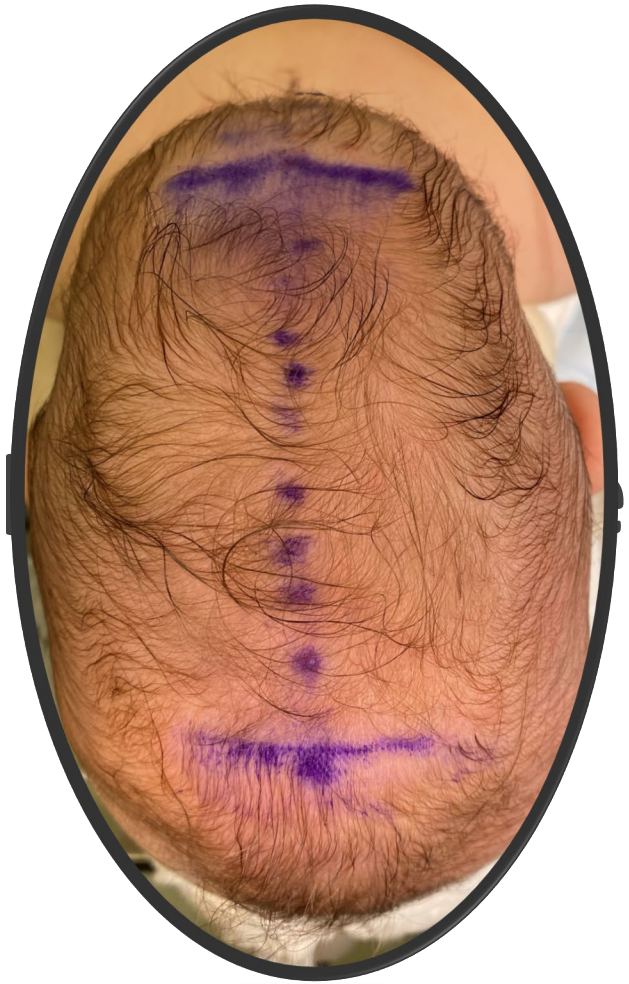


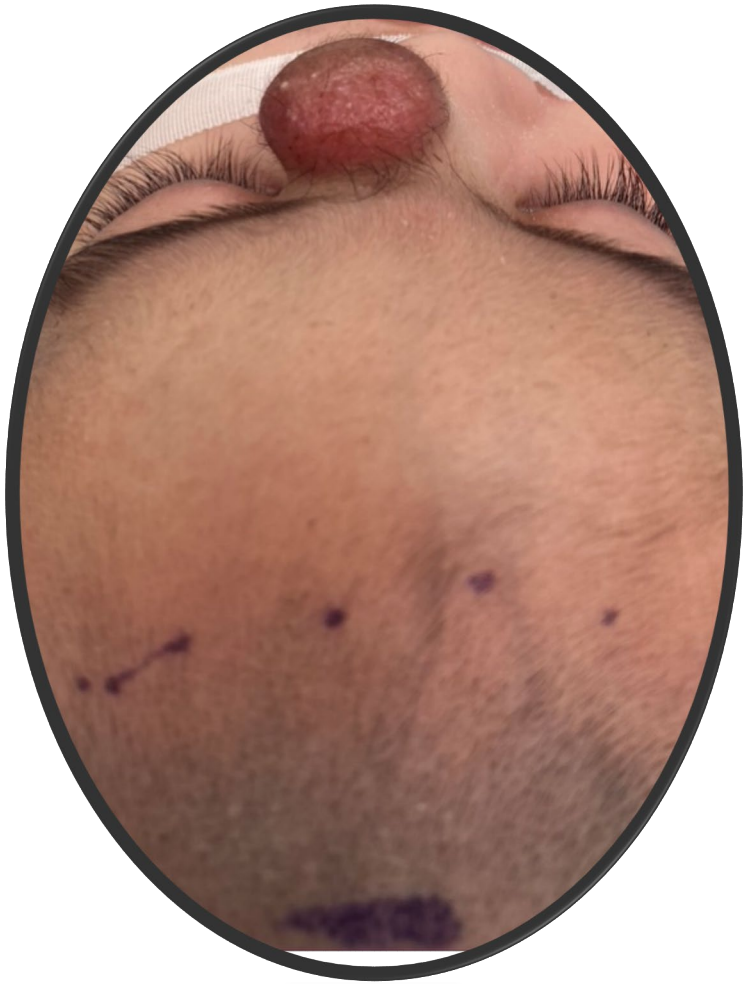




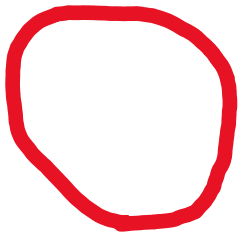


Cranial Disorders of Infancy





“A 3 month old with abnormal head shape …”



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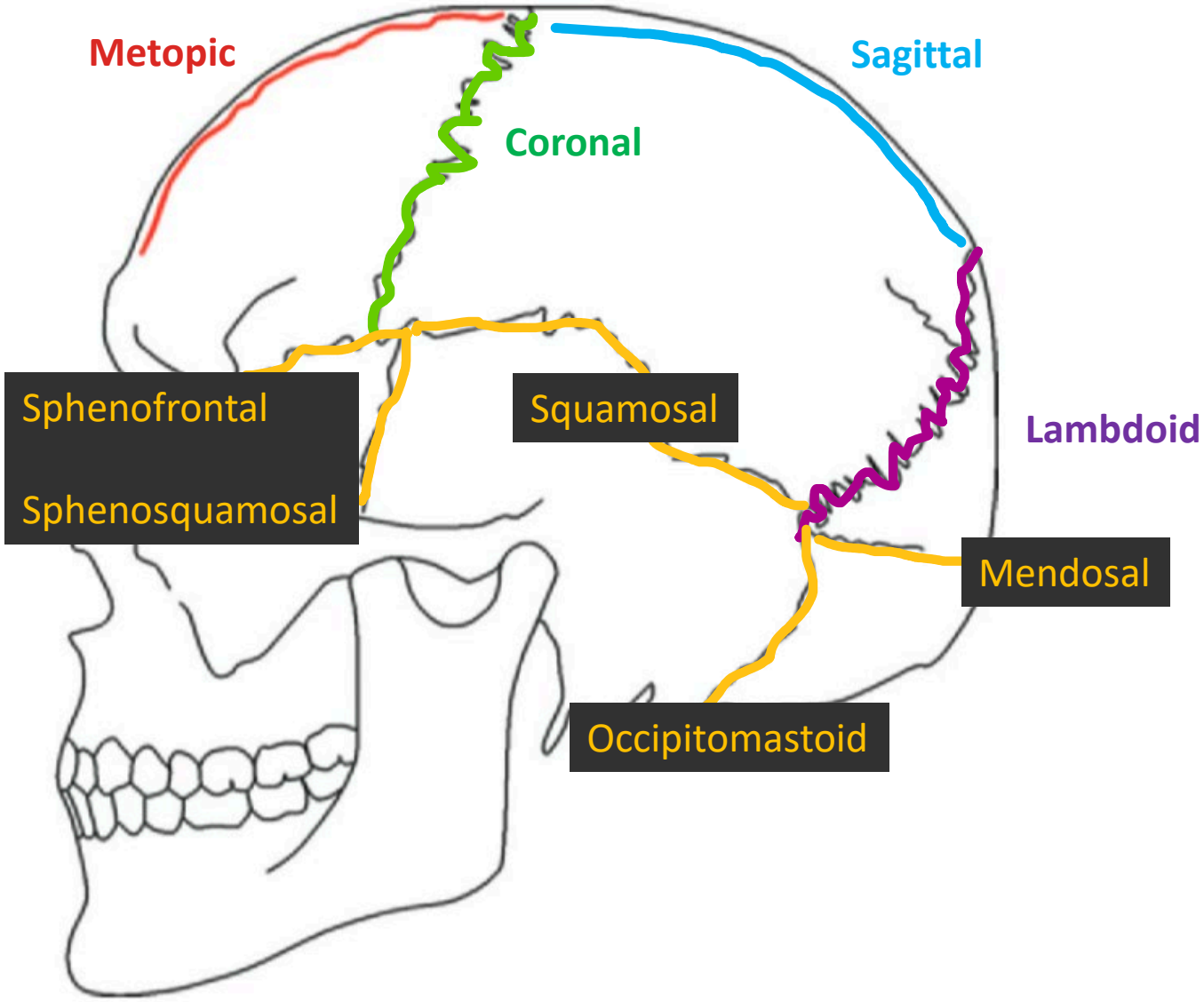
Metopic
Sagittal
Coronal
Sphenofrontal
Sphenosquamosal
Squamosal
Lambdoid
Mendosal
Occipitomastoid

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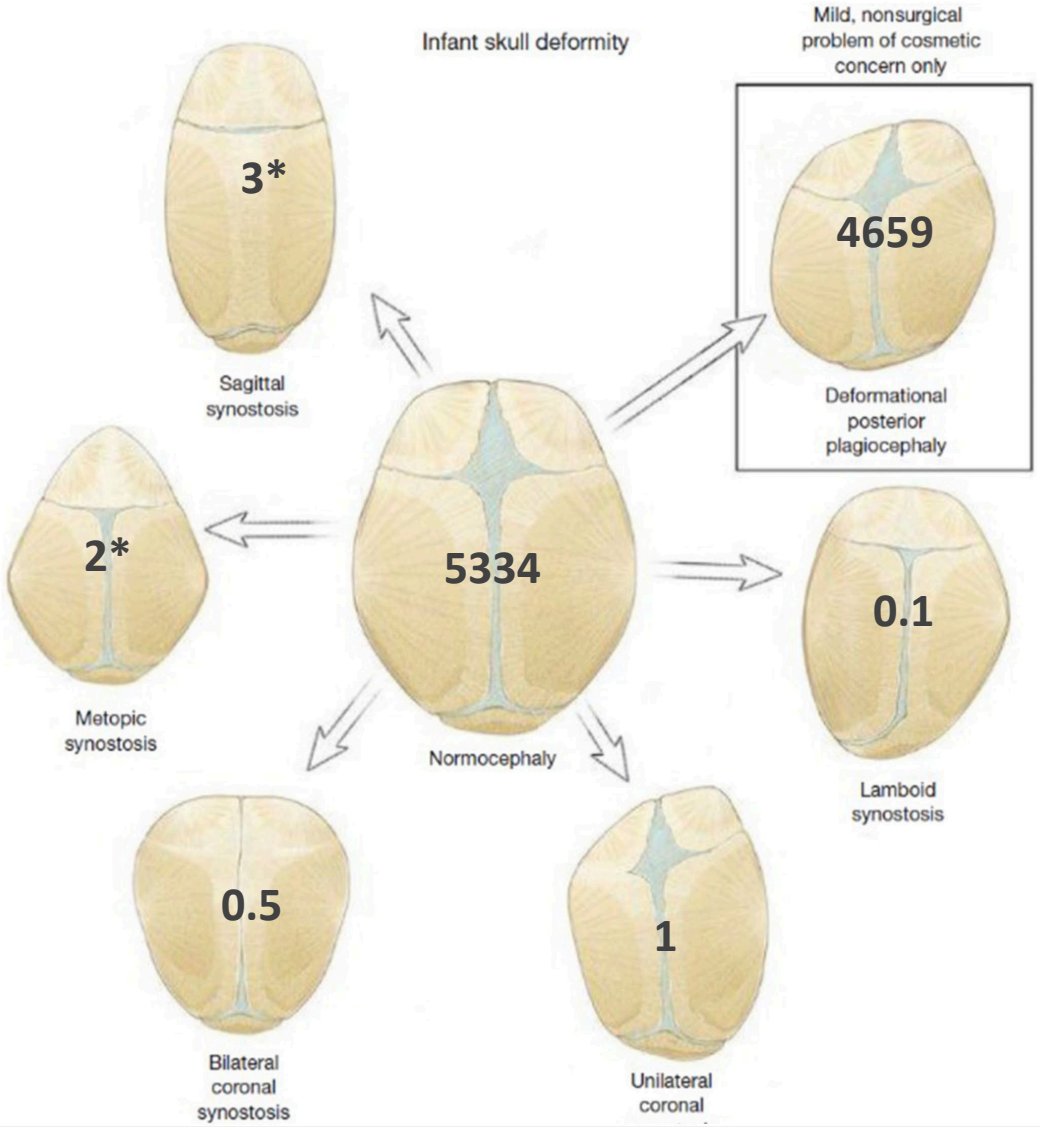
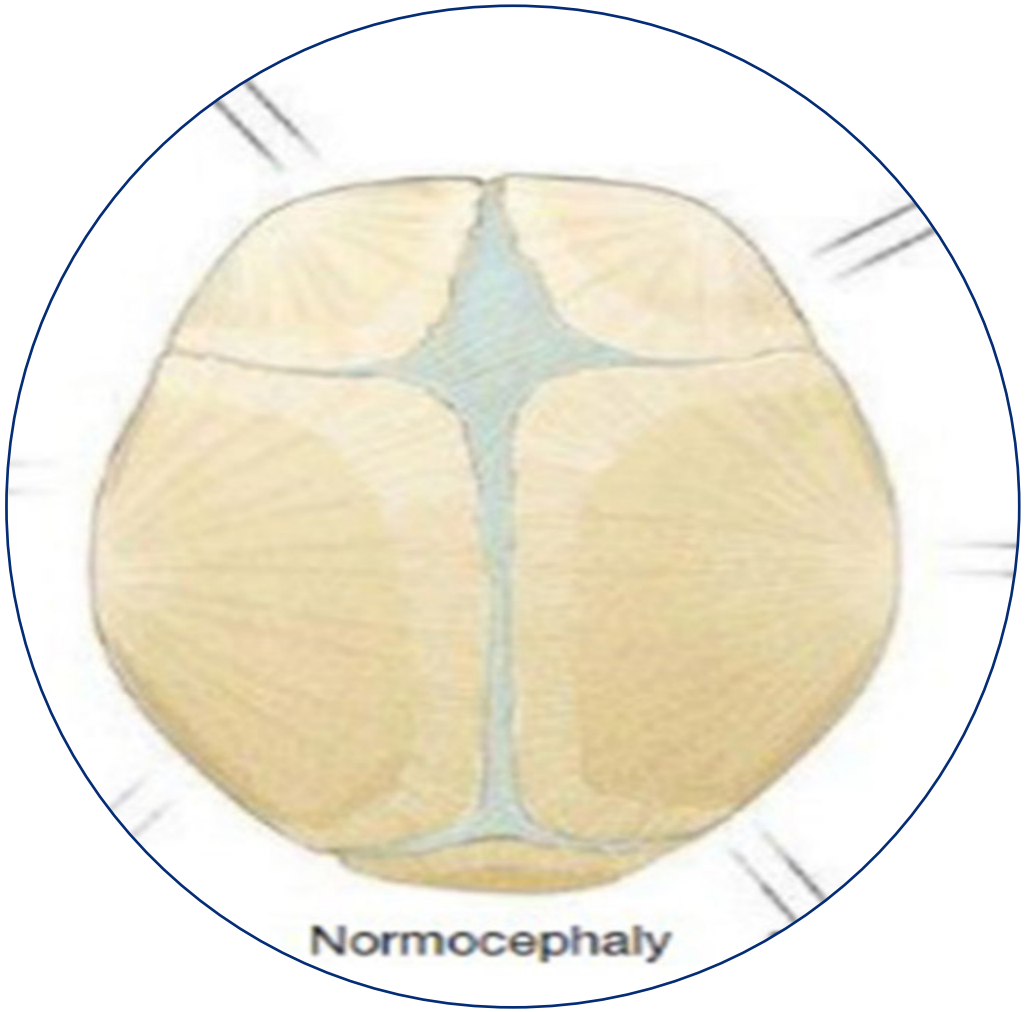
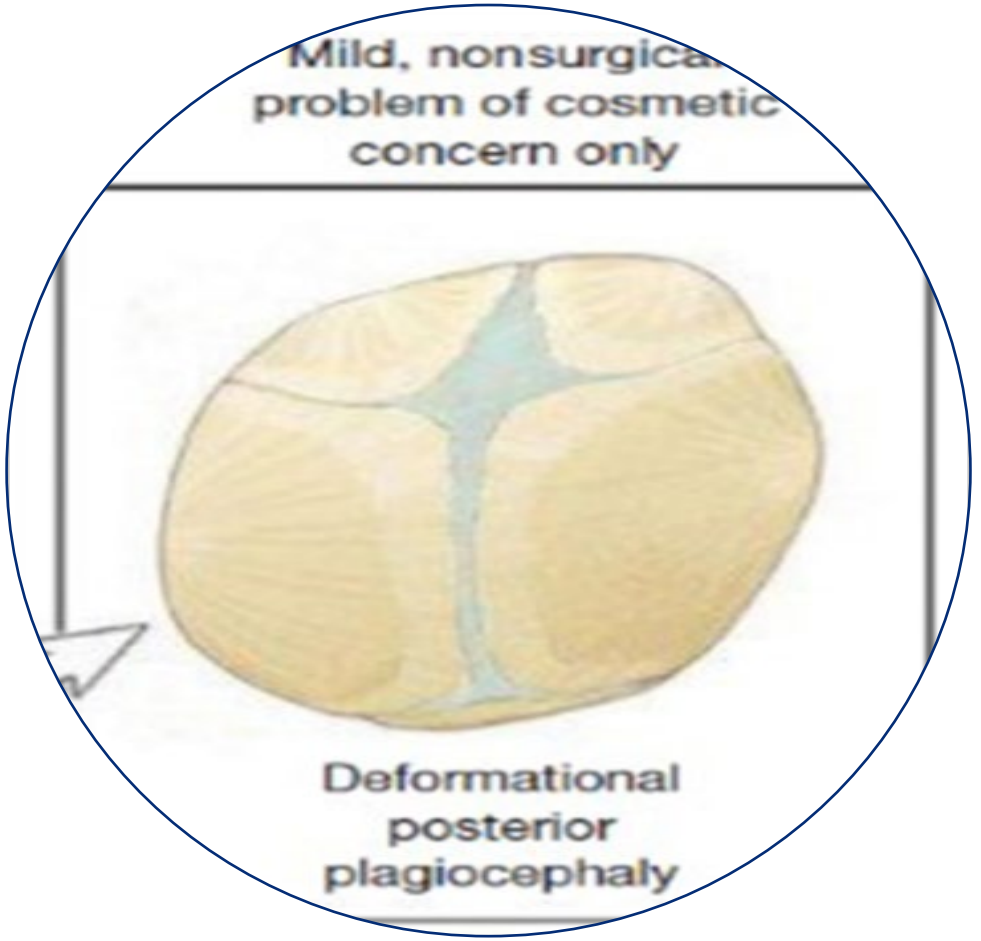
Identifying the Misshapen Head: Craniosynostosis and Related Disorders

Mark S. Dias, MD, FAAP, FAANS,[a] Thomas Samson, MD, FAAP,[b] Elias B. Rizk, MD, FAAP, FAANS,[a] Lance S. Governale, MD, FAAP, FAANS,[c] Joan T. Richtsmeier, PhD,[d] SECTION ON NEUROLOGIC SURGERY, SECTION ON PLASTIC AND RECONSTRUCTIVE SURGERY

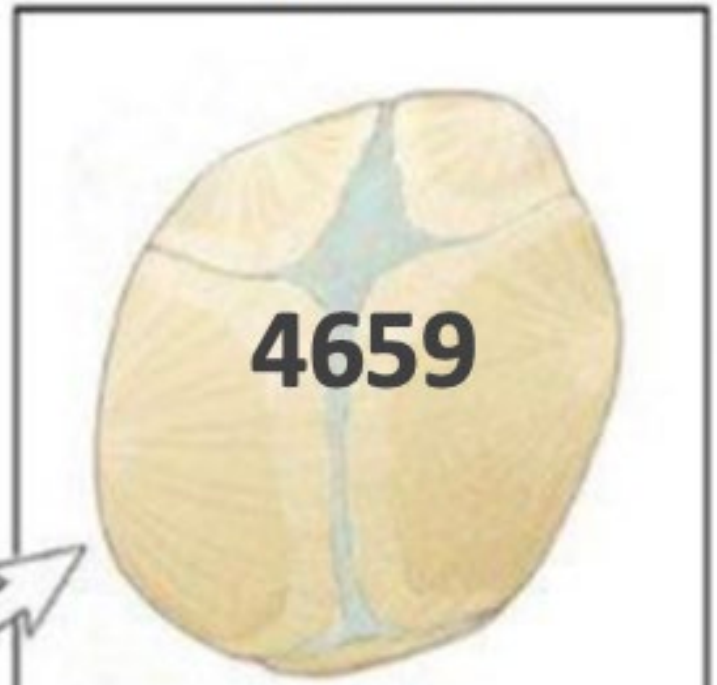
Craniosynostosis by Subtype and Frequency



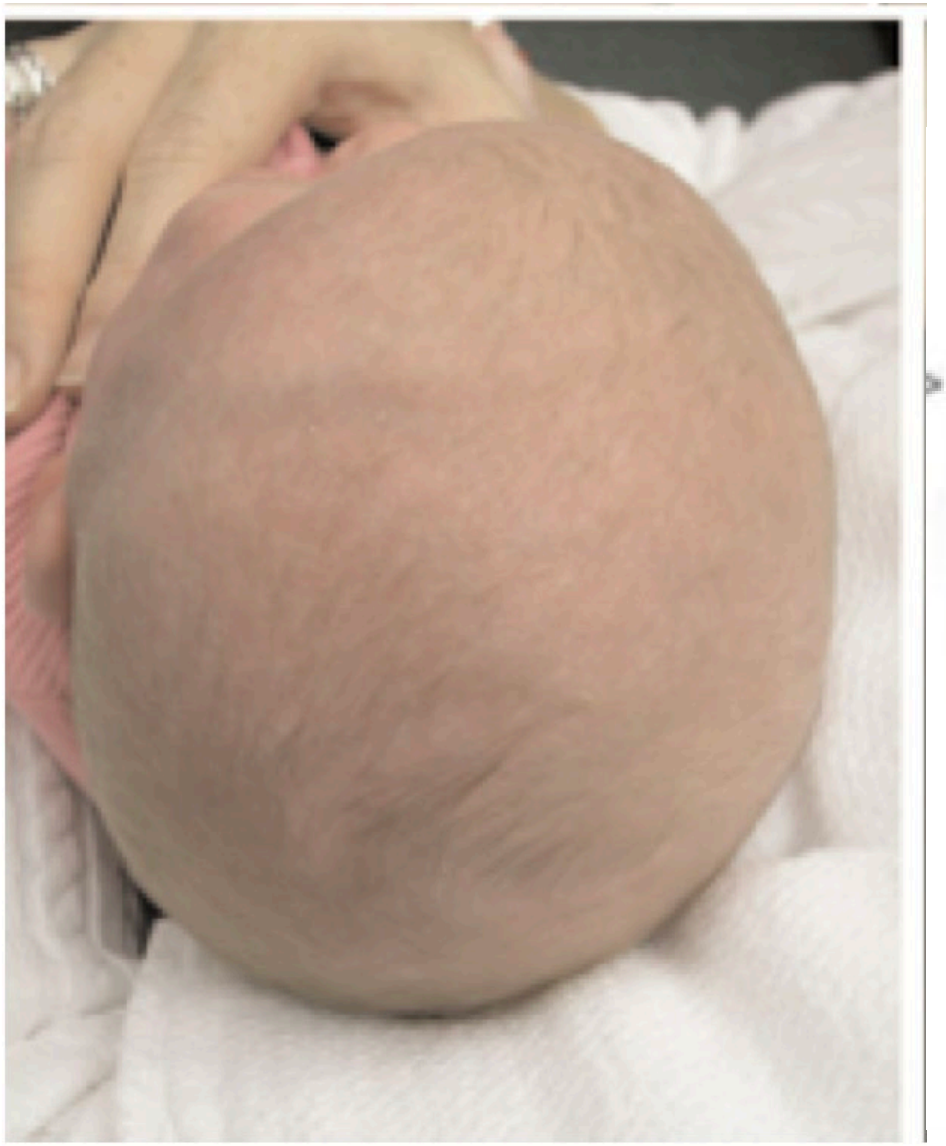

Normocephaly


problem of cosmetic
concern only
Deformational
posterior
plagiocephaly

Mild, nonsurgical problem of cosmetic concern only



Deformational posterior plagiocephaly



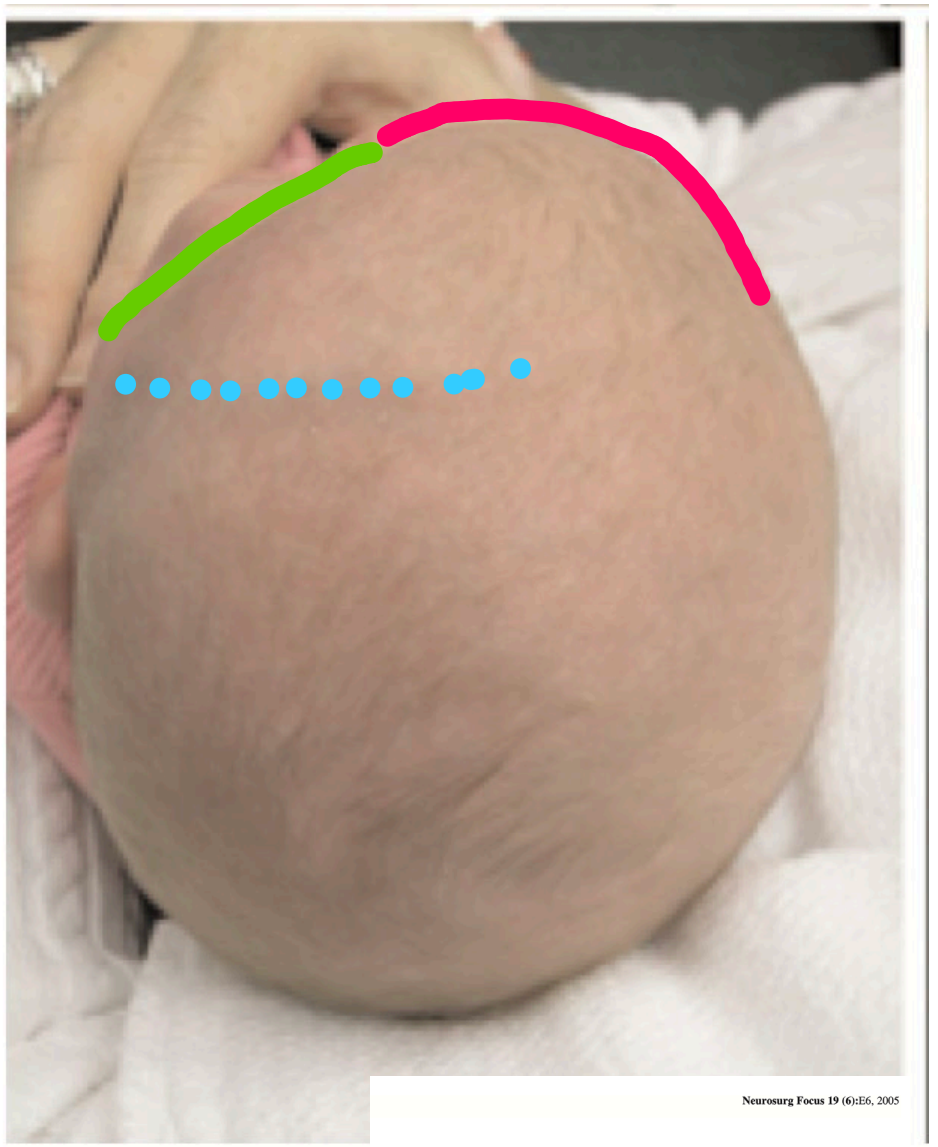
Lamboid synostosis

Neurosurg Focus 19 (6):E6, 2005

Endoscopic-assisted repair of craniosynostosis

GREGORY J. A. MURAD, M.D., MARK CLAYMAN, M.D., M. BRENT SEAGLE, M.D., SNO WHITE, M.D., LEIGH ANN PERKINS, A.R.N.P., AND DAVID W. PINCUS, M.D., PH.D.

Department of Neurosurgery, Divisions of Plastic Surgery and Pediatric Anesthesiology, and the University of Florida Craniofacial Center, University of Florida College of Medicine, Gainesville, Florida



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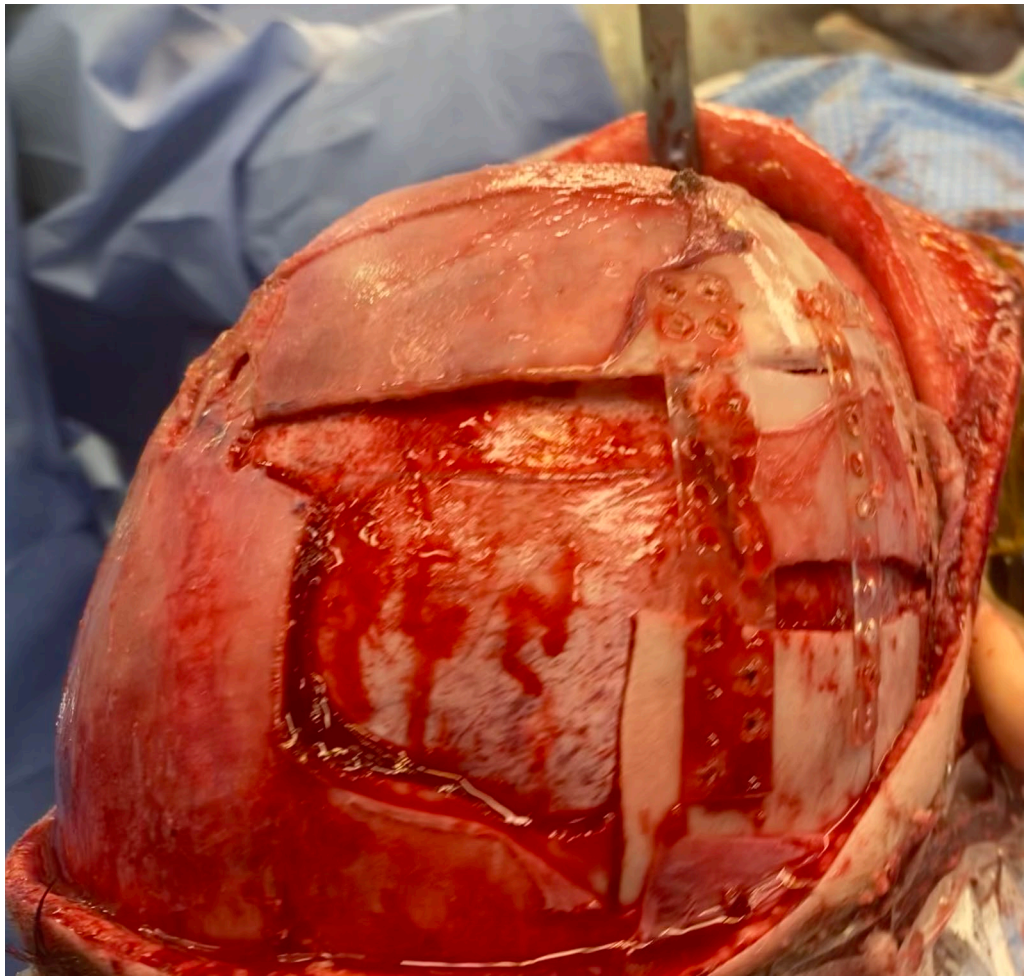
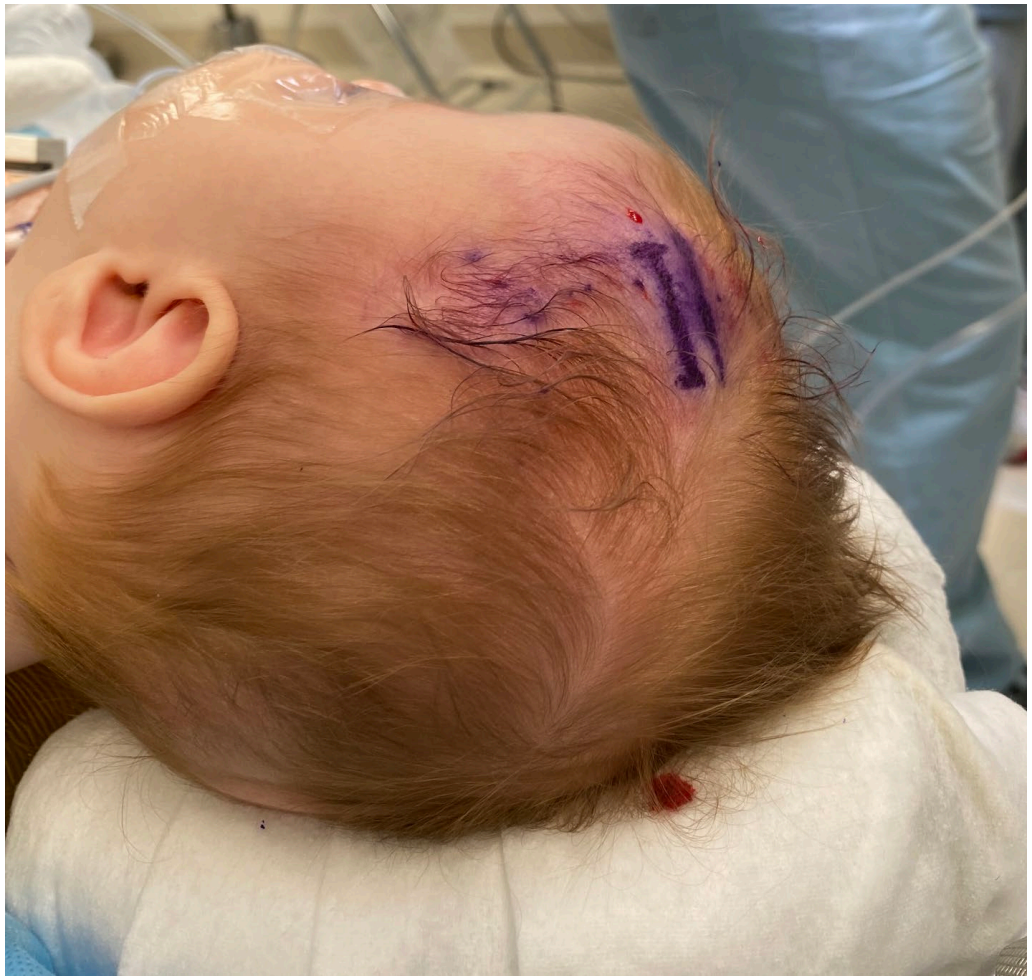
Endoscopic-assisted repair of craniosynostosis

Gregory J. A. Murad, M.D., Mark Clayman, M.D., M. Brent Seagle, M.D., Sno White, M.D., Leigh Ann Perkins, A.R.N.P., and David W. Pincus, M.D., Ph.D.

Department of Neurosurgery, Divisions of Plastic Surgery and Pediatric Anesthesiology, and the University of Florida Craniofacial Center, University of Florida College of Medicine, Gainesville, Florida

Which would you prefer?





Which Misshapen Heads are Dangerous?

“Does this child have craniosynostosis?”

Most Common diagnosis: **positional plagiocephaly**, ~1 in 2 kids since 1992

Common diagnosis: single suture sagittal (up to 6%*) or metopic*

Rare diagnosis: coronal, lambdoid, syndromic

Age-Based diagnosis:

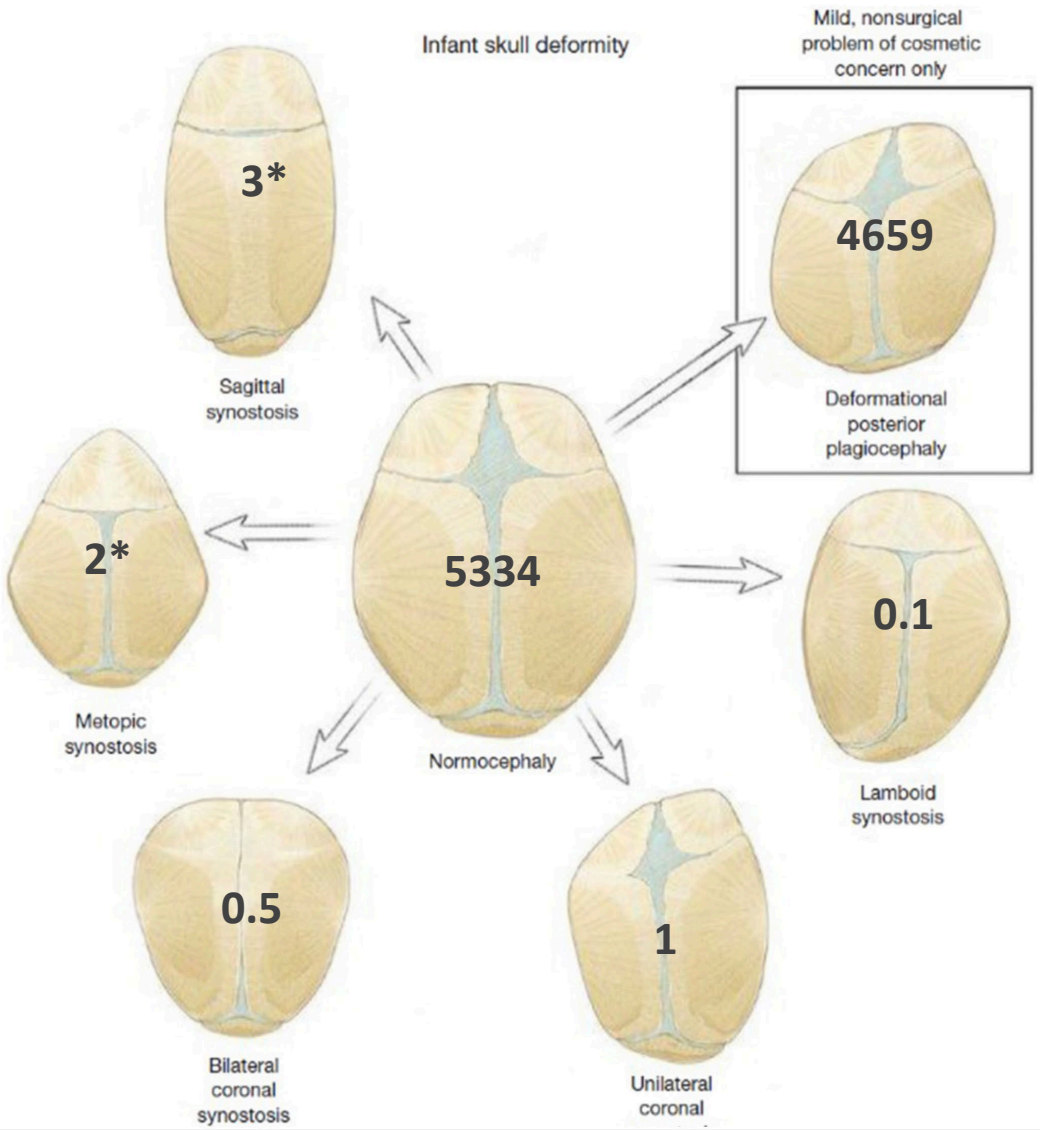
Complex multisuture/syndrome	Prior to discharge home (potentially lethal ICP)
Isolated sagittal, coronal, metopic	≤4 weeks to allow endoscopic treatment
Positional plagiocephaly	3-6 months to allow option of helmet threapy
Lambdoid or occult multisuture	1-3 years of age

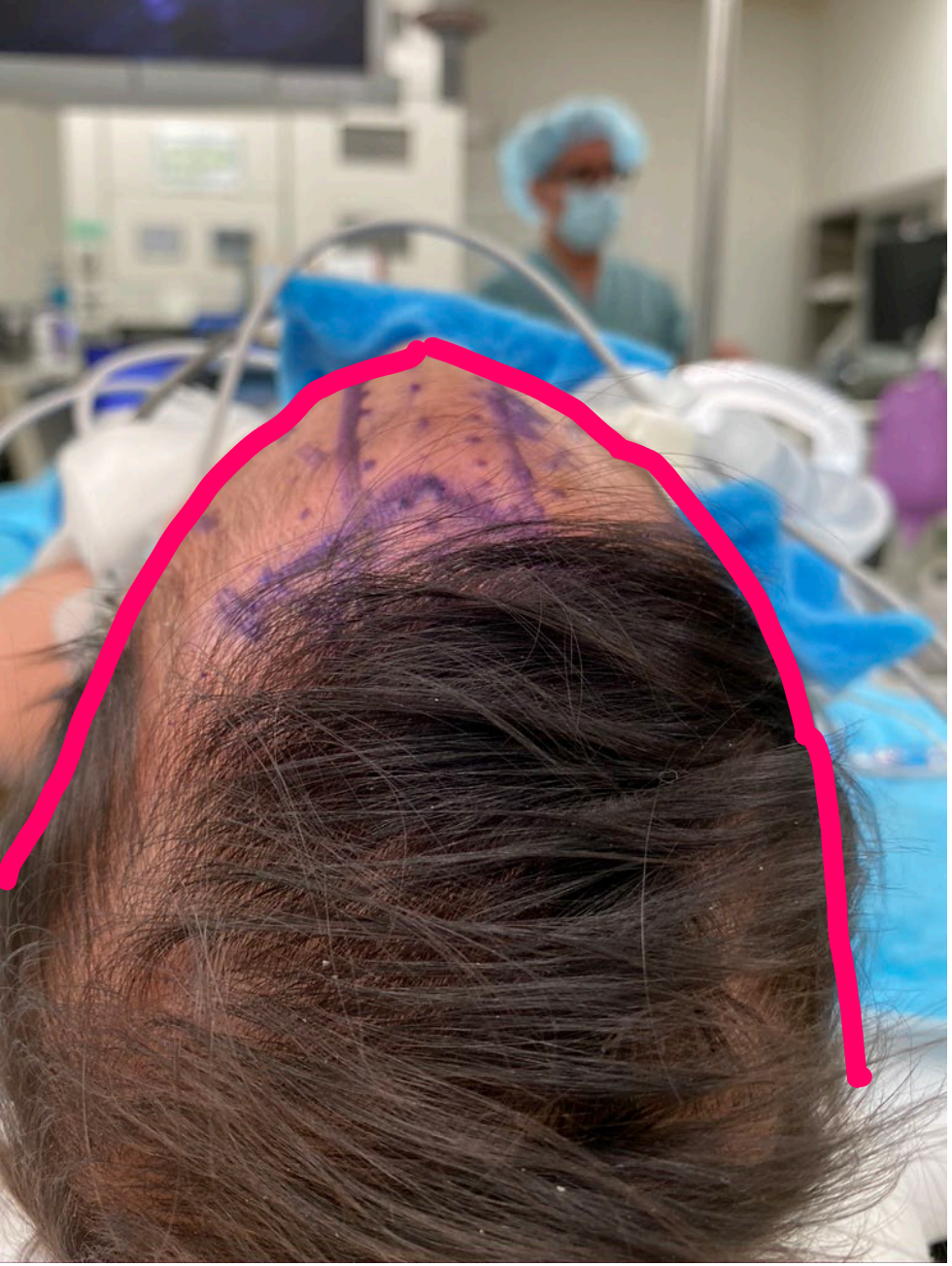
Clinical diagnosis with imaging for surgical planning or uncertain cases

“Does this child have craniosynostosis or PP?”

Present in parents/relatives	**Affected family**	Present in siblings only
Present at birth	**Present at birth**	Normal at birth
Progressively worsening	**Early course**	Peaks at 4-6 months, regressive/stable
Not improved by positioning	**Repositioning results**	Slows but not improved by positioning
Frontal bossing	**Frontal abnormality**	Unilateral frontal bulging
Bitemporal or biparietal expansion	**Parietal abnormality**	Uniparietal bulging with flattening
Ear deviation **away from** bulging	**Ear abnormality**	Ear deviation **with** bulging
Parietal bulging **worsens** ≥6 months	**Parietal bulge course**	Parietal bulging **persists** 6-18 months
Bulging in the mid forehead	**Forehead abnormality**	Ridge in the mid-forehead
Eye abnormalities	**Eye abnormality**	No hypotelorism or orbital flattening
Occipital prominence/bulge	**Occipital abnormality**	Symmetrically flat across the occiput
Sutural ridging and/or splaying	**Sutural findings**	Sutures not palpably deformed

Let's Review Each in Turn





Metopic Craniosynostosis

Physiologic closure at ~6 months, but highly variable

Metopic ridge (1 in 3) normal development and ICP

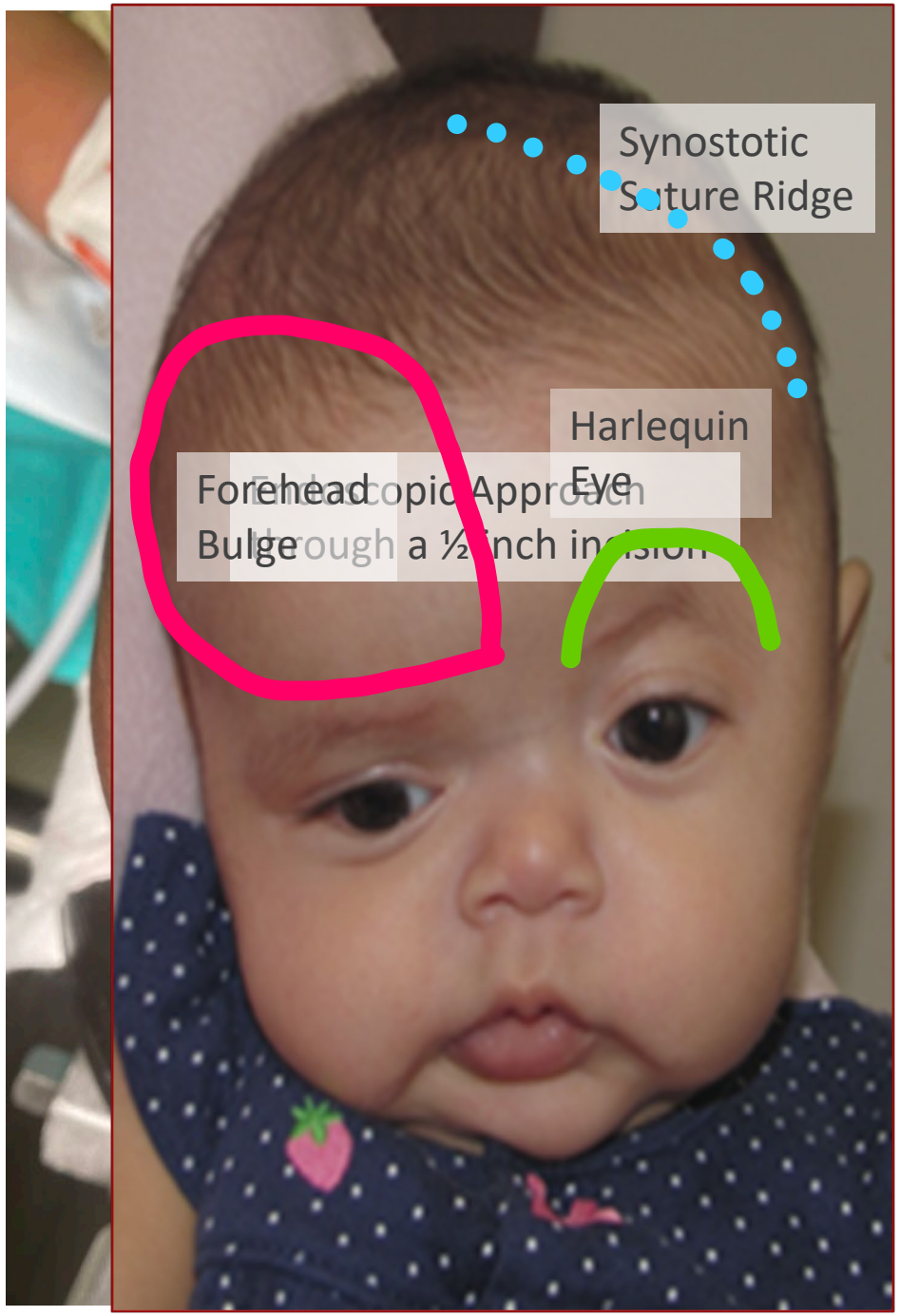
Trigonocephaly rarely affects development ICP (8%)

Hypotelorism **may** affect ocular motions

Treatment:

Endoscopic sutureectomy at ≤6 months (ideally earlier, metopic bone becomes thickened and risk of blood transfusion ↑)

Fronto-orbital advancement at ≥ 12 months



Unicoronal Craniosynostosis

Physiologic closure at ~6 months, but highly variable

Prominent suture ridge ipsilateral to harlequin eye

Nose and chin deviate toward harlequin eye (mid and lower face never affected in PP)

Fontanelle deviated away from the harlequin eye

Rarely affects development and ICP (8%)

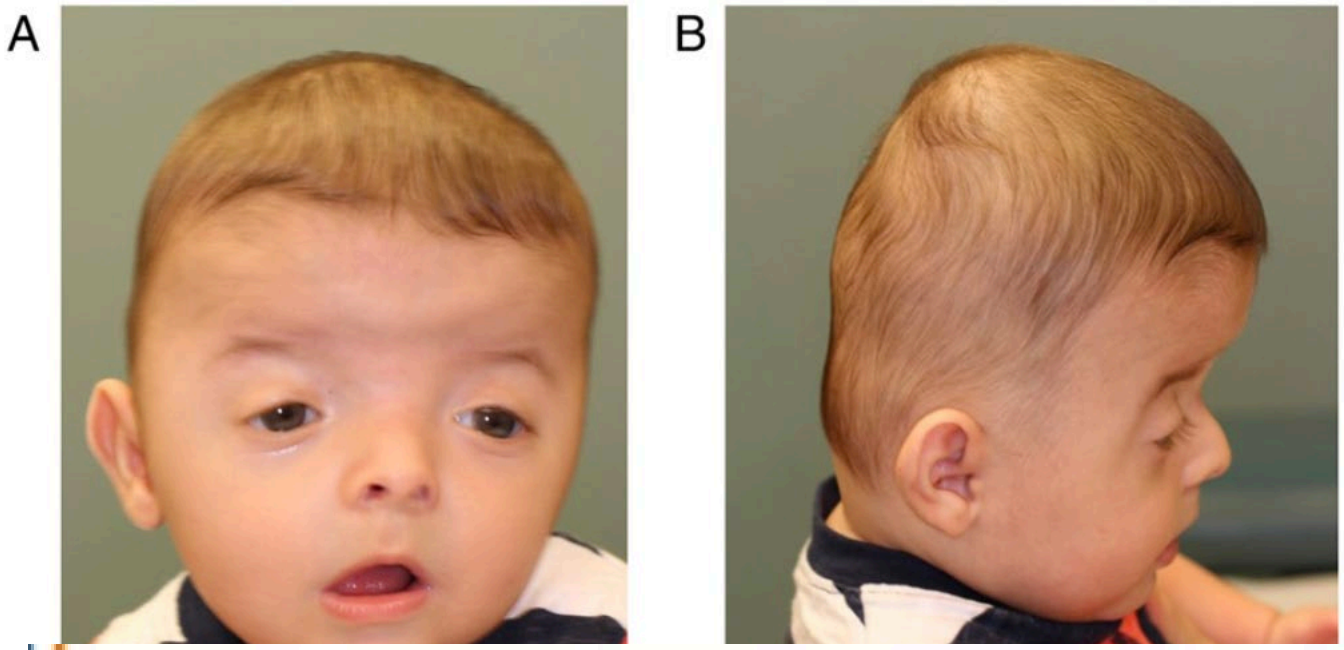
Strabismus anisotropia and ophthalmologic pathology

Treatment:

Endoscopic sutureectomy at ≤6 months with postoperative helmet therapy. (LOS 1 day, ≤25% transfusion)

Fronto-orbital advancement at ≥ 6 months if helmet therapy fails

Bicoronal Craniosynostosis vs. Deformational Brachycephaly

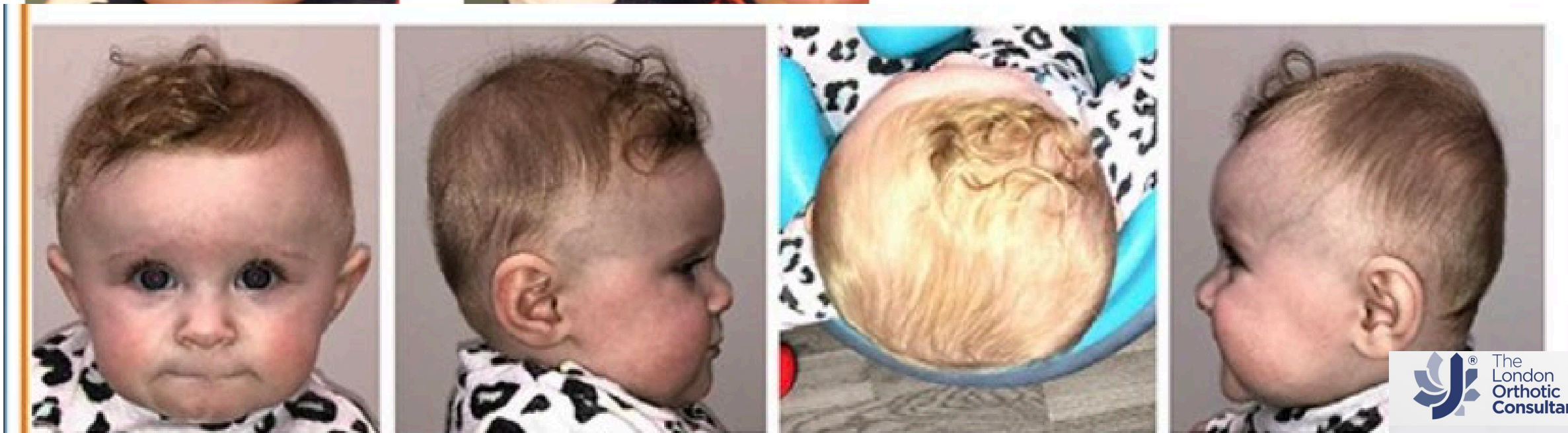


Almost all syndromic craniosynostses, few non-syndromic (1-3%).

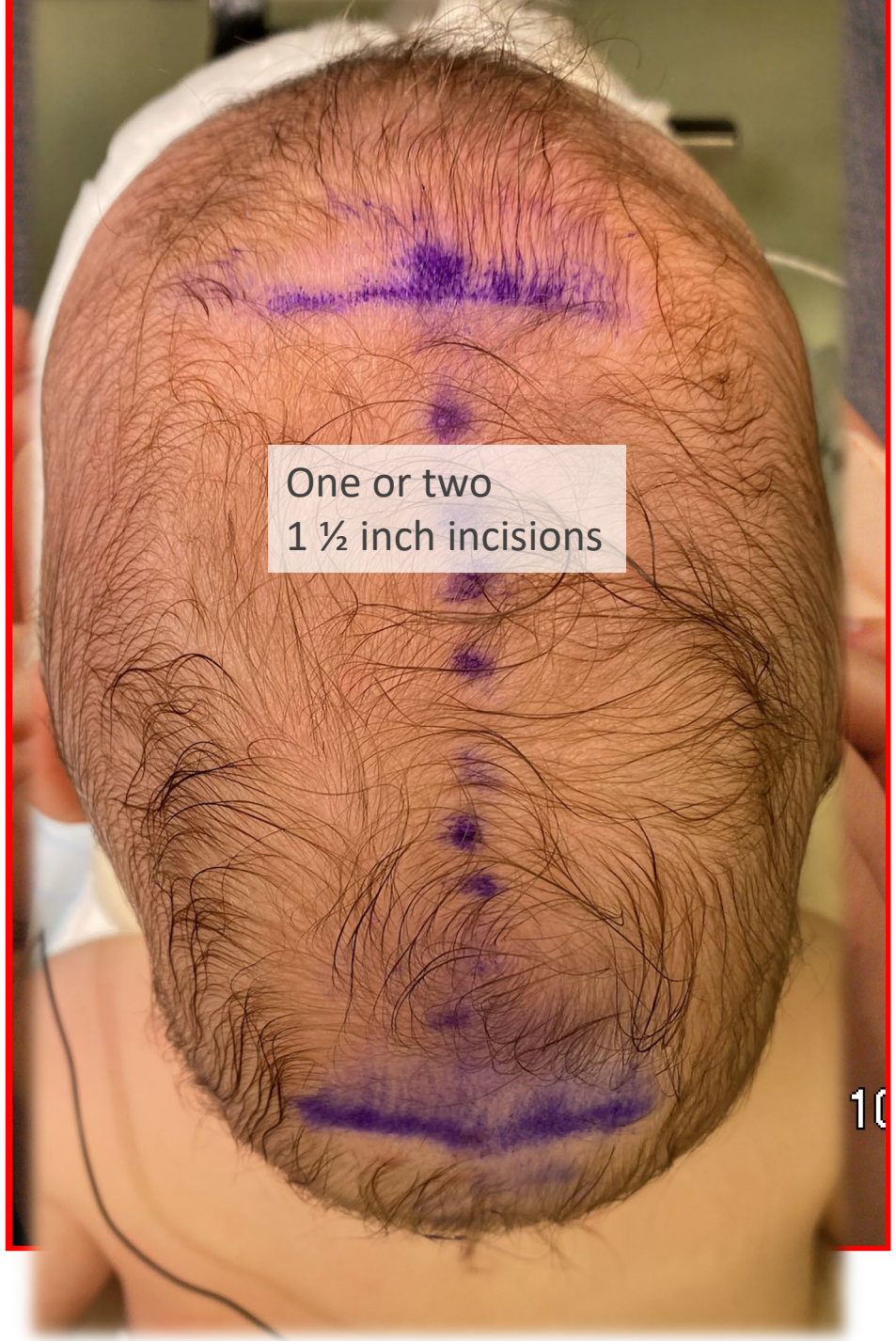
Towering

Bilateral harlequin, orbital retrusion

Bicoronal ridges



The London Orthotic Consultancy



Sagittal Craniosynostosis

Physiologic closure at 15-20 years, but highly variable

May be closed in 3-5% normocephalic; almost all with neurodevelopmental disorders

Rarely affects development and ICP (although development may be abnormal esp. VIQ)

Treatment:

Endoscopic sutureectomy at 2-4 months with postoperative helmet therapy (LOS 1 day, ≤10% transfusion)

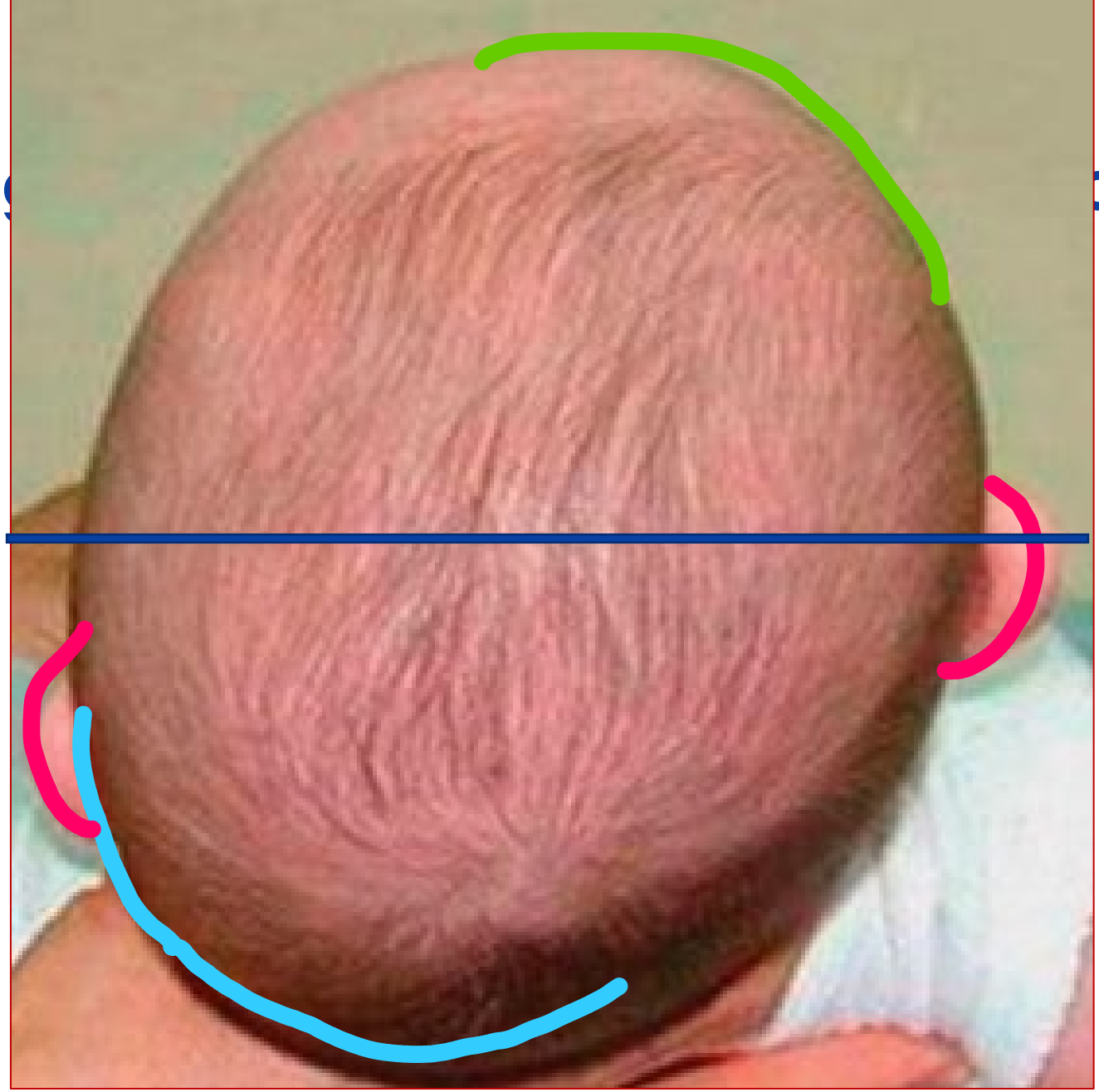
Pi procedure at 5-9 months (longer LOS, blood loss)

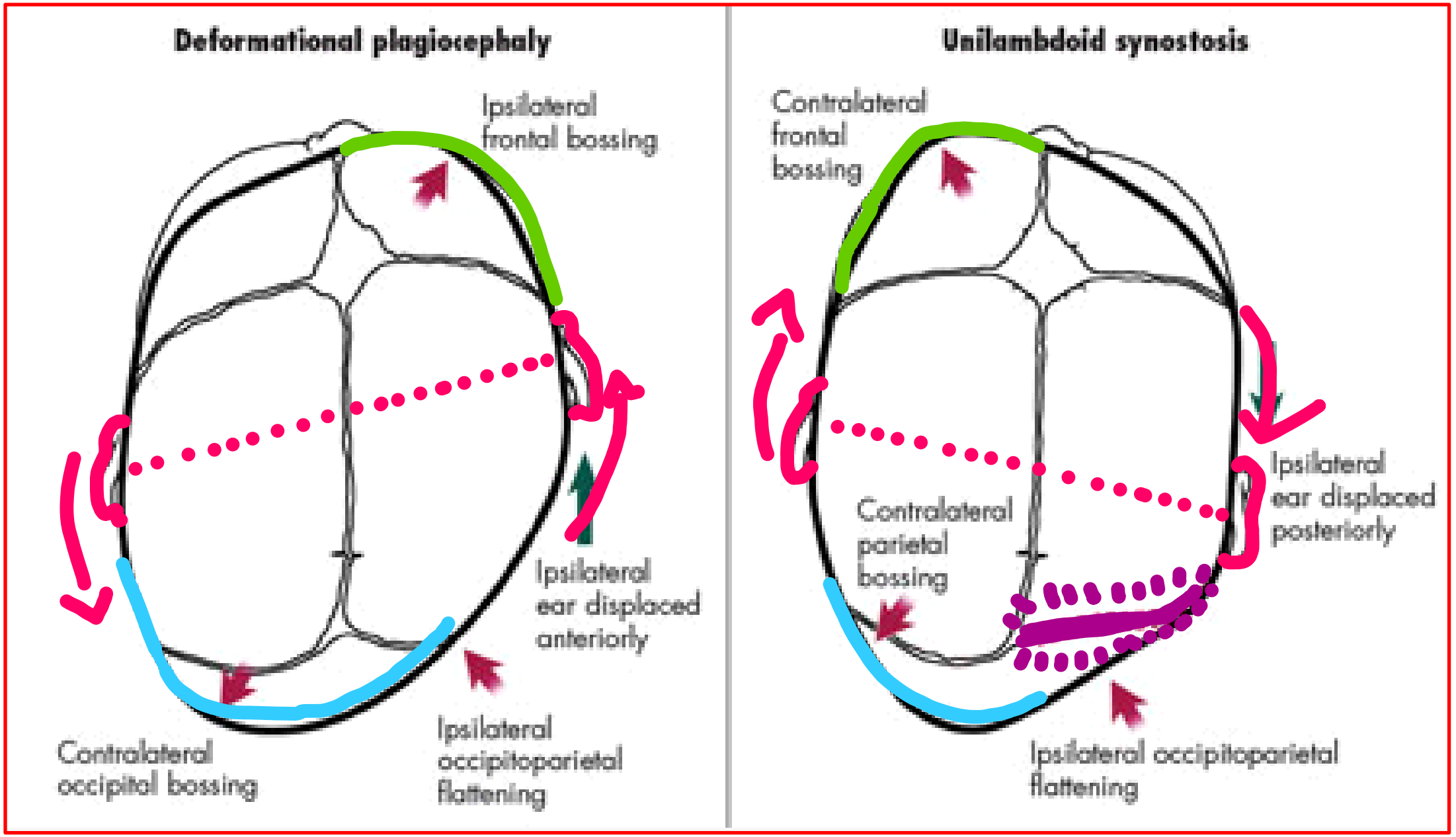
Plastic and Reconstructive Surgery®
Journal of the American Society of Plastic Surgeons

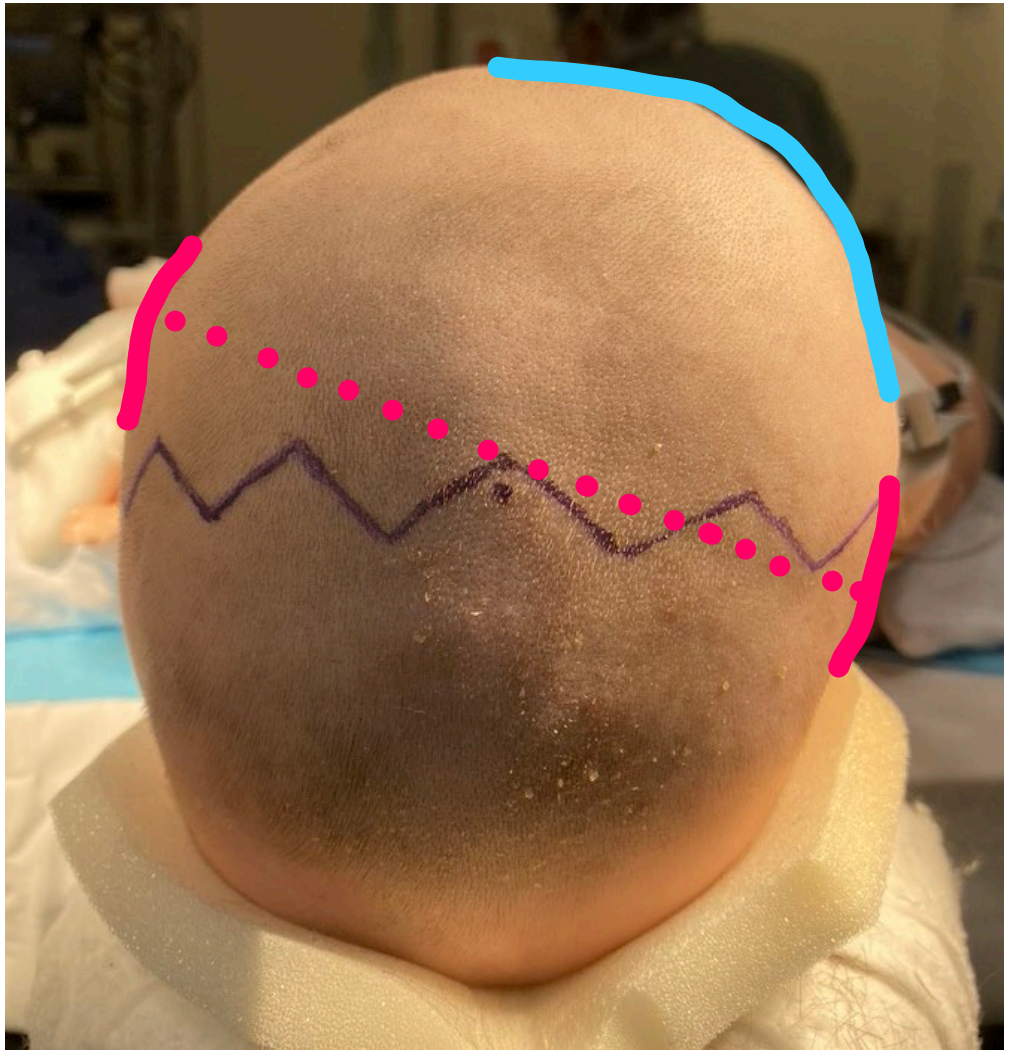
Premature Fusion of the Sagittal Suture as an Incidental Radiographic Finding in Young Children

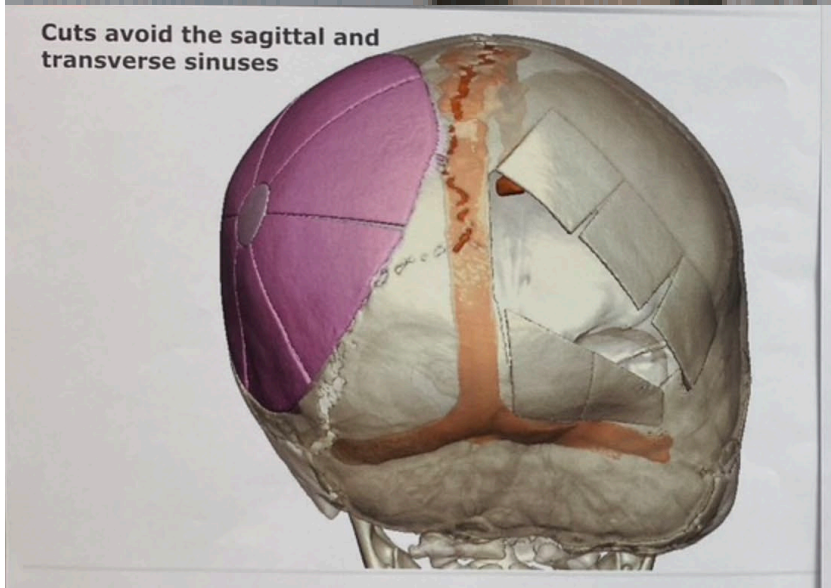
Manrique, Monica M.D.; Mantilla-Rivas, Esperanza M.D.; Porras Perez, Antonio R. Ph.D.; Bryant, Justin R. D.O., M.B.A.; Rana, Md Sohel M.B.B.S., M.P.H., C.P.H.; Tu, Liyun Ph.D.; Keating, Robert F. M.D.; Oh, Albert K. M.D.; Linguraru, Marius G. D.Phil.; Rogers, Gary F. M.D., J.D., LL.M., M.B.A., M.P.H.

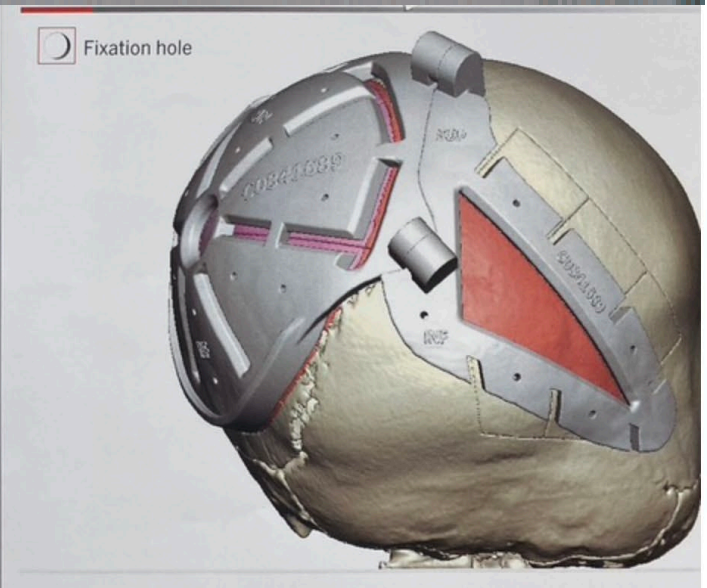
Positional Pla osynostosis




Deformational plagiocephaly
Ipsilateral frontal bossing
Ipsilateral ear displaced anteriorly
Ipsilateral occipitoparietal flattening
Contralateral occipital bossing
Unilambdoid synostosis
Contralateral frontal bossing
Contralateral parietal bossing
Ipsilateral ear displaced posteriorly
Ipsilateral occipitoparietal flattening







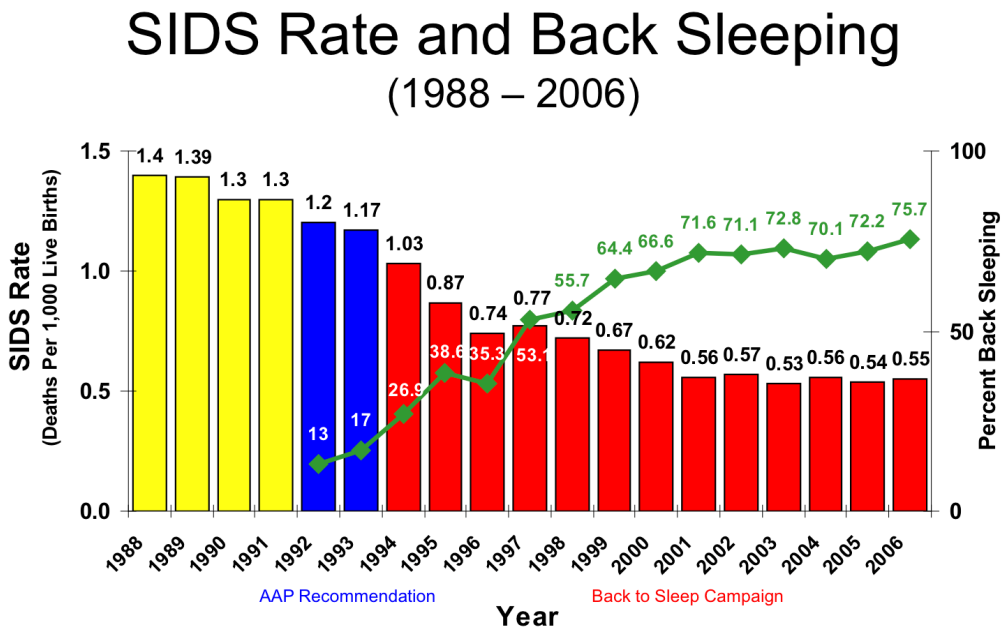
(BACK TO THE) **FUTURE OF PEDIATRICS**

Positional Plagiocephaly

1992 Guidelines become the 1994 "Back to Sleep" campaign

A package of interventions that reduced SIDS by **0.9/1000 live births**

Now known as the "Safe to Sleep" campaign



SIDS Rate Source: CDC, National Center for Health Statistics,
Sleep Position Data: NICHD, National Infant Sleep Position Study.

However …

46.6% of infants develop positional plagiocephaly (male, right sided predominance)

37 FDA-approved devices to treat PP

2% of untreated teenagers remain clinically evident, 12% CT evident (none severe)


Neurosurg Focus 35 (4):E2, 2013
©AANS, 2013

Orthotic (helmet) therapy in the treatment of plagiocephaly

Jo Ling Goh, B.A.,[1] David F. Bauer, M.D.,[2] Susan R. Durham, M.D.,[2] and Mitchell A. Stotland, M.D.[3]

[1]Geisel School of Medicine, Hanover; and Departments of [2]Neurosurgery and [3]Plastic Surgery, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire

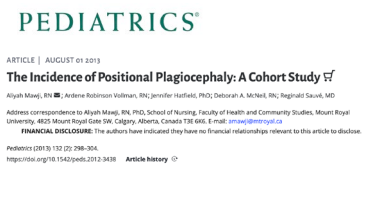
Object. The goal of this study was to review the current literature on orthotic (helmet) therapy use in the treatment of deformational plagiocephaly.

Methods. PubMed was used to search English articles using the medical subject headings "deformational plagiocephaly" and "orthosis," and "deformational plagiocephaly" and "helmet."

Results. Forty-two articles were found. There were no Class I studies, 7 Class II studies, 1 Class III study, and 13 Class IV studies. Cranial orthoses have been shown to be effective in treating deformational plagiocephaly. It continues to be debated as to whether the statistical significance of treatment with cranial orthoses compared with conservative therapies is clinically significant. Children older than 12 months of age with deformational plagiocephaly may still benefit from orthotic therapy. The long-term effects of orthotic therapy are controversial.

Conclusions. There is a lack of Class I literature evidence supporting the use of helmet therapy in deformational plagiocephaly. There are controversies surrounding the use of orthotic therapy such as appropriate use, cost, use in older children, and long-term outcomes. Clinical indications for orthotic therapy need to be better defined with further research studies.

(http://thejns.org/doi/abs/10.3171/2013.7.FOCUS13260)


PEDIATRICS

ARTICLE | AUGUST 01 2013

The Incidence of Positional Plagiocephaly: A Cohort Study

Aliyah Mawji, RN; Ardene Robinson Vollman, RN; Jennifer Hatfield, PhD; Deborah A. McNeil, RN; Reginald Sauvé, MD

Address correspondence to Aliyah Mawji, RN, PhD, School of Nursing, Faculty of Health and Community Studies, Mount Royal University, 4825 Mount Royal Gate SW, Calgary, Alberta, Canada T3E 6K6. E-mail: amawji@mtroyal.ca

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

Pediatrics (2013) 132 (2): 298–304.
https://doi.org/10.1542/peds.2012-3438 **Article history**

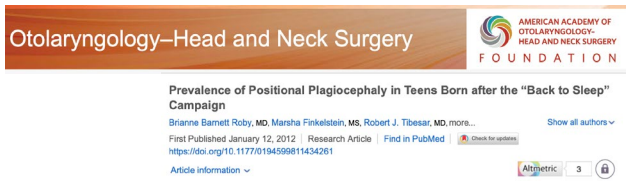

Acta Neurochirurgica
The European Journal of Neurosurgery

Prevalence and severity of positional plagiocephaly in children and adolescents

Federico Di Rocco [1], Valeria Ble [2], Pierre-Aurelien Beuriat [2], Alexandru Szathmari [2], Laura Nanna Lohkamp [2], Carmine Mottolese [2]

Affiliations + expand

PMID: 31041593 DOI: 10.1007/s00701-019-03924-2


Otolaryngology–Head and Neck Surgery

AMERICAN ACADEMY OF OTOLARYNGOLOGY-HEAD AND NECK SURGERY FOUNDATION

Prevalence of Positional Plagiocephaly in Teens Born after the "Back to Sleep" Campaign

Brianne Barnett Roby, MD, Marsha Finkelstein, MS, Robert J. Tibesar, MD, more...

Show all authors

First Published January 12, 2012 | Research Article | Find in PubMed | Check for updates

https://doi.org/10.1177/0194599811434261

Article information

Altmetric 3

Level I evidence for treatment of PP

Van Vlimmeren 2008: 65 infants with side preference and PP randomized to PT vs no PT. 5 sessions starting at 9 weeks. Rate of PP improved with PT, RR 0.43, **NNT ~3**.

Van Wijk 2014: 84 infants age 5-6 months with mod-severe randomized to 6mo helmet vs. no tx. **No difference** in shape, eye, face scores. 77% parents subjectively difficult to hug their children when helmeted

ARTICLE

Effect of Pediatric Physical Therapy on Deformational Plagiocephaly in Children With Positional Preference

A Randomized Controlled Trial

Leo A. van Vlimmeren, PhD, PT; Yolanda van der Graaf, MD, PhD; Magda M. Boere-Boonekamp, MD, PhD; Monique P. L'Hoir, PhD; Paul J. M. Helders, PhD, PT; Raoul H. H. Engelbert, PhD, PT

(REPRINTED) ARCH PEDIATR ADOLESC MED/VOL 162 (NO. 8), AUG 2008 WWW.ARCHPEDIATRICS.COM

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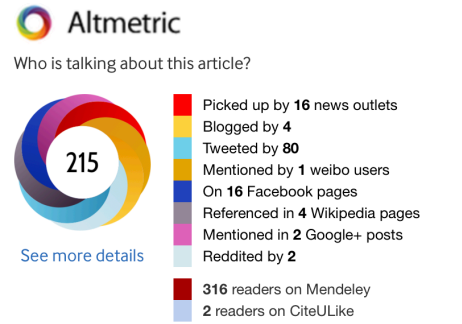

Altmetric

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Reddited by **2**

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BMJ

BMJ 2014;348:g2741 doi: 10.1136/bmj.g2741 (Published 1 May 2014) Page 1 of 13

RESEARCH

Helmet therapy in infants with positional skull deformation: randomised controlled trial

OPEN ACCESS

Renske M van Wijk *PhD candidate*[1], Leo A van Vlimmeren *senior researcher in paediatric physiotherapy*[2,3], Catharina G M Groothuis-Oudshoorn *biostatistician*[1], Catharina P B Van der Ploeg *epidemiologist*[4], Maarten J IJzerman *professor*[1], Magda M Boere-Boonekamp *associate professor of youth health care*[1]

[1]Department Health Technology and Services Research, Institute of Innovation and Governance Studies, University of Twente, Drienerlolaan 5, 7522 NB, Enschede, Netherlands; [2]Department of Rehabilitation, Paediatric Physical Therapy, Radboud university medical center, Nijmegen, Netherlands; [3]Scientific Institute for Quality of Healthcare, Radboud university medical center, Nijmegen, Netherlands; [4]TNO Child Health, Leiden, Netherlands

Current Guidelines on Helmet Tx

Congress of Neurological Surgeons

GUIDELINES

Mild-moderate plagiocephaly should be treated by **repositioning and physical therapy**

Helmet use results in a **more rapid** and **greater degree** of normalization of CVAI compared to non-helmet tx (despite the Van Wijk RCT)

Helmet application at an earlier age (<6 months, <9 months) is more likely to achieve benefit than later ages

In **selected severe** plagiocephaly cases, helmet use after 12 months can benefit (!!!)

Are we **preventing deformity**

or

monetizing parental stress?

Policy Coverage Criteria

Treatment	Medical Necessity
Adjustable cranial orthosis	**Use of an adjustable cranial orthosis (cranial banding or soft shell helmet) may be considered medically necessary when the following criteria are met:** • Age is between 3 and 18 months of age **AND** • The device is custom made and fitted for the individual **AND** • Either of the following is present: o The child has had surgery for craniosynostosis, and the orthosis is needed for post-operative care **OR** o The child has severe positional plagiocephaly* that has not responded to a two month trial of repositioning and/or physical therapy ***Severe plagiocephaly is defined by the following:** • 10 mm or more of asymmetry in one of the following measures: cranial vault, skull base, or orbitotragial depth (see **Table 1** below) **OR** • Cephalic index at least two standard deviations above or below the mean for the appropriate gender and age (see **Table 2** below) **Use of an adjustable cranial orthosis is considered not medically necessary for all other indications not outlined above.**

2. For brachycephaly evaluation, a cephalic index of 2 standard deviations (SDs) below mean (head narrow for its length) or 2 SDs above mean (head wide for its length) warrants coverage of a trial of orthotic banding to correct the craniofacial deformity in a child after 4 months of age and before 12 months of age. (**Note**: These measurements are generally obtained by the orthotist fitting the band or helmet).

Table 2: Brachycephaly Evaluation - Measurements and Measures

Head width (eu - eu)	from euryon (eu) on one side of head to euryon (eu) on the other side	measures greatest transverse diameter or maximal head width
Head length (g-op)	from glabella point (g) to opisthocranion (op)	measures maximal head depth or length

Cephalic index = $\frac{\text{Head width (eu - eu)} \times 100}{\text{Head length (g - op)}}$

Table 3: Cephalic Index for Male and Female and their age

Sex	Age	-2 SD	-1 SD	Mean	+1 SD	+2 SD
Male	16 days to 6 months	63.7	68.7	73.7	78.7	83.7
	6 to 12 months	64.8	71.4	78.0	84.6	91.2
Female	16 days to 6 months	63.9	68.6	73.3	78.0	82.7
	6 to 12 months	69.5	74.0	78.5	83.0	87.5

3. Infants who develop significant plagiocephaly secondary to a constant head position required for long-term hyperalimentation who do not respond to simple changing of the catheter location allowing the head to be re-positioned.

5. Premature infants with dolichocephalic head shape who have developed a mis-shapen head secondary to sustained head position.

Isn’t there an app for that?

SoftSpot™: The first and only mobile app cleared by the FDA for Cranial Measurements

Smart Digital Tool for Pediatric Head Measurement & Monitoring.
Recommended for all newborns.

Get Started

GET IT ON Google Play

Download on the App Store

SoftSpot™

“Does this child have craniosynostosis?”

Refer possible sagittal / coronal / metopic synostoses promptly to enable endoscopic surgery

How to catch your 1 lambdoid amidst 4659 plagiocephalics:

1. In positional plagiocephaly, the anterior ear and forehead are **opposite the parietal bulge**
2. The parietal bulge **should not worsen** once the child learns to sit up (~6 months)
3. Keep looking. Late referral >>> no referral.

Interventions for Positional Plagiocephaly:

Repositioning early, tummy time, PT if side preference/torticollis

Helmets may achieve a greater degree of normalization at earlier ages

Without tx, deformity ≤1%. No benefit to brain health

Cost $1000-$3000, will be worn 23h/day for first year of life, often not covered by insurance

Big head … which one is hydrocephalus?

Primary CSF disorders in Infancy

Benign Enlargement of the Subarachnoid Spaces

Fontanelle flat or sunken, sutures opposed

Large head, more notably brachycephalic

≥50% famililal (**measure the parents esp. dad**)

Progressive, peaks from 4-12 months of age

Obtain HUS to confirm diagnosis, self limited

Subdural hematomas are common (5%) **not diagnostic** of NAT

May have mild motor delays (macrocephaly) but should normalize in function and HC by age 2-3

Hydrocephalus

Fontanelle bulges, sutures splay (≥2mm)

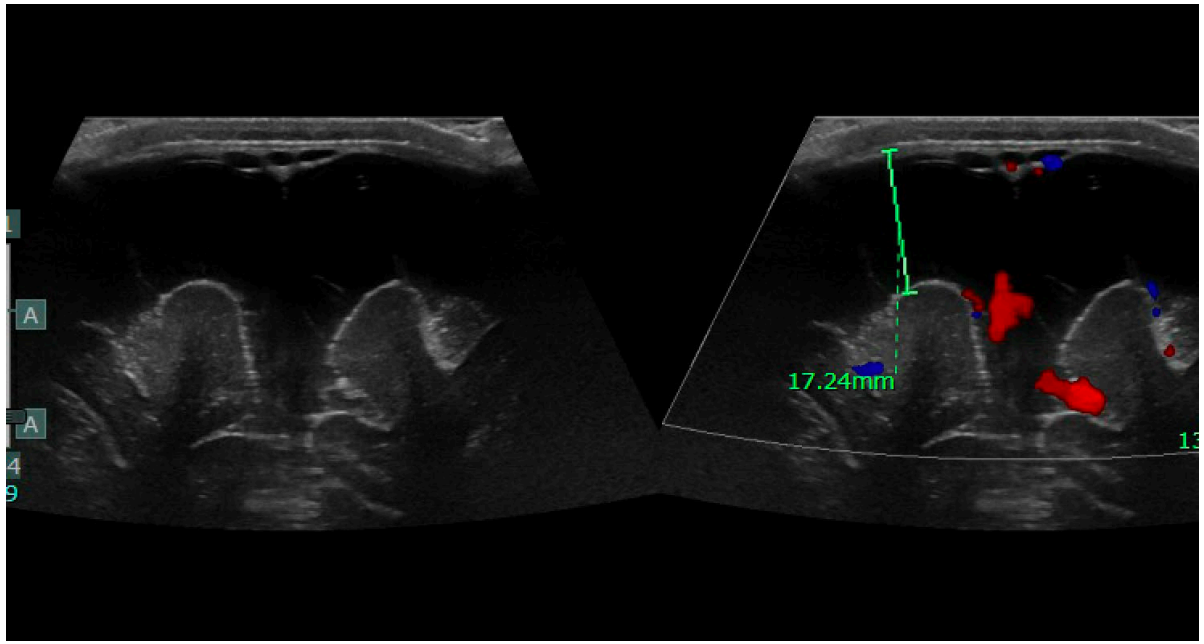
Frontal bossing, scalp veins dilated

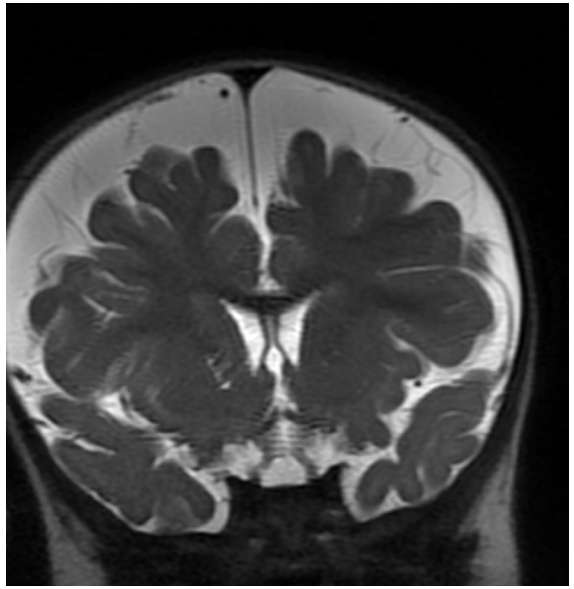
Usually sporadic (except X-linked)

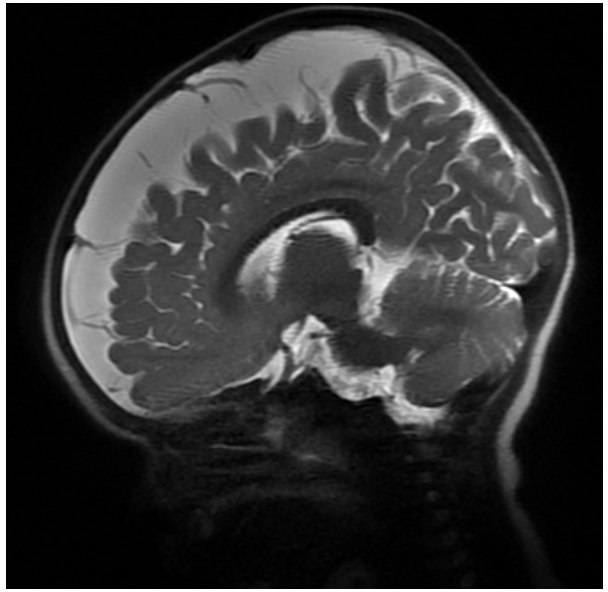
Recognized at any age, often ≤6 months

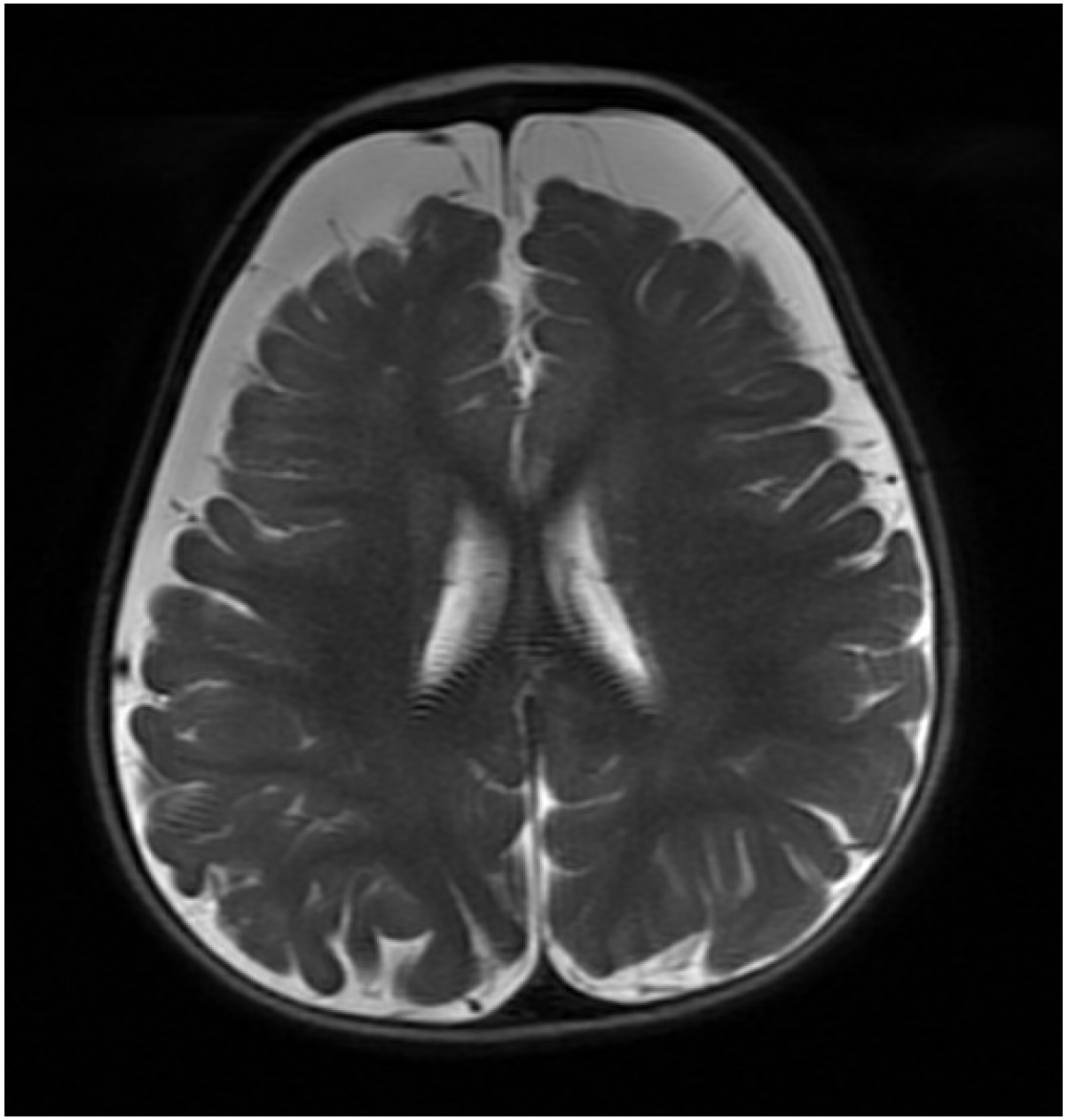
Danger Signs: **Send to ED**

Bradycardia, vomiting, sundowning eyes (sclera persistently visible above iris), tense fontanelle, seizure, lethargy or extreme irritability


17.24mm







Who should get a scan?

What is the role of head circumference screening?

N=75,412 in an integrated HCN

BESS: 233

Hydrocephalus: 24

CSDH: 15

Cyst/tumor: 17

Assoc. Conditions: 29

BESS 34:10,000

BESS:everything else is 4:1

HC measurements are not sensitive

Large relative (≥ 4 major %ile)

and absolute (>95-97 %ile) increases in HC

are ≥90% specific

Most patients with an intracranial process are not detected by screening using HC


Daymont *et al. BMC Pediatrics* 2012, **12**:9
http://www.biomedcentral.com/1471-2431/12/9

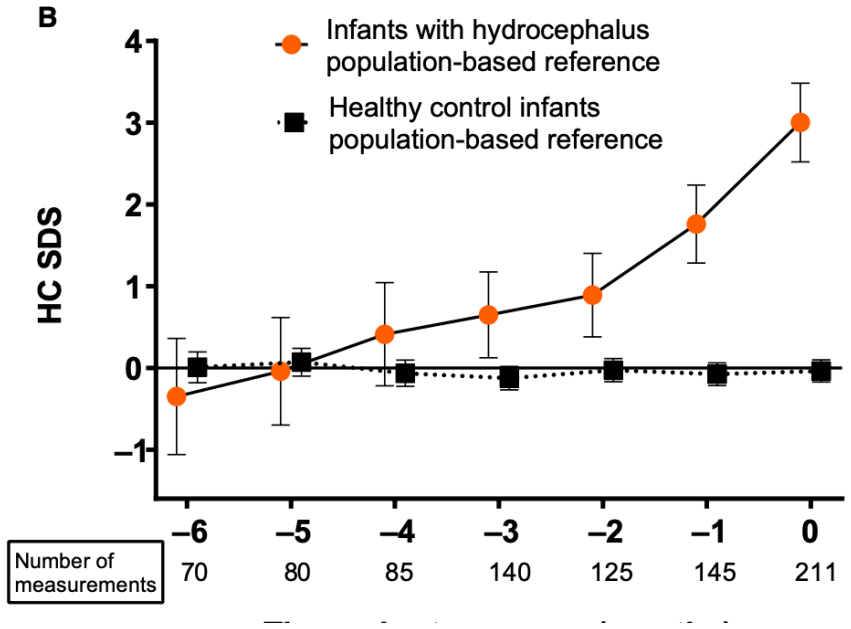
BMC Pediatrics

RESEARCH ARTICLE Open Access

The test characteristics of head circumference measurements for pathology associated with head enlargement: a retrospective cohort study

Carrie Daymont[1,2,3,4*], Moira Zabel[3,4], Chris Feudtner[3,5,6] and David M Rubin[3,5,6]

What is the trajectory of head circumference in acquired hydrocephalus?



Standard deviation score (SDS)	WHO HC standard		Population-based HC reference	
	Specificity (%) (95% CI)	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)	Sensitivity (%) (95% CI)
1.5	46 (44.8-46.4)	85 (73.8-93.0)	86 (85.1-86.3)	70 (57.4-81.5)
2.0	69 (68.3-69.7)	75 (62.7-85.5)	94 (93.8-94.5)	61 (47.3-72.9)
2.5	85 (84.3-85.4)	72 (59.2-82.9)	98 (97.5-98.0)	51 (37.7-63.9)
3.0	94 (93.7-94.5)	52 (39.3-65.4)	99 (99.2-99.5)	41 (28.6-54.3)

Abbreviations: CI, confidence interval.

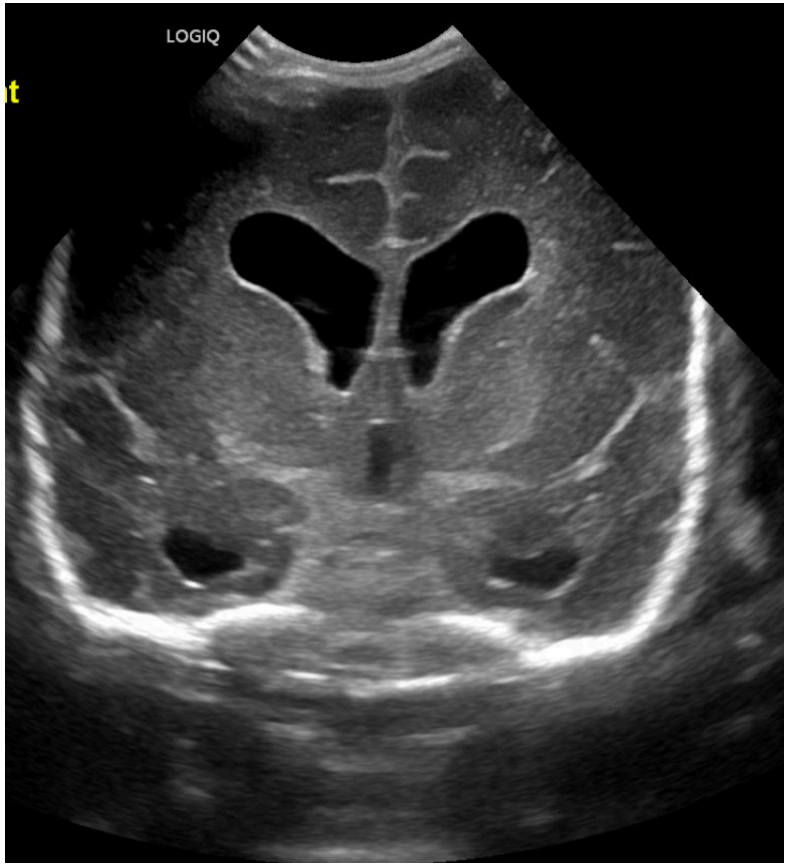
Received: 5 February 2020 | Revised: 3 July 2020 | Accepted: 11 August 2020
DOI: 10.1111/apa.15533
REGULAR ARTICLE
ACTA PÆDIATRICA WILEY

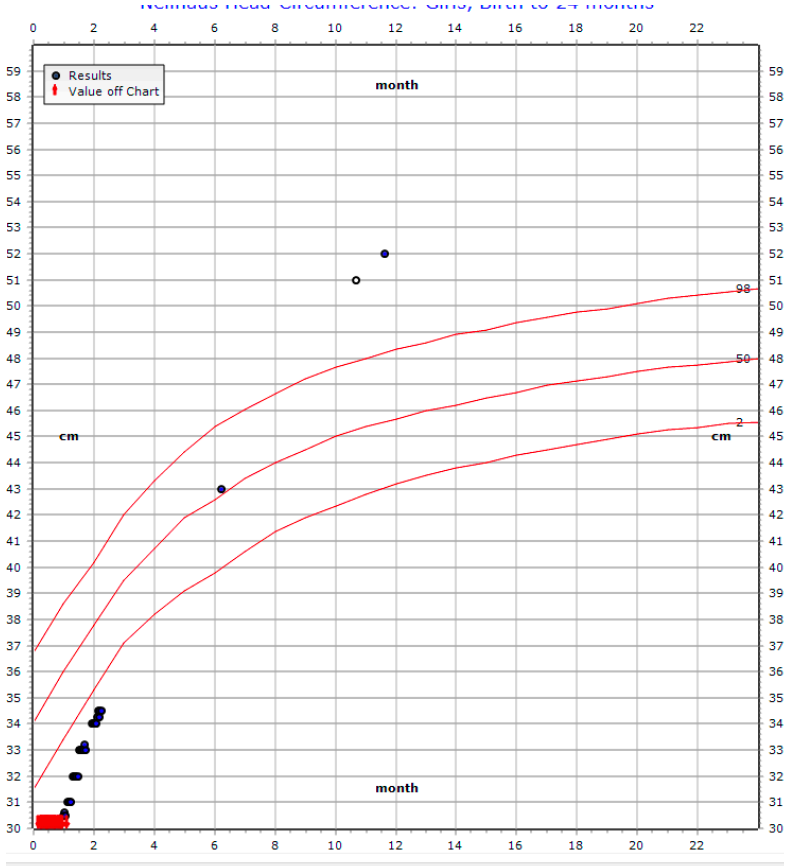
Screening of hydrocephalus in infants using either WHO or population-based head circumference reference charts

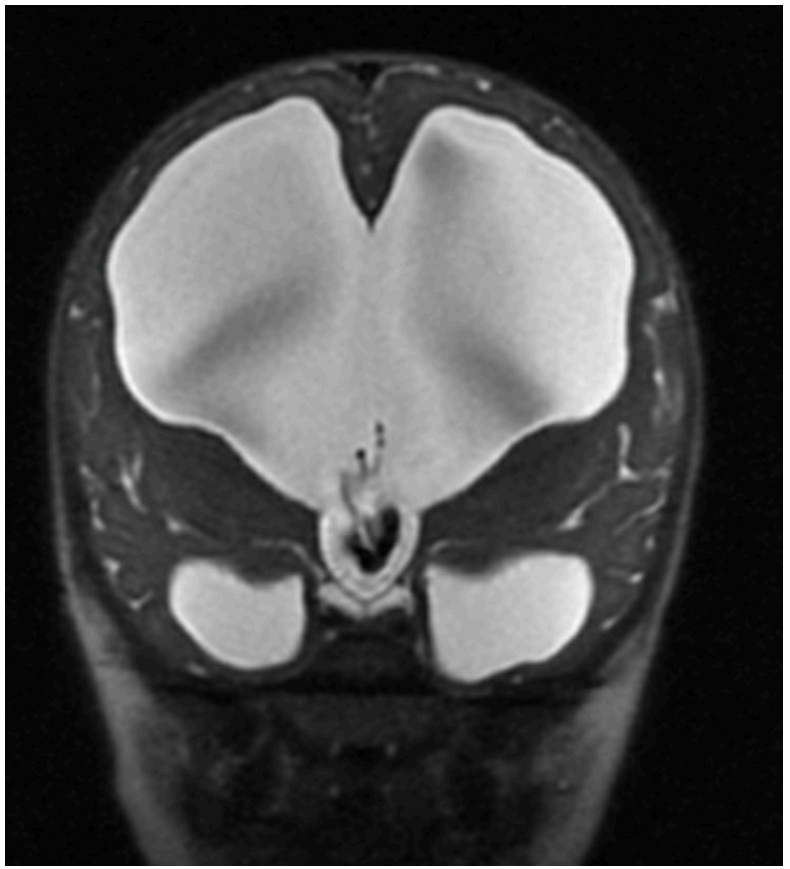
Marjo Karvonen[1,2] | Antti Saari[1,2] | Marja-Leena Lamidi[1] | Tuomas Selander[3] | Tuija Löppönen[1] | Tuula Lönnqvist[4] | Leo Dunkel[5] | Ulla Sankilampi[1,2]

When is a “normal” head circumference not normal?

Ex-30 weeker with bl Gr IV IVH and progressive macrocephaly







“Does this child have hydrocephalus?”

Head US is the image of choice in infants

Beware early macrocephaly before 4 months

Measure the parents (esp. dad) and siblings

Finding BESS is worthwhile (SDH vs. NAT)

MRI is used for surgical planning or unusual cases (can do limited MRI without sedation)

Watchful of clinical signs and symptoms (danger signs)

Imaging:

Absolute HC ≥ 2 SD or ≥ 95 %ile

Relative HC ≥ 2 SD

Disproportionate HC ≥ 2 SD

Hydrocephalus Treatment

Hydrocephalus is a surgical disease

Two options:

shunt placement

endoscopic third ventriculostomy

One is not better than the other (ESTHI trial, ongoing).

Almost any child with hydrocephalus can receive a shunt; some children have unfavorable anatomy or pathology for ETV.

Ventricular Shunts

Shunts are a CSF diversion system with at least one proximal catheter, reservoir +/- valve, and distal catheter.

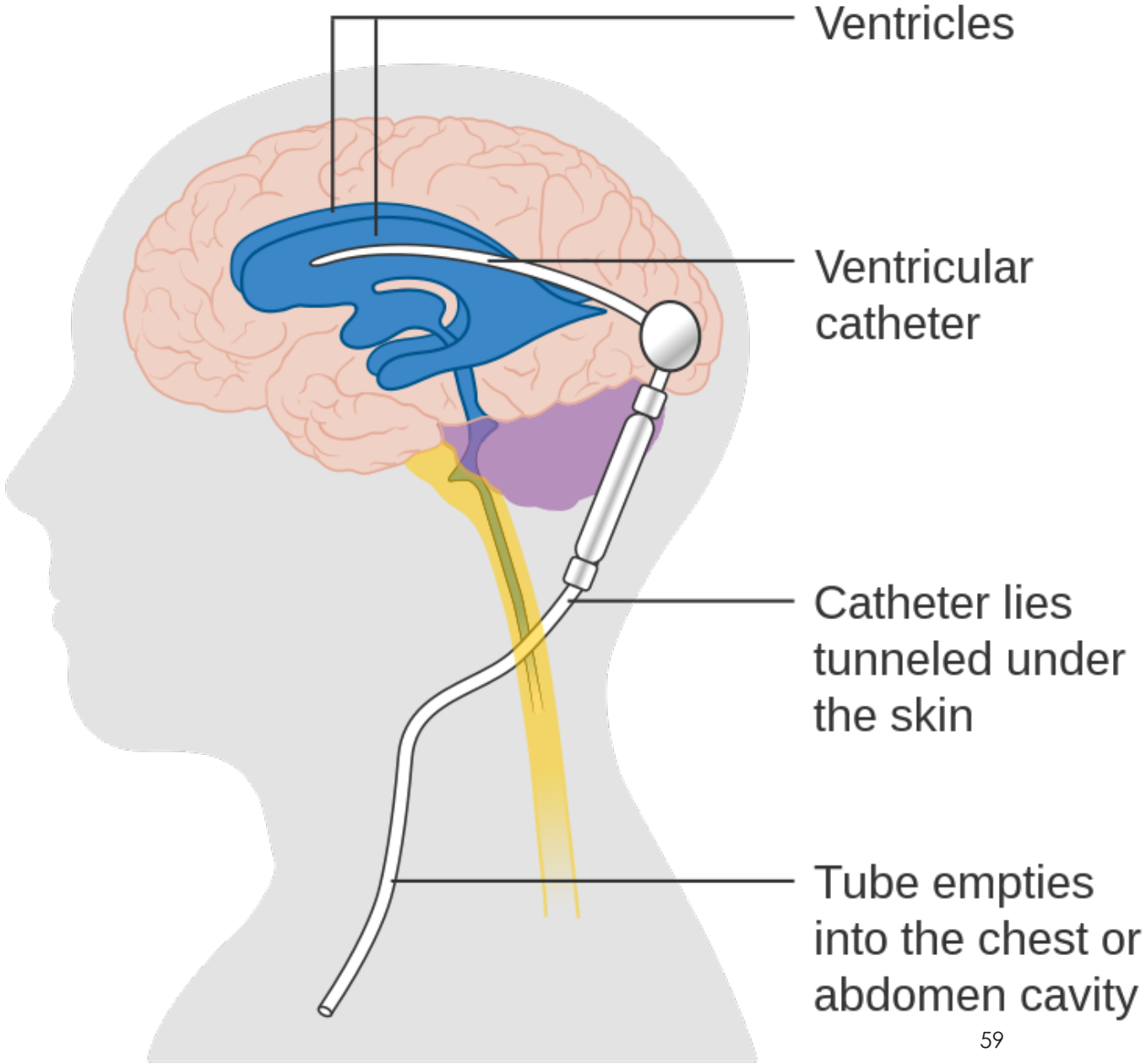
The proximal catheter can have an anterior or posterior entry site

Valves can be **fixed** or **programmable**

Programmable valves that are not MR-resistant require reprogramming after MRI (don't get an MRI in outpatient radiology)

The distal catheter commonly ends in the peritoneum, but right atrial, pleural, other termini are also used.

50% of shunts fail within two years of placement



There is no shunt like no shunt

Endoscopic Third Ventriculostomy

An intraventricular neuroendoscope guides fenestration of third ventricular floor into the prepontine cistern

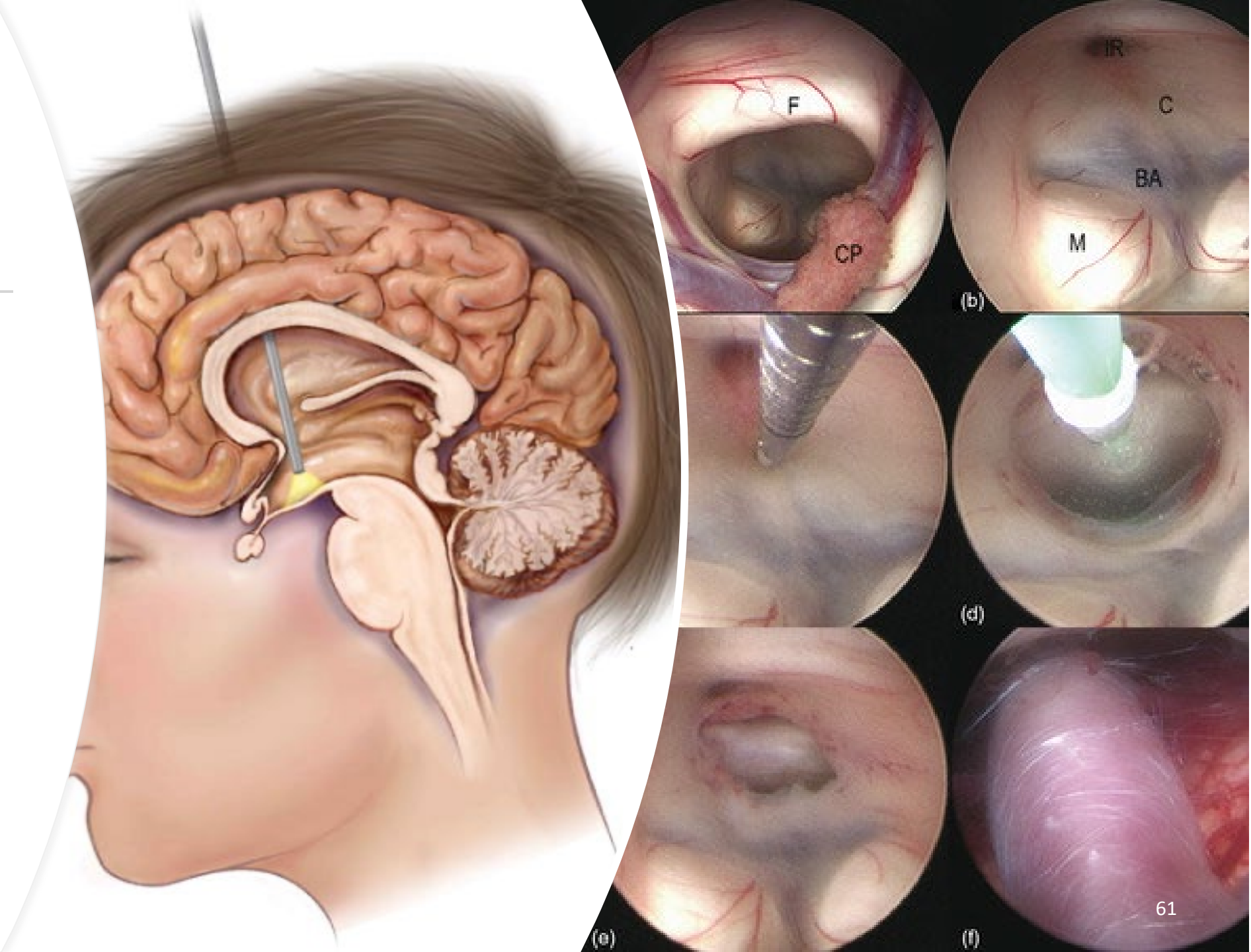
Success depends upon flow through the ostomy maintaining its patency

Patients with inflammation, infection or radiation are less favorable

≥6 months old and obstructive etiologies are more favorable

Equivalent failure rate to shunt but failures occur predictably (usually within 6 months) not stochastically (throughout life)

May be performed with or without choroid plexus cauterization (≤12 months)



“An 8 year old with headaches … ”

1.00 p(neurosurgery) 0.01

Intracranial Mass Lesion Warning Signs

Isolated headaches are **almost never** intracranial pressure/mass lesion

(41-62% of brain tumor patients, infratentorial>supratentorial)

Patients ≤4 rarely present with headache

Danger Signs

Worsening, unremitting headache (4 weeks)

Headache with straining / exertion / valsalva

Morning awakening / wake from sleep (66% of brain tumor patients)

Lethargy or profound irritability

Vomiting (51-67%), especially projectile

Neuro deficit (88%): papilledema, motor/sensory, CN, cerebellar, DTR, LOC

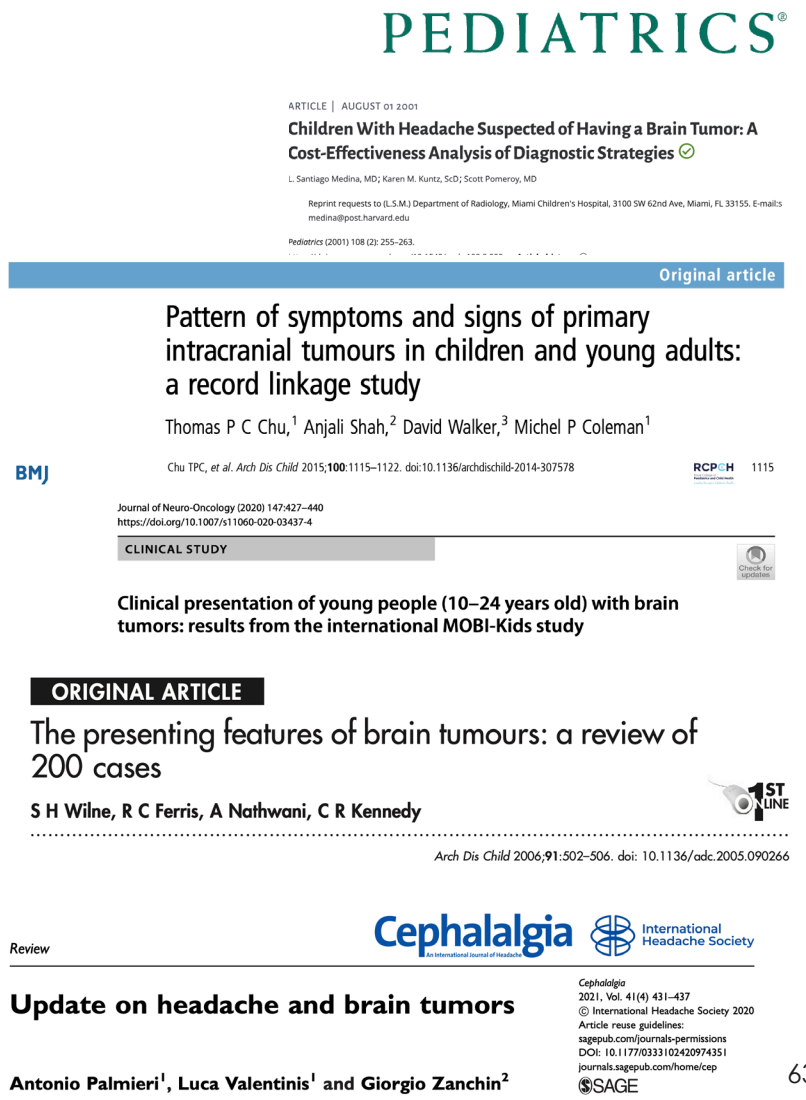
Visual Disturbance (nonmigrainous)

Seizure (supratentorial: 22% young, 68% teens, 6% infratentorial)

Fontanelle (when available…)

Imaging Strategy

Observe for 4 weeks in low risk, CT then MRI if CT findings in medium risk, MRI in high risk (neurologic deficit or danger signs)


PEDIATRICS®

ARTICLE | AUGUST 01 2001

Children With Headache Suspected of Having a Brain Tumor: A Cost-Effectiveness Analysis of Diagnostic Strategies

L. Santiago Medina, MD; Karen M. Kuntz, ScD; Scott Pomeroy, MD

Reprint requests to (L.S.M.) Department of Radiology, Miami Children's Hospital, 3100 SW 62nd Ave, Miami, FL 33155. E-mail: medina@post.harvard.edu

Pediatrics (2001) 108 (2): 255–263.

Original article

Pattern of symptoms and signs of primary intracranial tumours in children and young adults: a record linkage study

Thomas P C Chu,[1] Anjali Shah,[2] David Walker,[3] Michel P Coleman[1]

BMJ

Chu TPC, *et al. Arch Dis Child* 2015;**100**:1115–1122. doi:10.1136/archdischild-2014-307578 RCPCH 1115

Journal of Neuro-Oncology (2020) 147:427–440
https://doi.org/10.1007/s11060-020-03437-4

CLINICAL STUDY

Clinical presentation of young people (10–24 years old) with brain tumors: results from the international MOBI-Kids study

ORIGINAL ARTICLE

The presenting features of brain tumours: a review of 200 cases

S H Wilne, R C Ferris, A Nathwani, C R Kennedy

1ST LINE

Arch Dis Child 2006;**91**:502–506. doi: 10.1136/adc.2005.090266

Review

Cephalalgia An International Journal of Headache — International Headache Society

Update on headache and brain tumors

Antonio Palmieri[1], Luca Valentinis[1] and Giorgio Zanchin[2]

Cephalalgia
2021, Vol. 41(4) 431–437
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Cormac O. Maher, MD, FAAP, Joseph H. Piatt Jr, MD, FAAP, SECTION ON NEUROLOGIC SURGERY

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Mark Dias, MD, FAANS, FAAP, Michael Partington, MD, FAANS, FAAP, the SECTION ON NEUROLOGIC SURGERY

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Identifying the Misshapen Head: Craniosynostosis and Related Disorders

Mark S. Dias, MD, FAAP, FAANS,[a] Thomas Samson, MD, FAAP,[b] Elias B. Rizk, MD, FAAP, FAANS,[a] Lance S. Governale, MD, FAAP, FAANS,[c] Joan T. Richtsmeier, PhD,[d] SECTION ON NEUROLOGIC SURGERY, SECTION ON PLASTIC AND RECONSTRUCTIVE SURGERY

Summary – 30 words or less

Sacral Dimple – lumbosacral (neurosurgery), coccygeal (no surgery)

Headshape – craniosynostosis appearance, deformity in the first two months or worsening after 6 months

Headsize – cranial US if relative, disproportionate or absolute ≥ 2 SDS or danger signs

Chiari Malformation – gait > other developmental milestones

Brain Tumor – warning signs, new onset severe morning or awakening headaches

Arachnoid Cyst – rarely progress after 3 (but can be symptomatic or hemorrhage)

"If there's a doubt, there is **no doubt**" – call us!

Thank you!

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