Key recommendations for childhood stroke

This section contains 83 of the total 261 recommendations that the RCPCH Stroke in Childhood Guideline Development Group (GDG) have developed and felt key. If followed, these key recommendations will enhance the quality of stroke care in children and young people (aged 29 days to 18 years at time of presentation).

These recommendations have been extracted from the 2017 RCPCH Stroke in Childhood clinical guideline, which contains over 200 individual recommendations covering the diagnosis, management and rehabilitation of stroke in children and young people.

This concise guide should not be read in isolation, and individuals should always consider the guideline in full. The full list of recommendations can be found at www.rcpch.ac.uk/stroke-guideline.

Acute diagnosis of stroke in childhood (Chapter 3)

Clinical presentation (Chapter 3.1)

- Use the FAST ('Face, Arms, Speech Time') criteria to determine stroke in children and young people, but do not rule out stroke in the absence of FAST signs.
- Undertake urgent brain imaging of children/young people presenting with symptoms (e.g. acute focal neurological deficit, aphasia, or a reduced level of consciousness).

To access full recommendations, see Chapter 3.1.

Diagnosis (Chapter 3.2)

- Ensure that a cranial computerised tomography (CT) scan is performed within one hour of arrival at hospital in every child with a suspected stroke; including computerised tomography angiography (CTA), if the CT scan does not show haemorrhage, ***OR*** CTA limited to intracranial vascular imaging, if haemorrhagic stroke (HS) is demonstrated.
- Initial scan images should be reviewed on acquisition and if necessary transferred immediately to the regional paediatric neuroscience centre for review.

To access full recommendations, see Chapter 3.2.

Referral pathways and further investigations (Chapter 4)

Referral and care pathway for childhood stroke (Chapter 4.1)

- Children and young people seen by ambulance clinicians, or primary care providers outside hospital with the sudden onset of acute focal neurological symptoms should be screened for hypoglycaemia with a capillary blood glucose, and for stroke using a simple screening tool such as FAST. Where these are normal or negative, but stroke is still suspected, the acute stroke pathway should be used.
- Children and young people with persisting neurological symptoms who screen positive using a validated tool (or who screen negative, but in whom stroke is suspected) should be transferred to an emergency department with paediatric services urgently.

To access full recommendations, see Chapter 4.1.

Acute management (chapter 5)

Acute assessment (Chapter 5.1)

- Use the Paediatric National Institute of Health Stroke Scale (PedNIHSS) and age-appropriate Glasgow Coma Scale (GCS) or AVPU ('Alert, Voice, Pain, Unresponsive') to assess the child's neurological status and conscious level respectively.

To access full recommendations, see Chapter 5.1.

Framework for early functional assessment (Chapter 5.2)

- Provide clinical assessment of a child's body structures and functions and activities, by members of the relevant hospital multidisciplinary team (MDT) (including occupational therapists, physiotherapists, speech and language therapists), as soon as possible during hospital admission (within 72 hours), with consideration of the child's age and developmental abilities.
- Initiate early liaison with community-based medical, nursing, occupational therapists, physiotherapists, psychologists, orthoptists, speech and language therapists and other allied health professionals to establish links with local networks.

To access full recommendations, see Chapter 5.2.

Prevention, identification and management of complications (Chapter 5.3)

- Be aware of possible complications after arterial ischaemic stroke (AIS)/HS, as listed in the main guideline.

To access full recommendations, see Chapter 5.3.

Arterial Ischaemic Stroke (Chapter 6)

Risk factors for AIS and recurrent AIS (Chapter 6.1.1)

Risk factors for first AIS

- Be aware that certain conditions/factors are associated with an increased risk of AIS in children/young people, as listed in the main guideline.

Risk factors for recurrent AIS

- Be aware of increased risk of recurrence in children/young people with AIS and the following risk factors: arteriopathy, moyamoya, arteriopathy in sickle cell disease, congenital heart disease, thrombophilia, low birthweight.

To access full recommendations, see Chapter 6.1.1.

Follow-up imaging in AIS (Chapter 6.1.3)

- Be aware that magnetic resonance imaging (MRI) is the modality of choice for follow-up imaging of children and young people with AIS as it provides the best assessment of the extent of any permanent structural damage and of the cerebral circulation without using ionising radiation.
- Catheter angiography (CA) should be undertaken in children and young people with occlusive arteriopathy, who are being considered for revascularisation; if surgery is undertaken CA should be repeated a year after surgery.

To access full recommendations, see Chapter 6.1.3.

Acute medical interventions for AIS (Chapter 6.2.1)

Use of thrombolysis or anti-thrombotic therapy

- Prescribe and deliver 5mg/kg of aspirin up to a maximum of 300mg within 24 hours of diagnosis of AIS in the absence of contraindications (e.g. parenchymal haemorrhage). After 14 days reduce dose of aspirin to 1mg/kg to a max of 75mg.

- The off label use of tissue plasminogen activator (tPA) ***could*** be considered in children presenting with AIS who are more than eight years of age and ***may*** be considered for children aged between two and eight years of age on a case by case basis when the criteria detailed in 6.2.1 have been met.

Acute AIS treatment in children/young people with sickle cell disease (SCD)

- Treat children/young people with sickle cell disease (SCD) and acute neurological signs or symptoms urgently with a blood transfusion, to reduce the sickle haemoglobin (HbS) to less than 30%, and increase the haemoglobin concentration to more than 100–110g/l. This will usually require exchange transfusion.
- Provide a small top up transfusion to bring Hb to 100g/l to improve cerebral oxygenation if the start of the exchange is likely to be delayed by more than six hours.

To access full recommendations, see Chapter 6.2.1.

Interventions to prevent recurrence of AIS (Chapter 6.2.2)

Medical interventions to prevent recurrence of AIS

- Continue antithrombotic treatment initiated acutely in children and young people with AIS. Reduce dose of aspirin from 5mg/kg to 1mg/kg after 14 days.
- Treat all children and young people with AIS with aspirin, unless they have SCD or are receiving anticoagulation e.g. for a cardiac source of embolism.
- Maintain adequate levels of hydration in patients with occlusive arteriopathies including moyamoya, especially when fasting or during intercurrent illness.

AIS recurrence prevention in SCD

- Start regular blood transfusions as secondary stroke prevention in children and young people with SCD, aiming to keep the pre-transfusion HbS less than 30% and keeping the pre-transfusion haemoglobin above 90g/l. This can be done with either exchange or simple top-up blood transfusion.
- Monitor children with regular neurocognitive testing, MRI and transcranial doppler ultrasonography (TCD); frequency should be determined on a case-by-case basis.
- Hydroxycarbamide should be considered as part of a secondary stroke prevention programme when suitable blood (e.g. multiple alloantibodies or hyperhaemolysis) is not available, or when continued transfusions pose unacceptable risks (uncontrolled iron accumulation).

SCI progression prevention in SCD

- Discuss the possible benefits of transfusion with children/young people and families if silent cerebral infarctions (SCI) are identified on MRI. See 6.2.2 for factors favouring the implementation of a treatment program involving regular blood transfusions.

To access full recommendations, see Chapter 6.2.2.

Surgical and endovascular interventions for AIS (Chapter 6.2.3)

Indications for referral to neurosurgery in children and young people with AIS

- Discuss any impairment of conscious level or decline in Pediatric National Institutes of Health Stroke Scale (PedNIHSS) in a child with AIS with a neurosurgical team.
- Consider decompressive hemicraniectomy in children/young people with middle cerebral artery (MCA) infarction under the circumstances listed in 6.2.3 of main guideline.

Indications for referral to interventional neuroradiology

- Patients with acute AIS causing a disabling neurological deficit (NIHSS score of 6 or more) may be considered for intra-arterial clot extraction with prior intravenous thrombolysis, unless contraindicated, beyond an onset-to-arterial puncture time of five hours if a) PedNIHSS score is more than six, b) a favourable profile on salvageable brain tissue imaging has been proven, in which case treatment up to 12 hours after onset may be appropriate.

Haemorrhagic Stroke (Chapter 7)

Risk factors for HS and recurrent HS (Chapter 7.1.1)

Risk factors for first HS

- Be aware that certain factors/conditions are associated with an increased risk of HS in children/young people, as listed in the main guideline.

Risk factors for recurrent HS

- Be aware of increased risk of recurrence in children/young people with HS and the following risk factors: arteriovenous malformation (AVM), cerebral arterial aneurysms, cavernous malformations, moyamoya, SCD, all severe bleeding disorders, ongoing anticoagulation, illicit drug use.
- Be aware that in arteriovenous malformations, which have already bled, the greatest risk of a rebleed is from the part of the malformation which was responsible for the initial haemorrhage. Intranidal or perinidal aneurysms and venous varicosities/stenoses are sinister features.

To access full recommendations, see Chapter 7.1.1.

Investigations to identify underlying risk factors in HS (Chapter 7.1.2)

- If the child is known to have SCD, additional tests should include TCD and an extended blood group phenotype (e.g. ABO, Rh C, D and E, and Kell).

To access full recommendations, see Chapter 7.1.2.

Follow-up imaging in HS (Chapter 7.1.3)

- Discuss the modality and timing of imaging in children and young people with HS within a MDT; this will be influenced by factors relating to the individual patient and the lesion.
- Offer all children and young people with a previously treated brain AVM and angiographic confirmation of obliteration a final catheter angiogram at 16 to 18 years of age, prior to transition to adult services, to exclude AVM recurrence or a *de novo* lesion.

To access full recommendations, see Chapter 7.1.3.

Acute medical interventions for AIS (Chapter 7.2.1)

- Take blood for the measurement of routine coagulation parameters (prothrombin time (PT), partial thromboplastin time (PTT), Clauss fibrinogen) and full blood count (FBC) in all children and young people presenting with HS. Abnormal results should be discussed with a paediatric haematologist in order that appropriate investigations can be carried out urgently to ascertain whether a coagulation abnormality is primary or secondary.

Treatment should be focussed on maintaining normal levels of the appropriate coagulation factor for a period of intense treatment and then prophylactic treatment to prevent recurrence.

To access full recommendations, see Chapter 7.2.1.

Interventions to prevent recurrence of HS (Chapter 7.2.2)

Medical interventions to prevent recurrence of HS

- Refer all children and young people with inherited bleeding disorders to a children's comprehensive care centre (CCC) as the management of all inherited bleeding disorders is highly specialised. They will be registered on the United Kingdom Haemophilia Centre Doctors' Organisation's (UKHCDO) National Bleeding Disorders database.

HS recurrence prevention in SCD

- Provide anti-sickling treatment to children and young people with SCD and HS, and either a regular blood transfusion or a haematopoietic cell transplantation from a human leukocyte antigen (HLA)-matched sibling (or alternative donors in rare circumstances).
- Provide regular blood transfusions if there is clear evidence of arteriopathy (e.g. occlusive lesions or aneurysms) to keep HbS less than 30%.

- Follow up children and young people with HS in SCD, long-term with repeat neurocognitive testing, MRI and TCD to assess evidence of progressive cerebrovascular disease.

To access full recommendations, see Chapter 7.2.2.

Surgical and endovascular interventions for HS (Chapter 7.2.3)

Neurosurgical management of HS

- Children and young people with HS should always be cared for in conjunction with a neurosurgical team.
- Do not routinely evacuate intracerebral haemorrhage (ICH) in children and young people, except in cases where there is a rapidly deteriorating age-appropriate GCS score.

Interventional neuroradiology

- Discuss patient's cases with acute HS and vascular lesions in a neurovascular MDT including an interventional neuroradiologist.

Stereotactic radiosurgery

- Stereotactic radiosurgery (SRS) may be considered as a treatment option for vascular lesions and should be included in the discussion of the case in the MDT.

The safety and efficacy of surgical, radiosurgical and endovascular interventions in the treatment of ruptured in comparison to unruptured vascular lesions

- Consider active management more readily in children and young people with diagnosed unruptured AVM than in adults due to the higher cumulative risk of rupture attributable to the projected longer life span.
- Consider treatment options such as no treatment, surgical resection or stereotactic radiosurgery in the discussion of the case within the MDT.
- Consider micro-surgical resection or stereotactic radiosurgery for unruptured lesions that are enlarging on serial imaging.

To access full recommendations, see Chapter 7.2.3.

Discharge from hospital (Chapter 8)

- Plan discharge with input from the child or young person and their family and the MDT (medical, nursing and allied health professionals including education staff, occupational therapists, physiotherapists, orthoptists, psychologists, speech and language therapists) prior to discharge from hospital. If the child has been admitted for an extended period, this may involve more than one meeting and should occur in a time-frame that allows all necessary support to be in place on discharge.
- Provide a named key worker or a core group model (such as Team Around the Child/Family (TAC/F)). This can be effective in ensuring that the family has easy, personalised access to appropriate services as required, and is made aware of anticipated timelines and who is accountable for certain actions.

To access full recommendations, see Chapter 8.

Rehabilitation (Chapter (9)

Framework for assessing rehabilitation needs (Chapter 9.1)

- Provide a comprehensive multidisciplinary assessment of needs, taking into account all domains of the International Classification of Functioning, Disability and Health (ICF), using appropriate measures (see 9.1 of main guideline) considering the child or young person and family priorities/preferences as well as the age and developmental stage of the child or young person.

- The MDT should work in active partnership with the child/young person and family in a) formulation and agreement of individualised goals across health domains to develop a unified

and coordinated approach across disciplines; b) goal setting and decision making around intervention plans; c) identification of priorities when considering rehabilitation options.
- Identify a named key worker or key point of contact for families, who will remain a key point of contact through transfer from hospital to community or specialist rehabilitation services, and including starting/re-entering school. This named key worker/contact may vary as appropriate as the child progresses through different life stages.

To access full recommendations, see Chapter 9.1.

Rehabilitative interventions (Chapter 9.3)

Motor function and mobility

- Provide rehabilitation that fits within a neurological and developmental framework; individual therapies should complement each other to maximise functional skills.
- Deliver rehabilitation intervention focussed on what the child or young person and family need to, want to, or are expected to do. Motor interventions should be focussed on functional goals and undertaken with consideration of the whole child and their needs and abilities across all domains of health.
- Time since stroke should not be a barrier for the consideration of intensive training.
- Offer motor skills rehabilitation interventions based on the principles of motor learning with sufficient intensity, repetition and functional relevance to support lasting change.

Sensory functions

- Assess vision and hearing as part of the multidisciplinary assessment.
- Treat all pain actively, using appropriate measures including positioning, handling and medication.

Dysphagia

- Refer for speech and language therapy (SLT) assessment and advice if parents/carers have concerns about coughing or choking on eating and drinking, frequent chest infections, or failure to move through the typical stages of eating and drinking development.

Communication, speech and language functions

- Offer neuropsychological assessment (by educational, clinical or neuropsychologist) for children and young people when starting or returning to school/not meeting their attainment targets. Refer for more detailed SLT assessment, including the use of formal testing, where there are specific concerns about speech, language or communication limitations.
- Offer referral to SLT when there are parental or professional concerns about communication skills, language understanding, expressive language or poor intelligibility due to persisting motor speech disorders (dysarthria and dyspraxia), dysfluency or voice disorders.

Cognition

- Provide neuropsychological assessment and advice to schools and affected families throughout formal education.
- Train and involve parents/carers of children who have suffered stroke in delivery of interventions to support cognitive functioning in their child's daily life activities.

Mental health

- Refer children, young people and their families to local children and young people's mental health services or paediatric psychology services within hospitals for psychotherapeutic interventions.
- Develop acquired brain injury specific adaptations to support local children and young people's mental health services to provide appropriate input.

Interpersonal relationships and interactions/psychosocial

- Refer children, young people and families to psychology services when there are concerns about social relationships.
- Include parent/carer, child/young person, and teacher reports using standardised questionnaires in assessment and monitoring of family and peer relationships.

Learning and applying knowledge

- Teach factual knowledge (e.g. word reading, maths facts) through Precision Teaching with Direct Instruction. Direct Instruction refers to systematic scripted lesson plans. Use the principles of Precision Teaching which is a well-established method of teaching involving high levels of repetition of specific material e.g. high frequency words, typically involving daily assessment of progress.
- Provide a Special Educational Needs and Disabilities Co-ordinator (SENCo) or equivalent to act as a keyworker/named coordinator once the child is attending school. This individual should liaise with parents/carers and professionals as per the Special Educational Needs and Disability (SEND) code of practice: 0 to 25 years.
- Health professionals should provide regular consultation to educators, including both advice and brain injury training. This should be with a professional with experience of both education and acquired brain injury.

Self-care/independence

- Assess the child's ability to perform self-care tasks, household tasks, tasks in major life areas such as school, play, and community life
- Involve an occupational therapist in provision of intervention in this area if difficulties are identified.
- Consider goal directed, functional training with home programmes where appropriate.

Goal setting

- Discuss areas of functional difficulty and intervention priorities with children, young people and families.
- Create goals/principles which follow the general principles of being SMART (Specific, Measurable, Agreed, Realistic and Time-bound).
- Review goals and priorities at least annually. This should be done with the child/young person and their family and health and education professionals.

To access full recommendations, see Chapter 9.3.

The needs of the family during the planning of care/rehabilitation (Chapter 9.4)

- Inform, as relevant for the individual child or young person and family, the potential or actual role of health, education and social care systems in providing support and care. Include information and education about assessment processes.
- Consider the impact of stroke on the health, social and economic wellbeing of family members and make onward referrals as necessary to support the broader family.
- Provide regular opportunities for the child or young person and family to access support from professionals from health, education and social care as needed; this should include (with parent/child or young person consent) communication between care agencies including the family and child or young person and documented integrated planning.

To access full recommendations, see Chapter 9.4.

Long-term care: transfer and transition (Chapter 10)

Managing educational and social-care transition (Chapter 10.1)

- Ensure regular, effective collaboration and communication between the child, young person and family and health, education, and social care professionals throughout the child's schooling to identify and respond to their specific needs and disabilities. This can include meetings, joint assessments and sharing of relevant knowledge and skills to optimise and personalise the provision of learning support.

- Be aware that children and young people with stroke may require a flexible, holistic, integrated approach in supporting them, ranging from targeted therapy or educational interventions for particular difficulties, to a comprehensive Education, Health and Care Plan (EHCP).

To access full recommendations, see Chapter 10.1.

The transition of a young person into adult health care (Chapter 10.2)

- Consult the National Institute for Health and Care Excellence (NICE) guideline on 'Transition from children's to adults' services for young people using health or social care services' (NG43).
- Inform young people and their parents/carers about the professionals involved in future management and how to gain access to them.

To access full recommendations, see Chapter 10.2.