

# Diagnostic Imaging Pathways - Paediatric, Headache

## Population Covered By The Guidance

Provides guidance on imaging children with unexplained headaches.

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## Quick User Guide

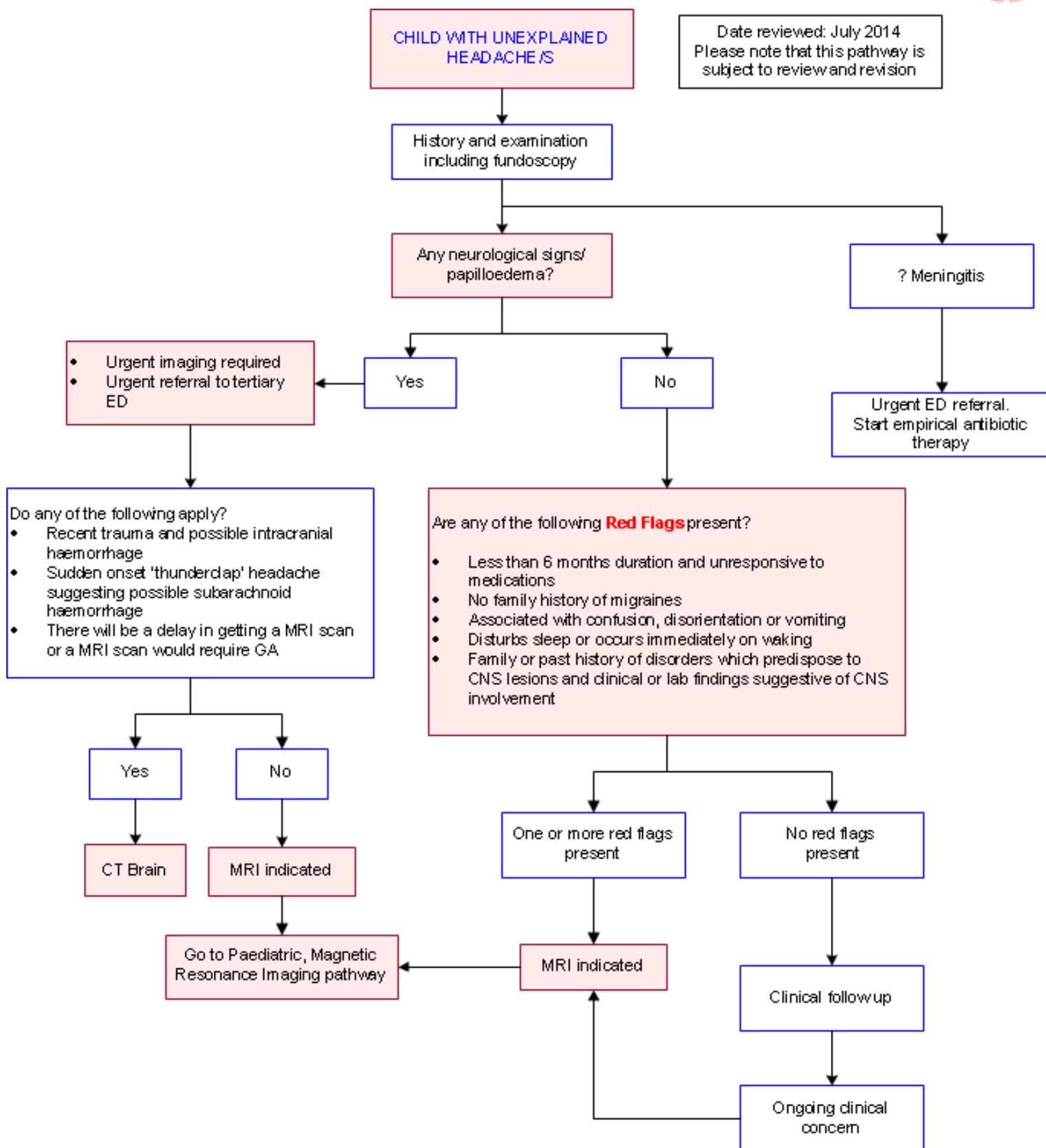
Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

## Pathway Diagram



## Image Gallery

*Note: Images coming soon*

## Teaching Points

- Headaches in children are common. By the age of 18 years, around 90% of children would have suffered a headache. [1](#) Population-based studies report that almost 60% of children report having prolonged headaches (recurring over months and years) [2](#)
- Prevalence of headaches is similar in pre-pubertal boys and girls but the rate increases in girls of post-pubertal age (>12 years) [3](#)
- Headaches are classified into two main groups: primary and secondary headaches
- Primary headaches include migraine headaches, tension-headaches, cluster headaches and chronic daily headaches. In primary headaches, headache is the disease
- Secondary headaches may be caused by acute febrile illnesses (like respiratory viral infections, sinusitis), head injury, meningitis, raised intra-cranial pressure, intra-cranial haemorrhage, brain tumour etc. In secondary headaches, headache is the symptom of an underlying disease
- Thorough history of headaches and physical examination are of paramount importance to help differentiate between primary headaches and headaches secondary to an underlying pathology. This distinction can frequently be difficult to determine and laboratory investigations, lumbar puncture and neuro-imaging may help in these instances to diagnose accurately and help plan management
- The goal of investigating headaches in children is to rule out secondary life-threatening causes like bacterial meningitis, encephalitis, hydrocephalus and intra-cranial haemorrhage which require urgent medical or surgical management. [4](#) Hence the need to check thoroughly for neurological deficits or signs of raised intra-cranial pressure
- Other than the presence of associated neurological signs, including papilloedema, there is a lack of good evidence for which children require imaging
- In children, acute headache presentation is more commonly due to an upper respiratory tract infection or a migraine. Other serious conditions like tumours or haemorrhages are less common and, when present, patients usually have positive examination findings like papilloedema, hemiparesis or other neurological signs [5,6](#)
- In the absence of any neurological signs or signs of raised intra-cranial pressure, attention must be given to other high risk features (red-flag signs) like [7,8](#)
  - Recent onset (<6 months duration) especially when unresponsive to medical therapy
  - Headache on awakening
  - Headache associated with vomiting or confusion or trauma
  - Negative family history for primary headaches
  - Family history of CNS disorders
  - Occipital in location
- Presence of any of these red-flag signs should warrant further investigations including neuro-imaging

## Types of Headache

### Primary Headache

- Primary headaches (migraine and tension-headache) are the most common type of headaches in children. Cluster headaches and other types of autonomic cephalalgias are less frequent in children, especially in <10 year-olds [9](#)
- Primary headaches are typically self-limited and do not require neuro-imaging or extensive

laboratory investigations. Presence of atypical features like migraine with hemiparesis warrant neuro-imaging to rule out any sinister underlying cause which may potentially be treatable

- Magnetic Resonance Imaging (MRI) is preferred over Computed Tomography (CT) scanning in view of lack of ionising radiation, better sensitivity and specificity in diagnosing posterior fossa structural abnormalities and subtle grey-matter abnormalities and the ability to provide functional information when needed. But, if MRI is unavailable or sedation would be an issue in performing an acceptable MRI scan, CT scan is an excellent alternative [10](#)
- Functional imaging like Positron Emission Tomography (PET), Single Photon Emission Computed Tomography (SPECT) and cerebral perfusion studies should be restricted to a selective group of patients when suspecting complications secondary to headaches when patients present with a sudden change in characteristics or severity of headaches [6,9](#)

## Migraine

- Migraine is the second most common type of headache seen in children [5,11](#)
- Classic migraine has no aura. It resolves spontaneously without any sequelae and has no discernible underlying structural pathology that can be identified
- Atypical migraine may have a preceding aura before the onset of headache and includes several sub-types of migraine
- Migraine sub-types that may benefit from neuro-imaging are migraine with hemiparesis/hemiplegia, basilar-type migraine, ophthalmoplegic migraine and acute confusional migraine
- Studies report prevalence of neuro-imaging abnormality in patients with non-acute headache with normal neurological examination to be extremely low at 0.18% - 0.9%, supporting the idea of not routinely imaging these patients [7,10](#)
- A systematic review of available evidence on neuro-imaging reported a prevalence rate of 2.3% of surgically treatable lesions in children with recurrent headaches who were examined by a neurologist prior to imaging [11](#)

## Tension-type Headache (TTH)

- Tension headaches are estimated to be more prevalent in children than migraines as a significant number of cases are not reported to parents or family physicians [5](#)
- TTH may be hard to differentiate from migraine as the symptomatology frequently overlaps between the two. TTH is the most common headache in the age group 8-12 years [9](#)
- A diagnosis of TTH is frequently made by excluding other causes. So, in the absence of any worrisome features, no routine neuro-imaging or laboratory investigations are necessary. An enquiry into physical and mental stressors for a child should be made to rule out psycho-social triggers for TTH episodes

## Secondary Headache

- In emergency setting, Secondary headaches are the most common presentations (secondary to upper respiratory tract infections) but in a primary care setting they are less common [5,6](#)
- The International Classification of Headache disorders (ICHD) attributes secondary headaches to causes like [6](#)
  - Head or neck trauma
  - Cranial or cervical vascular disorders
  - Non-vascular intra-cranial disorders
  - Substance abuse or withdrawal
  - Infections
  - Loss of haemostasis



- Disorders of cranium, neck, eyes, ears, nose, sinuses, teeth, mouth, or other facial or cranial structures
- Psychiatric disorders
- Although headaches secondary to upper respiratory tract infections are the most common type, the main concern in a child with headache is the possibility of a brain tumour. Although brain tumours are the second most common primary neoplasms in childhood, their annual incidence rate is low [12](#)
- Almost 95% of children with intra-cranial space occupying lesions had positive neurological findings at diagnosis in a study done by Childhood Brain Tumor Consortium [12](#)
- MRI is reported to have a higher sensitivity and specificity 92% and 99% for detecting intra-cranial lesions compared to CT's 81% and 92% but there was no statistically significant difference in detecting surgically-relevant intra-cranial space occupying lesions [12](#)
- One study reports an increased number (50%) of incidental findings on brain MRI in children with headaches which were clinically irrelevant but lead to increased further testing due to parental anxiety and the authors suggest that with increasing MR technology, these numbers may rise manifold [13](#)
- Whilst MRI is preferred for most cases there are certain scenarios where CT should still be the initial investigation given its excellent sensitivity and specificity for these conditions, availability, rapidity and the ease of acquiring imaging [14](#)
- When the suspicion of a SAH is high, a negative CT scan should be followed by lumbar puncture especially when the CT scan was performed after 6 hours of headache onset [14](#)
- Empirical treatment and / or in-patient management should not be delayed or with-held for children suspected to have bacterial meningitis with a view to acquire neuro-imaging
- When an aneurysm or an arterio-venous malformation is identified on a non-contrast neuro-imaging scan, it should be followed by a MR angiogram preferably or CT angiography to further characterise the lesion and for treatment planning [14](#)

## Computed Tomography (CT)

- Magnetic Resonance Imaging (MRI) is preferred over Computed Tomography (CT) scanning in view of lack of ionising radiation, better sensitivity and specificity in diagnosing posterior fossa structural abnormalities and subtle grey-matter abnormalities and the ability to provide functional information when needed. If MRI is unavailable or sedation would be an issue in performing an acceptable MRI scan, CT scan is an excellent alternative [10](#)
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