Neurology Academy

Neuromuscular Academy

Spinal Muscular Atrophy:
Paediatric Care Pathway

ENTER

Biogen

Roche

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About this pathway

This integrated care pathway has been created as a collaborative effort – our special thanks to the spinal muscular atrophy (SMA) professionals representing a range of specialist SMA centres who contributed to this project. We hope the pathway will be a useful resource for both healthcare professionals and providers to map the SMA journey and best practice care. We are particularly keen to share this resource and receive comments in order to ensure the pathway is as comprehensive as possible.

Currently awareness of SMA and access to SMA services across the UK is variable. As a result many infants may wait too long for a referral and diagnosis which can have major ramifications for their symptom management, quality of life and life expectancy. It is essential that the complexity of SMA care is understood and we hope this integrated care pathway will help to unravel the SMA journey and aid improvements and streamlining the care delivered.

International standards of care for SMA are already available, but granularity around the patient journey is important for specialists and generalists alike so that they can understand the care infants and children with SMA are likely to need throughout their journey. If the pathway is explicit, then:

- The child's and their family's journey is smoother
- Teams can ensure the right care is delivered at the right time.

International Standards of Care

- Part 1: Diagnosis and management of spinal muscular atrophy: Recommendations for diagnosis, rehabilitation, orthopedic and nutritional care – ScienceDirect
- Part 2: Diagnosis and management of spinal muscular atrophy: Pulmonary and acute care; medications, supplements and immunizations; other organ systems; and ethics - ScienceDirect

The SMA integrated care pathway is easy to navigate by clicking on the menu tabs.

Click on icons in the pathway to open further information:

 Information

 Red flags and alerts

 Sub pathway

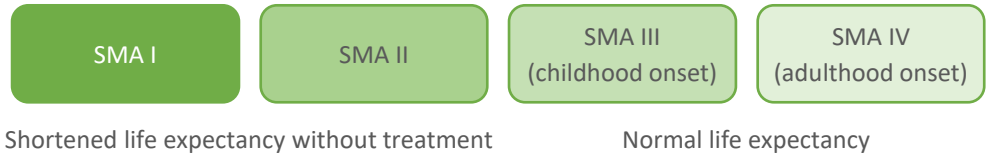
The pathway is designed to be viewed electronically. Some links redirect to resources that will open in your internet browser – these will require an internet connection.

About SMA

Spinal muscular atrophies (SMA) include a group of neuromuscular disorders characterised by degeneration of alpha motor neurons in the spinal cord with progressive muscle atrophy, weakness and paralysis. The most common form of SMA is due to a defect in the survival motor neuron 1 (SMN1) gene localised to 5q11.2-q13.3. It includes a wide range of phenotypes that are classified into clinical groups on the basis of age of onset and maximum motor function achieved.

Approximately 1 in 40 people carry an SMA-associated genetic mutation in the survival motor neurone 1 gene (SMN1) leading to an insufficient production of full length SMA protein. As a result 1:10,000 infants is born with the condition. The majority of infants with SMA have the most severe form of the disease (SMA I) in which symptoms manifest in the first few weeks or months of life. Milder forms of the disease also exist, e.g. SMA II, III and IV, which are associated with later onset and better prognosis.

Treatment expectations for emerging phenotypes:



Management of SMA

SMA is managed through multidisciplinary supportive care. Treatment should follow guidelines from the International Standards of Care Committee for Spinal Muscular Atrophy. Supportive care strategies aim to minimise the impact of disability, address complications and improve quality of life. These may involve respiratory, gastroenterology, and orthopaedic care, as well as nutritional support, physiotherapy, assistive technologies, occupational therapy and social care. New treatments now present opportunities to change the management and survival landscape of SMA.

Treatment expectations

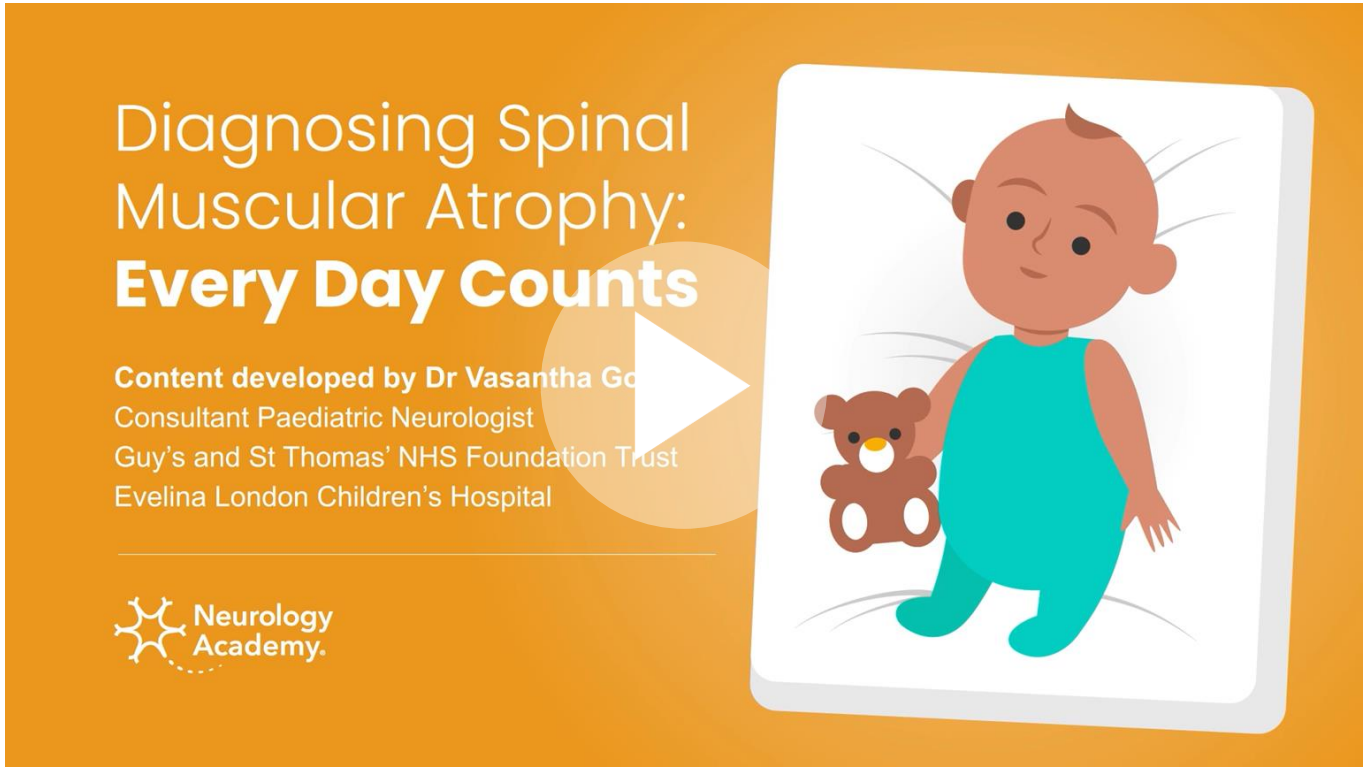
Treatment expectations are subjective and based on each individual patient. To make sure the right treatment expectations are set a broad and holistic understanding of each patient's needs is required. These relate to: treatment access, access to supportive care, education level, geography, social isolation, information, peer-to-peer exchange and access to technology.

What does it mean for patients and carers?

- Functional improvement from baseline – any improvement is good. SMA is a deteriorating disease, so even stabilisation is seen as beneficial.
- Reduced manifestations.
- Improved life expectancy and stabilisation.

Every day counts

Early diagnosis is very important as there are now available effective treatments for all SMA types but it is crucial for SMA type I and II.



Watch the video at: https://vimeo.com/773301958/ff578dfb70

Acknowledgements

Our thanks to the following individuals who contributed to the development of the integrated care pathway:

- Sian Ball, neuromuscular care advisor, Sheffield Children's NHS Foundation Trust
- Lisa Edel, respiratory neuromuscular physiotherapist, Great Ormond Street Hospital for Children NHS Foundation Trust
- Vasantha Gowda, consultant paediatric neurologist, Guy's and St Thomas' NHS Foundation Trust
- Janet Johnson, neuromuscular specialist practitioner, Manchester University NHS Foundation Trust
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- Heather McMurchie, paediatric neuromuscular physiotherapist, University Hospitals Birmingham NHS Foundation Trust
- Min Ong, paediatric neurology consultant, Sheffield Children's NHS Foundation Trust
- Sithara Ramdas, consultant paediatric neurologist, Oxford University Hospitals NHS Foundation Trust
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- Mariacristina Scoto, senior clinical research associate, Great Ormond Street Hospital for Children NHS Foundation Trust
- Kirstie Spencer, clinical care advisor, Nottingham University Hospitals NHS Trust
- Sandya Tirupathi, consultant paediatric neurologist, Belfast Health and Social Care Trust
- Elizabeth Wraige, consultant paediatric neurologist, Guy's and St Thomas' NHS Foundation Trust

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Pathway design: Sarah Mehta, medical writer

Contact us

Please contact us with your comments and feedback at: info@neurologyacademy.org

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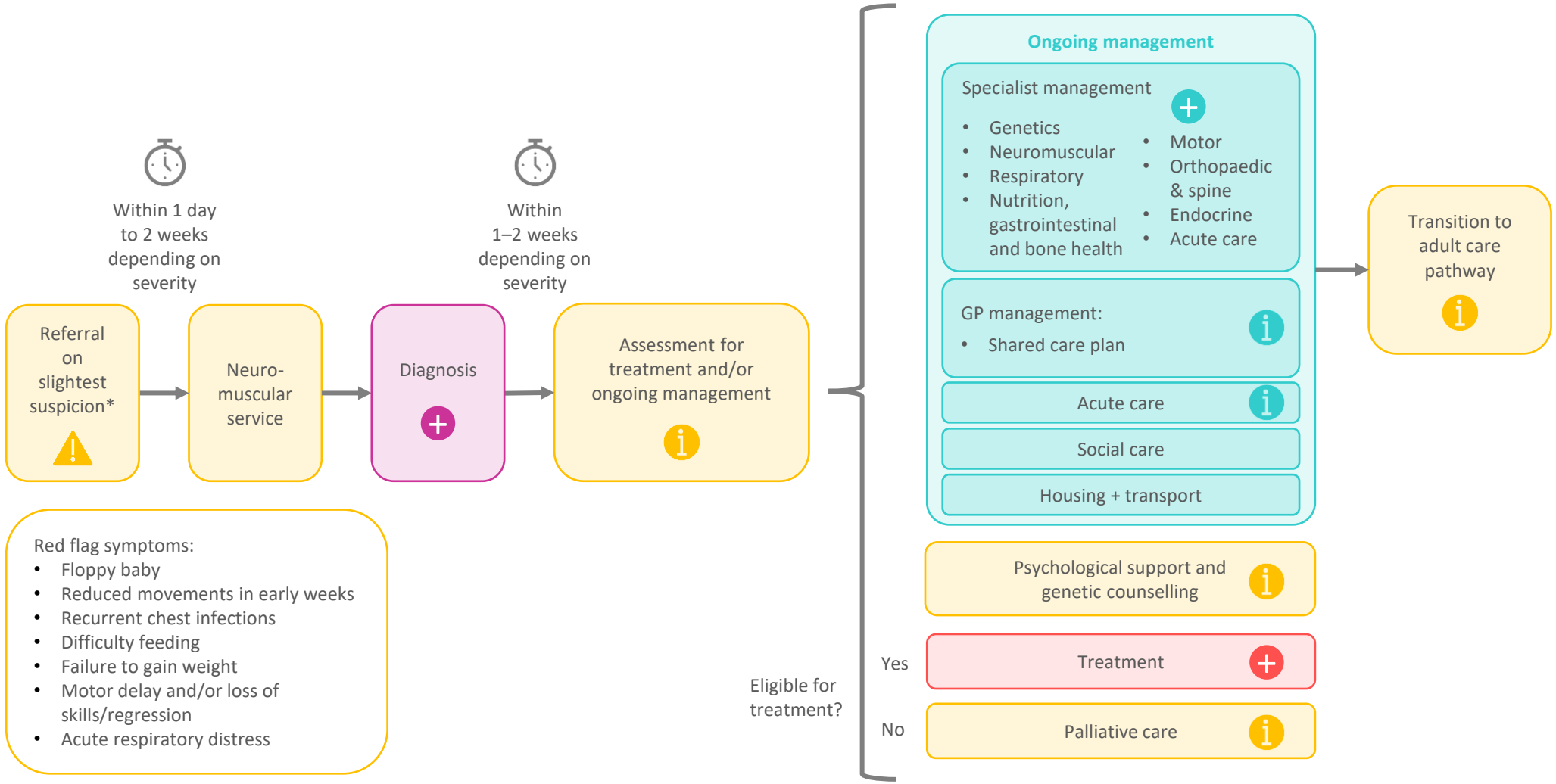
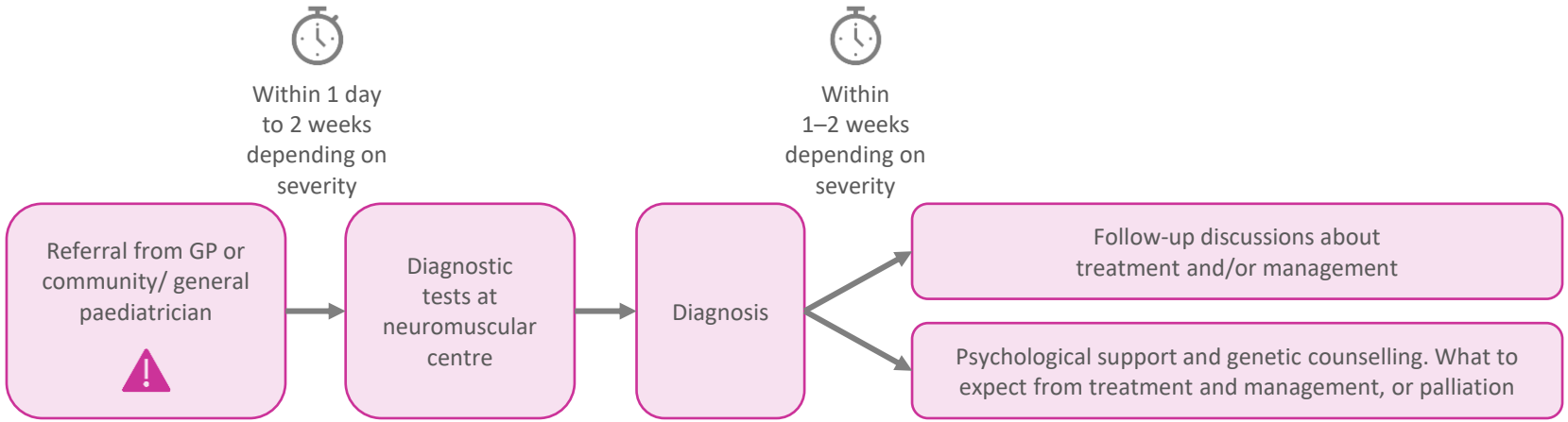
Centres involved in the development of this pathway:

- Barts NHS Health Trust
- Belfast Health and Social Care Trust
- Great Ormond Street Hospital for Children NHS Foundation Trust
- Guy's and St Thomas' NHS Foundation Trust
- Manchester University NHS Foundation Trust
- Nottingham University Hospitals NHS Trust
- Oxford University Hospitals NHS Foundation Trust
- Sheffield Children's NHS Foundation Trust
- University Hospitals Birmingham NHS Foundation Trust



*GP, hospital, general paediatrics



Red flag symptoms:

- Floppy baby
- Reduced movements in early weeks
- Recurrent chest infections
- Difficulty feeding
- Failure to gain weight
- Motor delay and/or loss of skills/regression
- Acute respiratory distress

The Expert Working Group recommends infants are reviewed as soon as possible. This will depend on local waiting times but should be between one day and a maximum of two weeks

If SMA is suspected the paediatrician or clinician (any type, including neonatologists) should undertake an SMN1 genetic test (usually done via MLPA), test code R70 under the National Genomic Test Directory for Rare and Inherited Diseases. This will enable rapid diagnosis and treatment.

Early diagnosis and treatment avoids emergency care appointments

Treatment options

There are three first-line treatments for paediatric SMA. Treatment will depend on clinical assessment and patient/family preference.

Nusinersen (Spinraza)

Nusinersen is provided under a Managed Access Agreement (MAA). The drug is an antisense oligonucleotide drug that modifies pre-messenger RNA splicing of the SMN2 gene and thus promotes increased production of full-length, more functional SMN protein. Administered intrathecally, it is the first drug to have been licensed for the treatment of 5q SMA. Clinical trials have shown significant improvement in motor function in children enabling them to achieve motor milestones unprecedented in SMA. Clinical trials have demonstrated efficacy in children and also highlighted that there may be a benefit in patients who start treatment earlier.

In July 2019, NICE, Biogen and NHS England came to an arrangement for the MAA, which allows children and adults with SMA types I, II and III to have the treatment in England if they meet access criteria. The MAA is an interim scheme that enables data collection on treatment effectiveness whilst ensuring treatment access. The Spinraza nusinersen agreement has been granted for five years and currently runs to 2024.

- NICE (2019) Nusinersen for treating spinal muscular atrophy. Technology appraisal guidance [TA588]
- Further information about the MAA for nusinersen

Risdiplam (Evrysdi)

Risdiplam is recommended as an option for treating 5q SMA in people aged ≥2 months with a clinical diagnosis of SMA types I, II or III or with pre-symptomatic SMA and 1–4 SMN2 copies. It is provided under a MAA and recommended only if the MAA conditions are followed.

Developed through a collaboration between NICE, the NHS, SMA REACH and Roche, the MAA sets out conditional reimbursement and is composed of a Data Collection Agreement (DCA) and a Commercial Access Agreement (CAA).

Risdiplam is a survival motor neuron 2 (SMN2) splicing modifier designed to treat SMA caused by mutations in chromosome 5q that lead to SMN protein deficiency. This small molecule targets and encourages the SMN2 ‘back-up’ gene to produce a greater amount of functional SMN protein, which is lacking in people with SMA.

It is designed to provide a sustained increase in SMN protein centrally and peripherally when given daily at home in liquid form by mouth or feeding tube making it suitable for when patients may not be able to tolerate intrathecal injections or be eligible for nusinersen.

- NICE (2021) Risdiplam for treating spinal muscular atrophy in children and adults [TA755]
- Further information about the MAA for risdiplam

In addition, the Scottish Medicines Consortium have accepted risdiplam for use within NHS Scotland for the treatment of 5q SMA in patients aged ≥2 months with a clinical diagnosis of SMA type I, II or III or with 1–4 SMN2 copies.

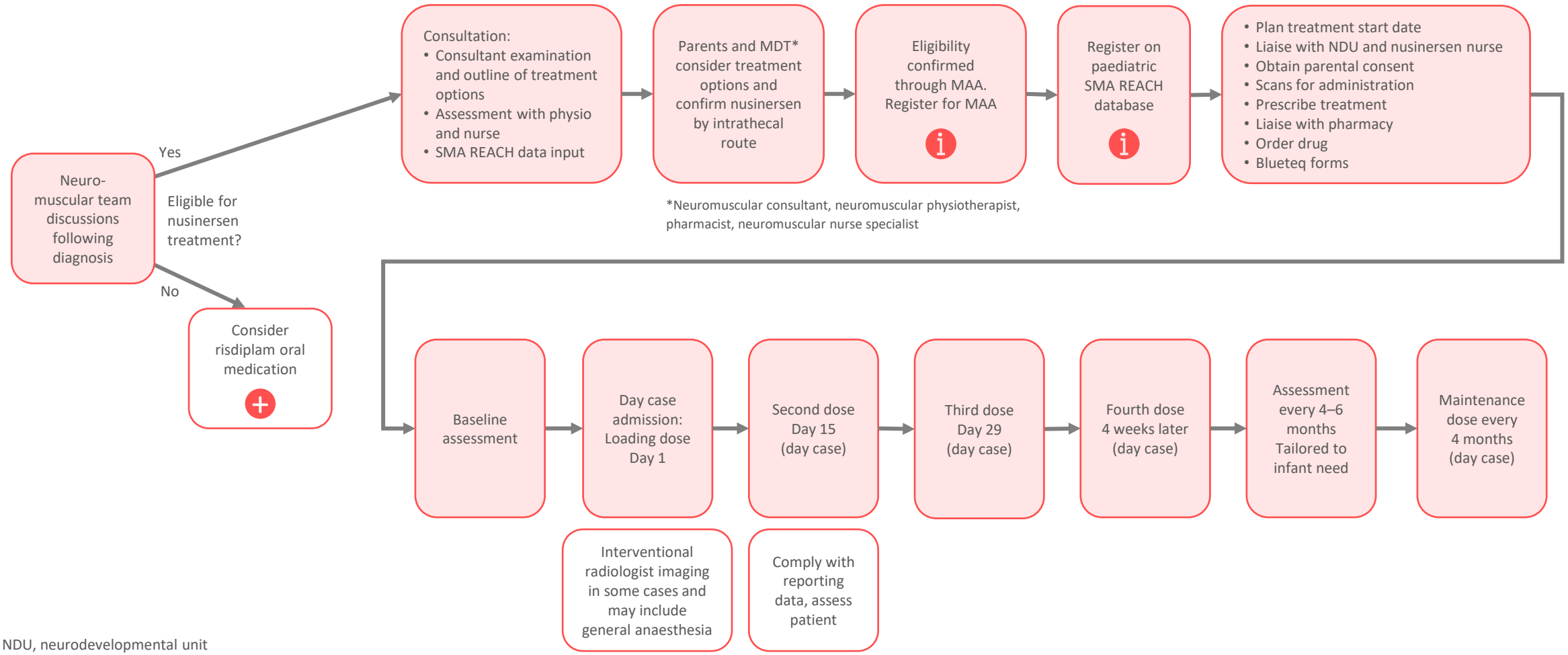
Onasemnogene abeparvovec (Zolgensma)

Onasemnogene abeparvovec is a gene therapy treatment delivered by IV injection designed to address the root cause of SMA and limit the progression of the condition by replacing the faulty or missing SMN1 gene. This provides an alternative source of SMN protein in these cells, which is expected to promote the survival and function of the motor neurons that contain the vector.

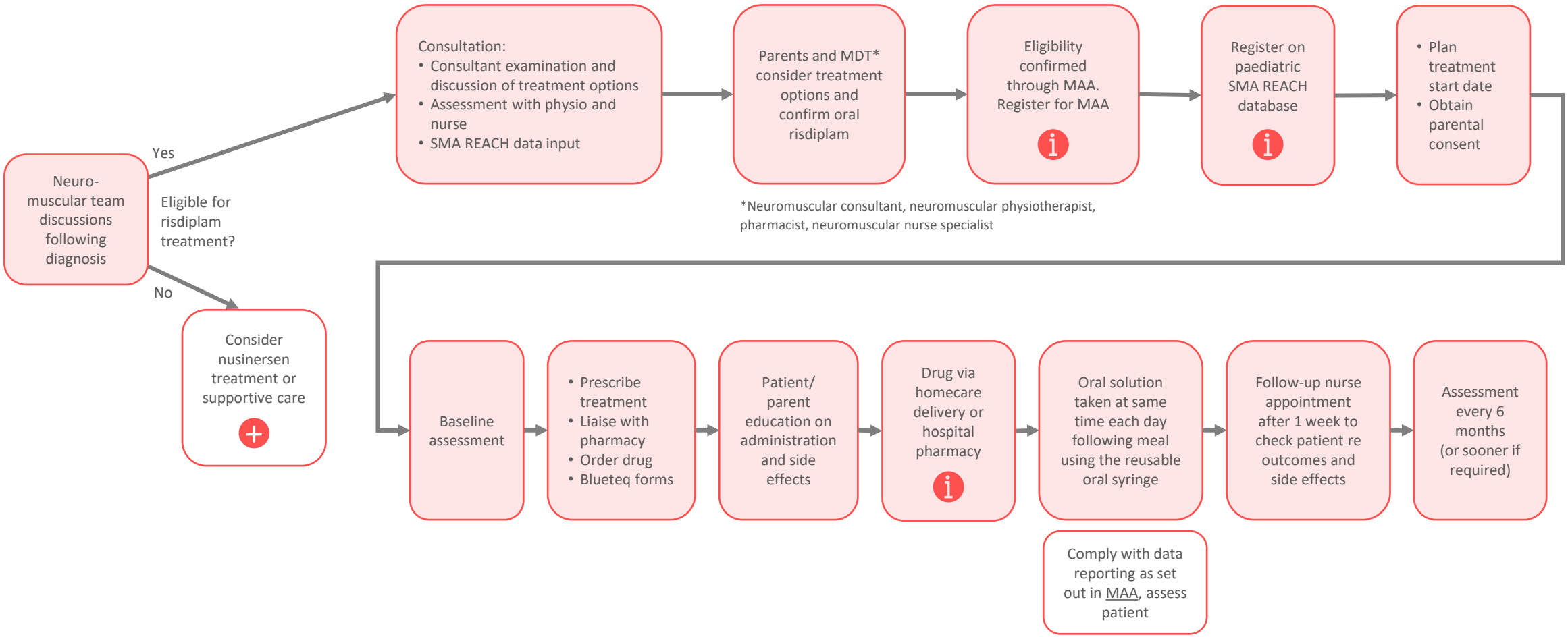
It is available as a possible NHS treatment for 5q SMA with a bi-allelic mutation in the SMN1 gene and a clinical diagnosis of type I SMA in babies aged ≤6 months or 7–12 months (if treatment will give them at least a 70% chance of being able to sit independently) and their treatment is agreed by the national multidisciplinary team. It is not recommended if tracheostomy or permanent ventilation is needed >16 hours a day.

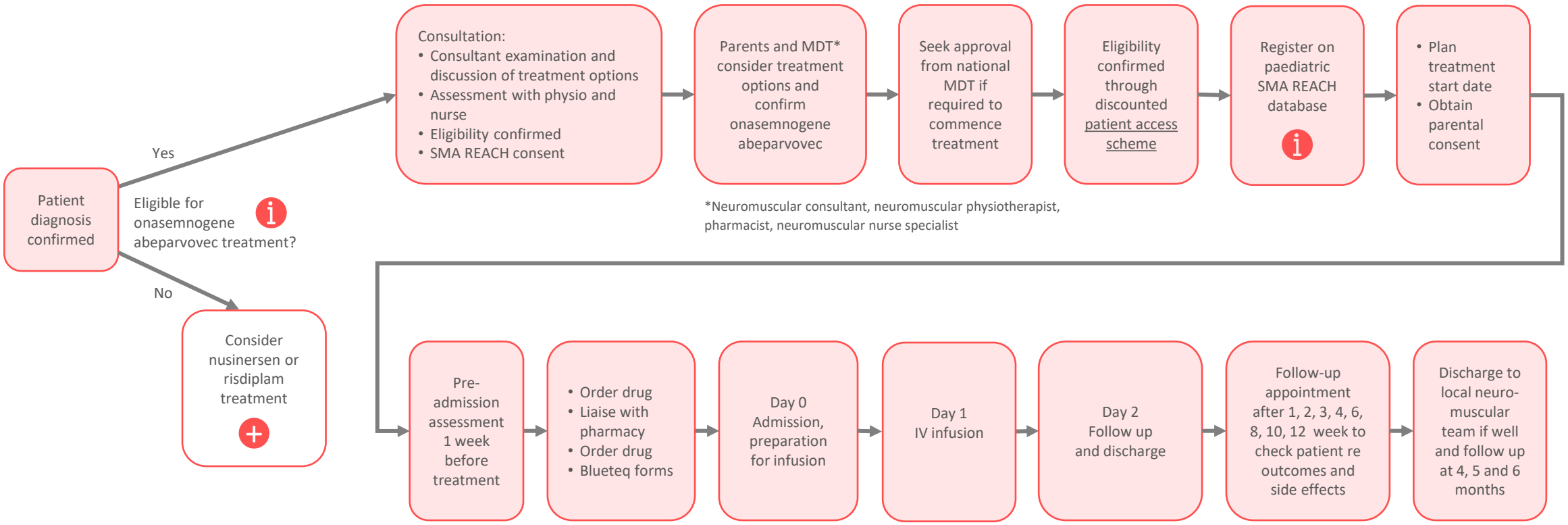
NICE first published guidance in July 2021, which was updated in April 2023 recommending the drug as a treatment option:

- NICE (2021) Onasemnogene abeparvovec for treating spinal muscular atrophy. Highly specialised technologies guidance [HST15]
- NICE (2023) Onasemnogene abeparvovec for treating presymptomatic spinal muscular atrophy. Highly specialised technologies guidance [HST24]



NDU, neurodevelopmental unit


Neuro-muscular team discussions following diagnosis
Eligible for risdiplam treatment?
Yes
No
Consultation:
• Consultant examination and discussion of treatment options
• Assessment with physio and nurse
• SMA REACH data input
Parents and MDT* consider treatment options and confirm oral risdiplam
Eligibility confirmed through MAA. Register for MAA
Register on paediatric SMA REACH database
• Plan treatment start date
• Obtain parental consent
*Neuromuscular consultant, neuromuscular physiotherapist, pharmacist, neuromuscular nurse specialist
Consider nusinersen treatment or supportive care
Baseline assessment
• Prescribe treatment
• Liaise with pharmacy
• Order drug
• Blueteq forms
Patient/ parent education on administration and side effects
Drug via homecare delivery or hospital pharmacy
Oral solution taken at same time each day following meal using the reusable oral syringe
Comply with data reporting as set out in MAA, assess patient
Follow-up nurse appointment after 1 week to check patient re outcomes and side effects
Assessment every 6 months (or sooner if required)



Best practice example: Sheffield Children's Zolgensma pathway

Neuromuscular management

A multidisciplinary team approach is the key element in management of SMA infants and children and the different aspects of care should not be dealt with in isolation but as part of an MDT approach taking into consideration all aspects of daily living including school and social activities. A coordinator should be available to coordinate all aspects of care. The diagnosis and management of SMA recommendations for care highlight an approach for management that addresses prevention of impairment and disability.

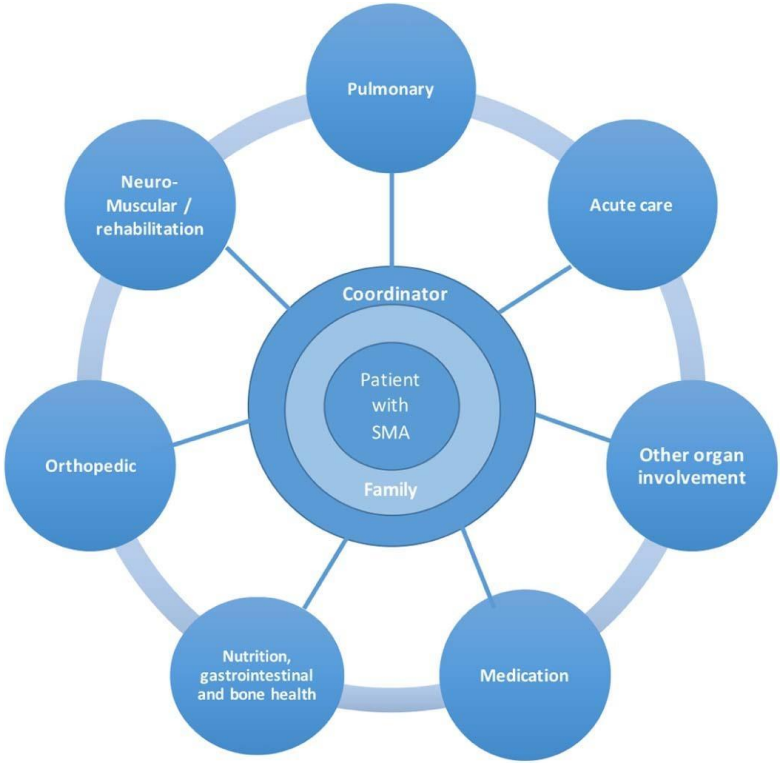
The key to all management is a baseline assessment and regular review of the child's ability (see SMA outcome measures and measures evaluated in clinical trials). Any improvement or maintenance is good.

Prevention and rehabilitation as needed: physiotherapy, occupational therapy, speech and language therapy:

- Contracture management
- Movement abilitation
- Equipment/adaptations
- Swallow management
- Cognitive stimulation.

Respiratory rehabilitation and management:

- Baseline respiratory assessments
- Individualised respiratory care plans
- Routine follow up including monitoring and sleep studies
- When appropriate, use BiPAP and/or cough assist
- Training with parents on management of emergencies.



Multidisciplinary approach.
Source: Mercuri E, Finkel RS, Muntoni F et al (2017) Diagnosis and management of spinal muscular atrophy: Part 1: Recommendations for diagnosis, rehabilitation, orthopedic and nutritional care

Orthopaedic management and impact on spine

Regular assessment and review: orthopaedic consultant, physio and OT

Non-sitters

- Reduce impact on tight joints
- Prevent scoliosis
- Postural control and bracing
- Customised upright seating, standing frames
- Thoracic and cervical bracing
- Modifications should include respiratory support.
  Ensure no restrictions on thoracic expansion / secretion clearance
- Stretching
- Muscle weakness: promote functioning
- Communication
- Cobb angle >20° rechecked 6-monthly until bones no longer growing

Sitters

- Mobility aids – carry out assessment powered wheelchair / customised seating

Ambulant

- Promote function and mobility
- Exercise, e.g. swimming
- Contractures: stretching
- Posture: position and bracing
- Promote function and mobility, lightweight wheelchair

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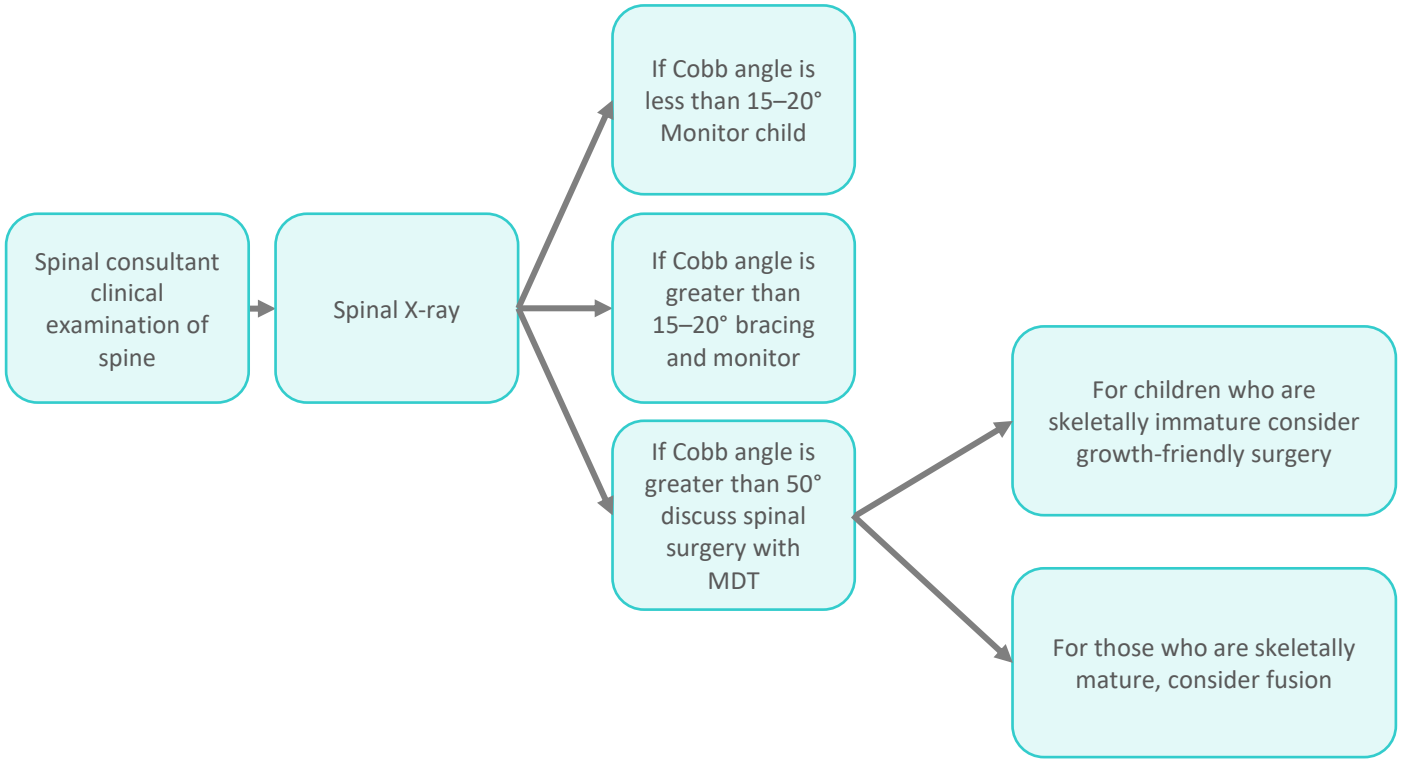

Recommended age of spinal intervention:

The standard of care recommendations to medical teams vary depending on age and are as follows:

- **Under 4 years:**
  In general, spinal surgery should be delayed until after 4 years of age.
- **Age 4 – 10 years:**
  As children are skeletally immature, growth-friendly spinal surgery is recommended.
- **Age 10 – 12 years:**
  At this stage children are transitioning to skeletal maturity. If surgery is needed, the type will depend on the child's skeletal maturity and how much more their spine is likely to grow.
- **Age over 12 years:**
  This is when children are skeletally mature. If surgery is needed, spinal fusion surgery is recommended.

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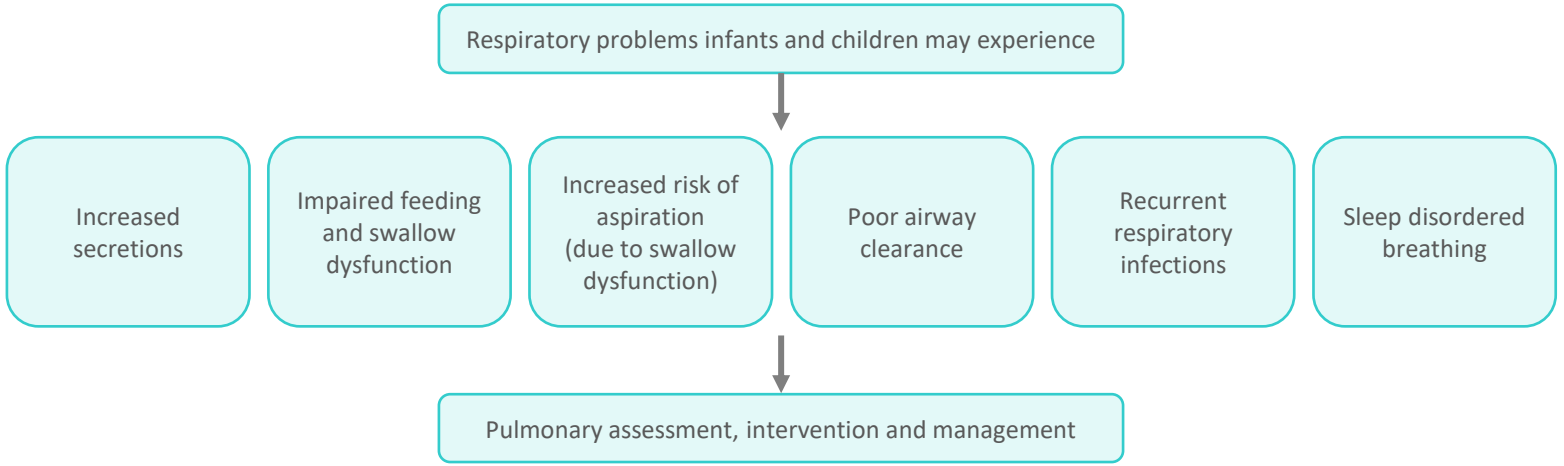
Respiratory problems infants and children may experience
Increased secretions
Impaired feeding and swallow dysfunction
Increased risk of aspiration (due to swallow dysfunction)
Poor airway clearance
Recurrent respiratory infections
Sleep disordered breathing
Pulmonary assessment, intervention and management

Next »

Non-sitters	Sitters	Ambulant
Assessment • Clinic visits every 3–6 months. • Monitor $SP0_2$ and CO_2. • Sleep studies may be needed to confirm sleep disordered breathing/respiratory failure and indicate NIV. • Assess for reflux.	Assessment • Clinic visits every 6 months. • Sleep study to assess for nocturnal hypoventilation and indicate NIV. • Assess for reflux. • Spirometry (depending on age/cooperation.).	Referral for respiratory team if: • Evidence of weak cough. • Recurrent infections. • Signs/symptoms of nocturnal hypoventilation.
Intervention: • Proactive. • Ensure full MDT.	Intervention: • Proactive. • Ensure full MDT.	Medications • Annual influenza vaccine. • Pneumococcal vaccine with addition of Pneumovax(R) from 2 years of age.
Airway clearance • Clinical assessment of PCF. • Initiate individualised chest physiotherapy (this may include manual CPT, effective oral/nasal suctioning and cough assist).	Airway clearance • Clinical assessment of PCF. • Initiate individualised chest physiotherapy (this may include manual CPT, effective oral/nasal suctioning and cough assist).	
Ventilation • Use bilevel ventilation in all symptomatic infants. • Ensure correct interface. • Avoid CPAP.	Ventilation • Use bilevel ventilation in all symptomatic infants. • Ensure correct interface. • Avoid CPAP.	
Medications • Consider mucolytics if secretions are problematic. • Glycopyrrolate for salivary management. • Ensure RSV vaccine up to 24 months and influenza vaccine annually during winter months after 6 months of age. • Pneumococcal vaccine with addition of Pneumovax(R) from 2 years of age.	Medications • Ensure RSV vaccine up to 24 months and influenza vaccine annually during winter months after 6 months of age. • Pneumococcal vaccine with addition of Pneumovax(R) from 2 years of age.	

NB. If bilevel ventilation is not available in a local hospital during an acute respiratory episode, stabilise on CPAP/Optiflow and monitor O_2/CO_2. It is then vital the patient moves to a tertiary centre.

The respiratory pathway at Great Ormond Street

Referral to respiratory neuromuscular physiotherapist
Set up with respiratory physiotherapy management plan

Ongoing respiratory physiotherapy
Positioning, manual techniques, suction, nebulisers, MIE

Referral to community care

Respiratory physiotherapy clinic follow up / telephone support

Diagnosis meeting
Neuromuscular team and palliative care team

Referral to NIV team
Neuromuscular service team liaise with NIV team

Meeting on sleep unit/respiratory clinic with parents, NIV clinical nurse specialist and respiratory consultant
Discussion about respiratory management (including pros and cons of NIV)

Baseline sleep study
Arranged according to clinical assessment and parental consent to trial of NIV if indicated

Acclimatisation

Elective admission for initiation
Issue of NIV equipment and training session for parents. Involvement of community team and palliative care team.

Respiratory clinic follow up
Follow-up sleep study for monitoring of ventilation. Home visit with palliative care team. Telephone support.

Great Ormond Street criteria for NIV initiation

≥1 main criteria +/- supportive criteria

Note: supportive criteria alone are not sufficient indications for initiation of NIV

Main criteria
1. Infective exacerbation (acute)
2. Recurrent chest infections
3. Baseline increased work of breathing/dyspnoea
4. Documented respiratory failure – either chronic (as shown on sleep studies) or acute

Supportive criteria
1. Poor weight gain in spite of optimised feeding
2. Chest deformity

Example pathway from Great Ormond Street Hospital

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Key messages

- Safe swallowing is one of the most important aspects of care as children with a weak swallow are at risk of inhaling (aspirating) their feed which can cause choking and chest (respiratory) infections.
- Standards of Care recommend that a dietician reviews feeding and diet every 3–6 months for younger children and annually for older children.
- If swallowing becomes unsafe, or if the child is not gaining enough weight, feeding alternatives may be suggested:
    - Short-term options may include feeding through a:
        - Nasogastric (NG) tube - a thin flexible feeding tube passed through the nose into the stomach
        - Nasojejunal (NJ) tube - through the nose into the middle part of the small intestine (the jejunum)
    - A longer-term option is:
        - Gastrostomy (PEG) tube - placed in the stomach via a surgical procedure and also called a PEG - percutaneous endoscopic gastrostomy. Another procedure called a Nissen Fundoplication, which helps to reduce any reflux, may be done at the same time.

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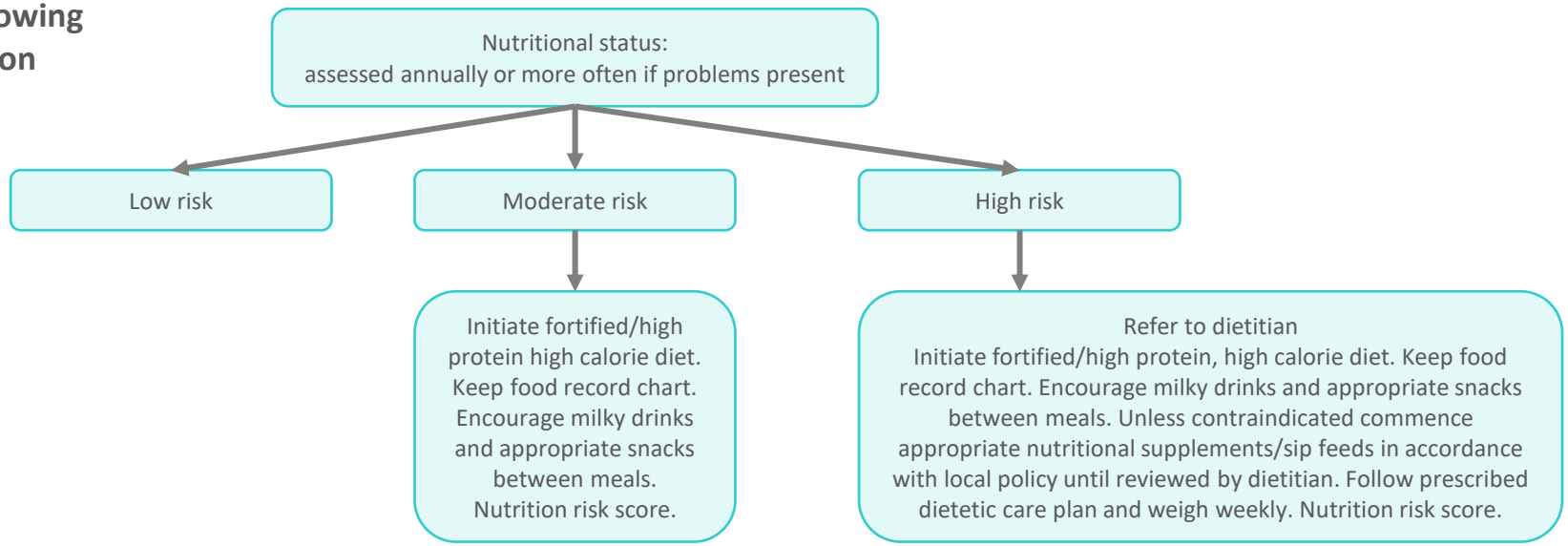
Non-sitters	Sitters	Ambulant
Assessment safe swallowing – bulbar dysfunction can result in aspiration and pulmonary infections.	Assessment of symptoms of dysphagia/aspiration/difficulties with feeding. Video fuoroscopic swallow study if clinical signs suggestive of dysphagia. Nutritional analysis of food records/feeding regimen Longitudinal anthropometrics (height, weight, OFC) Nutrition labs may be indicated. Acute care monitoring Glucose metabolism labs 25 Hydroxy-vitamin D labs, body composition and bone density (DXA)	Dietician assessment • See dietitian if over/under nutrition • Nutritional analysis/monitoring if underweight or overweight • Longitudinal anthropometrics (height, weight, OFC). Glucose metabolism labs 25 Hydroxy-vitamin D labs
Oral feeding may be limited.		
Interventions - failed swallow study NG or NJ tube.		
Adequate hydration and electrolyte balance important during illness.		
Video Fluoroscopic swallow study shortly after diagnosis and when suggested by clinical signs suggestive of dysphagia (weak suck, fatigue, pneumonias). Difficulties with feeding (pocketing, jaw contractures, increased feeding time). Nutritional analysis of food records/feeding regimen Longitudinal anthropometrics, acute care monitoring, Hydroxy-vitamin D tabs, body composition and bone density.	Constipation management – evaluation of fluid and fibre intake recommended for constipation	Bone health important • High incidence of osteopenia and fractures • DEXA scan
Care considerations: Determine appropriate calorie needs based on growth. Standardised growth charts to track growth trends in combination with body composition measurement tools to assess appropriate growth.	Dietician evaluation shortly after diagnosis and for concerns of under/over nutrition. Possibility of obesity greater than the 25th percentile. Optimal care evaluation by a dietitian 3–6 monthly for younger children and annually for older children. NB Evaluation important for specialised diets.	
Dietician evaluation 3–6 monthly for younger children and annually for older children. NB Evaluation essential important for those on specialised diets.		

NB. Children with SMA are at risk of hypoglycaemia; following period of vomiting or fasting ensure sufficient fluids to prevent ketosis.

Source: Mercuri E, Finkel RS, Muntoni F et al (2017) Diagnosis and management of spinal muscular atrophy

Nutritional assessment, swallowing and gastrointestinal dysfunction and intervention



Monitor weight, height and BMI

Children with elevated BMI should be assessed for possible obesity / excess body fat. Body composition monitored to ensure proportion of bone fat and muscle is healthy. Reduced mobility may result in weight gain.

Swallowing

Rare for ambulant children to have swallowing and feeding difficulties but non sitters and sitters may have NG/NJ/gastric tube in situ. Ensure adequate nutrition.

Constipation

Can be an issue due to lack of mobility and diet

Hypoglycaemia

Children with SMA are at risk of hypoglycaemia (low blood sugar) following periods of vomiting or fasting ensure sufficient fluids to prevent ketosis.

Signs of hypoglycaemia: pale, clammy, tired, confused, glazed, not acting as they normally should, unable to wake them.

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Physiotherapy and rehabilitation

Non sitters

Physiotherapy and rehabilitation aims to reduce impact on tight joints, optimise function and help an infant/child tolerate different positions, lying or sitting with assistance. Regular assessment from physiotherapist and OT is required.

- Positioning, bean bags, wedges and pillows help support non-sitters.
- Custom made seats, reclining or sitting strollers and power chairs help provide support.
- **Stretching**: flexibility is important, utilise:
  - Assisted stretches.
  - Splints to support or immobilise limbs or spine
  - Splints should be applied for more than 60 minutes or overnight.
  - Serial casting which puts the limb into a series of plaster slowly correcting the position with each re-casting.
  - Braces used to support part of the body for stabilisation – these should be used at least 5 times a week.
- **Neck collars**: helpful for head support and to assist breathing.
- **Standing frames**: used to help maintain and improve posture. They also help with bone health and digestion.
- Exercise and movement in water can be helpful providing the head is well supported and the infant/child supervised.

Sitters

The main objective is to reduce impact and flexibility of tight joints and prevent scoliosis. physiotherapy and occupational therapy should give guidance and training on how to achieve aims.

- **Orthoses**: to support arms, leg and spine to assist movement or achieve activities such as standing and supported walking.
- **Braces**: to stabilise use minimum x 5 weekly.
- **Splints and braces**: keep joints in certain positions should be worn for 60 mins or overnight.
- **Neck support:** supported standing – stretches legs, promotes good posture increases bone density, blood circulation and eases constipation. 60 mins minimum 3–5 times weekly, 5–7 times is recommended
- **Stretching**: combining effective stretches with splints and standing exercises is crucial. Routine should be adapted individually by physiotherapy or occupational therapy 5–7 times a week.
- **Mobility and exercise**: all sitters should have a powered wheelchair and custom seating. Beneficial to carry out an assessment before the age of 2. Exercise will maintain and improve strength, flexibility, resilience and balance and improve participation in school and for leisure and social activities. Resistance training, swimming, horse riding and wheelchair sports are all useful ways to participate in exercise.

Ambulant

Involvement of physiotherapy and occupational therapy.

The overall aim if to promote maximum mobility range of movement and as much independence as possible with day-to-day activities:

- Work on flexibility strength endurance and balance.
- Stretching.
- Positioning.
- Mobility and exercise.
- Lightweight manual wheelchairs or ones with power-assisted wheels useful as may be tiring to walk.
- Powered wheelchairs or scooters for long distance.

Acute care

Chest infections and breathing issues are the most frequent problems that require acute or emergency care.

There should be an emergency healthcare plan or illness plan in place written by the medical team including the following information:

- Brief summary of the individual's diagnosis/es and the parents' or child's understanding of it.
- What are the warning signs or indications that the child should be taken to hospital?
- Which healthcare providers should be contacted in an emergency?
- A list of regular and PRN medications, and indications for any rescue medications left in the patient's home for emergency use.
- Any ceilings of care that have been requested by the parents, child and any that have been recommended by healthcare professionals.
- Describe actions for emergencies arising at home.
- Preferences around respiratory management and preferences for supported breathing i.e. NIV / intubation.
- Any neck or jaw limitations.
- Nutritional and fluids needed.
- Techniques used for clearing secretion.
- When and which antibiotics should be given.
- Action agreed if resuscitation is required.
- Individual wishes, of the parents (for children) or child.

Where possible, local emergency medical services should be contacted in advance to discussed any specific needs and what equipment is used at home. In an emergency, you should go to the closest hospital. Wherever possible, the equipment used at home should also be used, even if this is in an ambulance that is well equipped. Sometimes non-sitters and sitters may need to be transferred between hospitals as they should be cared for at a specialist (tertiary) centre that is equipped to look after them. The clinical team responsible for their long-term care should always be notified about the illness.

See further information about patients requiring anaesthetic.

Further reading

- Diagnosis and management of spinal muscular atrophy: Part 1: Recommendations for diagnosis, rehabilitation, orthopedic and nutritional care
- Diagnosis and management of spinal muscular atrophy: Part 2: Pulmonary and acute care; medications, supplements and immunizations; other organ systems; and ethics
- NICE (2019) Nusinersen for treating spinal muscular atrophy. Technology appraisal guidance [TA588]
- NICE (2021) Onasemnogene abeparvovec for treating spinal muscular atrophy. Highly specialised technologies guidance [HST15]
- NICE (2023) Onasemnogene abeparvovec for treating presymptomatic spinal muscular atrophy. Highly specialised technologies guidance [HST24]
- SMA UK (2023) Who may access Zolgensma?
- NICE (2021) Risdiplam for treating spinal muscular atrophy in children and adults [TA755]
- NICE (2021) Managed Access Agreement: Risdiplam for treating spinal muscular atrophy in children and adults [ID1631]
- NICE (2019) Managed Access Agreement – nusinersen 5q SMA
- Scottish Medicines Consortium (2022) risdiplam (Evrysdi®)
- Care Quality Commission (2014) From the pond into the sea: Children's transition into adult health services

Organisations

- Muscular Dystrophy UK www.musculardystrophyuk.org
- SMA REACH UK www.smareachuk.org
- Spinal Muscular Atrophy UK www.smauk.org.uk
- Royal College of General Practitioners www.rcgp.org.uk

Glossary of abbreviations

BiPAP	Bilevel positive airway pressure
CT scan	Computerised tomography scan
EHP	Emergency healthcare plan
EMG	Electromyogram
MAA	Managed access agreement
MDT	Multidisciplinary team
MRI	Magnetic resonance imaging scan
NICE	The National Institute for Health and Care Excellence
NIV	Non-invasive ventilation
NG tube	Naso-gastric tube
NJ tube	Naso-jejunal tube
OT	Occupational therapy
RSV vaccine	Respiratory syncytial virus vaccine
SCR	Shared-care record
SLA	Service level agreement
SMA	Spinal muscular atrophy

Within 1 day

Within

Ongoing management

Specialist management

- Genetics
- Neuromuscular
- Respiratory
- Nutrition, gastrointestinal
- Motor
- Orthopaedic & spine
- Endocrine

Transition to

Suspect SMA: red flags for GPs and health visitors

Red flag symptoms that the GP, paediatrician, or intensive care should look for:

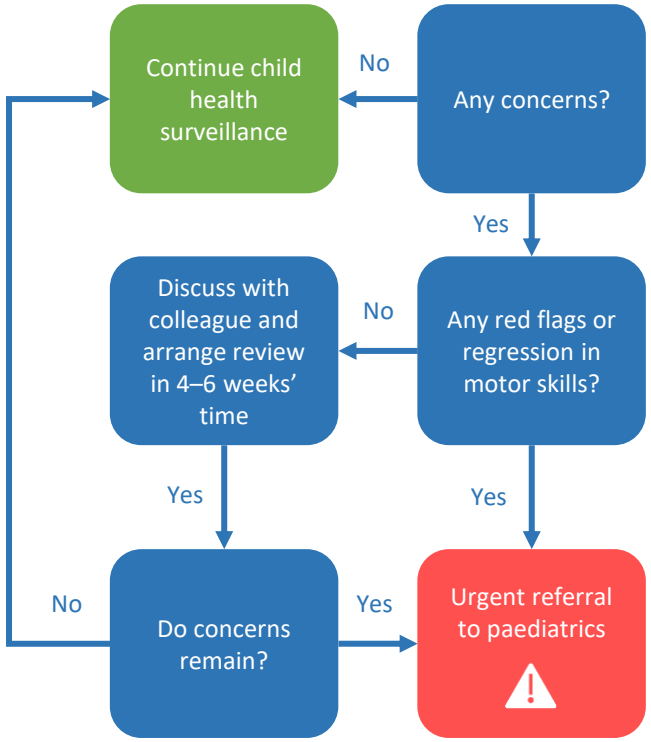
- Floppy baby
- Reduced movements in early weeks
- Recurrent chest infections
- Difficulty feeding
- Failure to gain weight
- Motor delay or loss/regression of skills
- Acute respiratory distress.

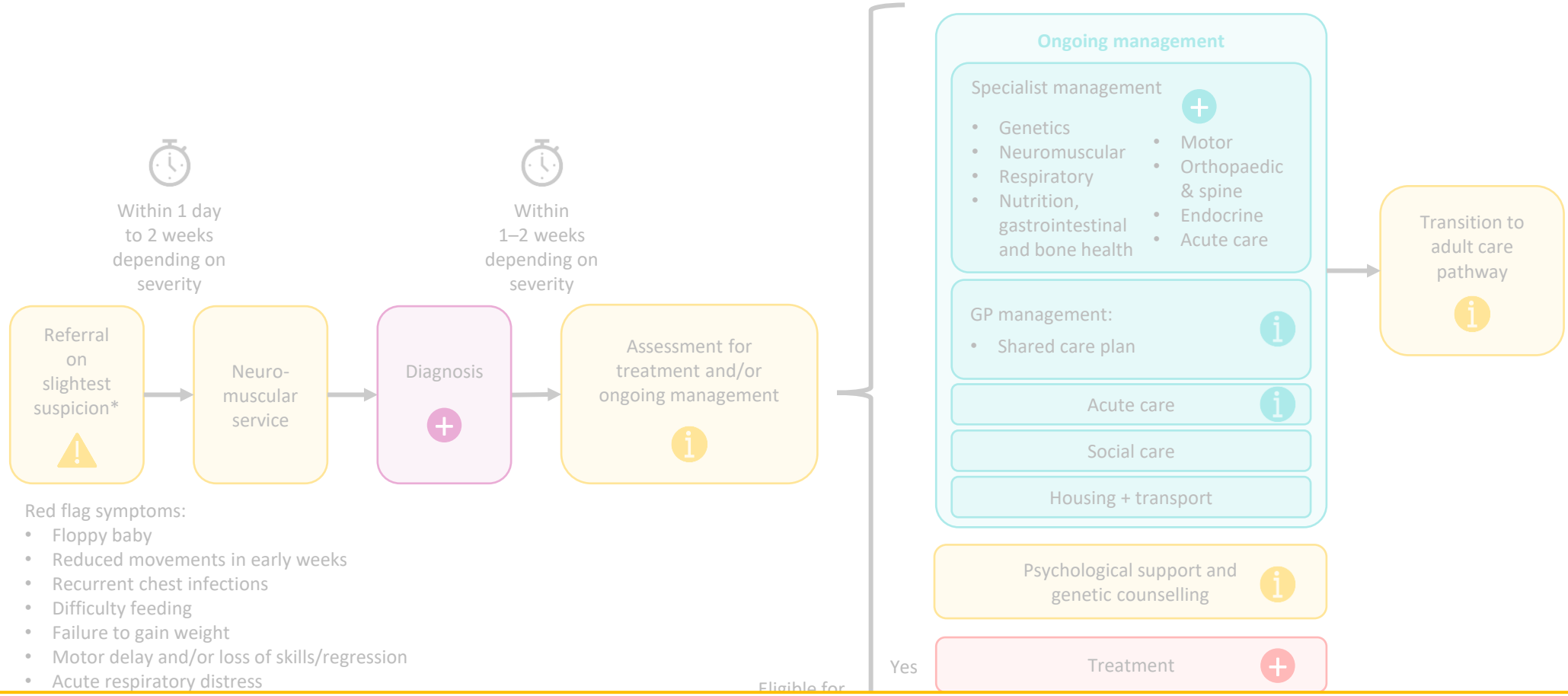
Urgent referral

Red flag symptoms that the GP, paediatrician, or intensive care should look for:

- Infants with acute respiratory distress requiring respiratory support.

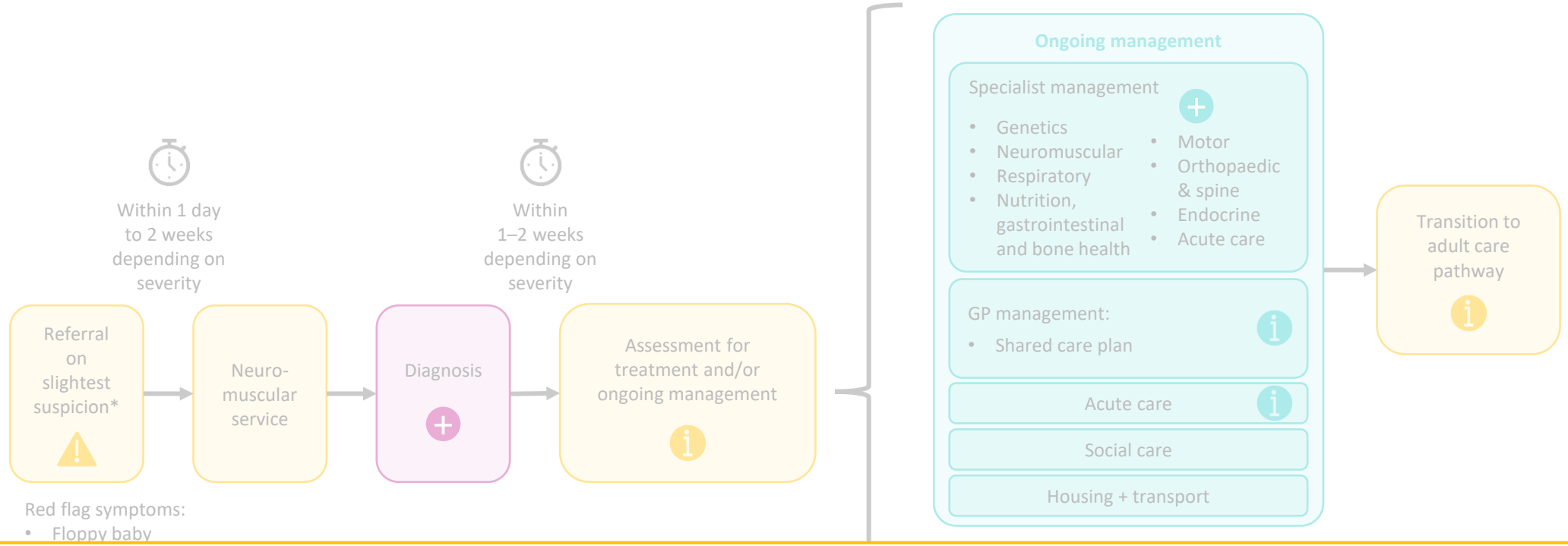
Source: Recognising Neuromuscular Disorders – a practical approach eLearning module www.rcpch.org.uk





Availability of treatment

Education of the family and GP is important to understand there are now treatments available.

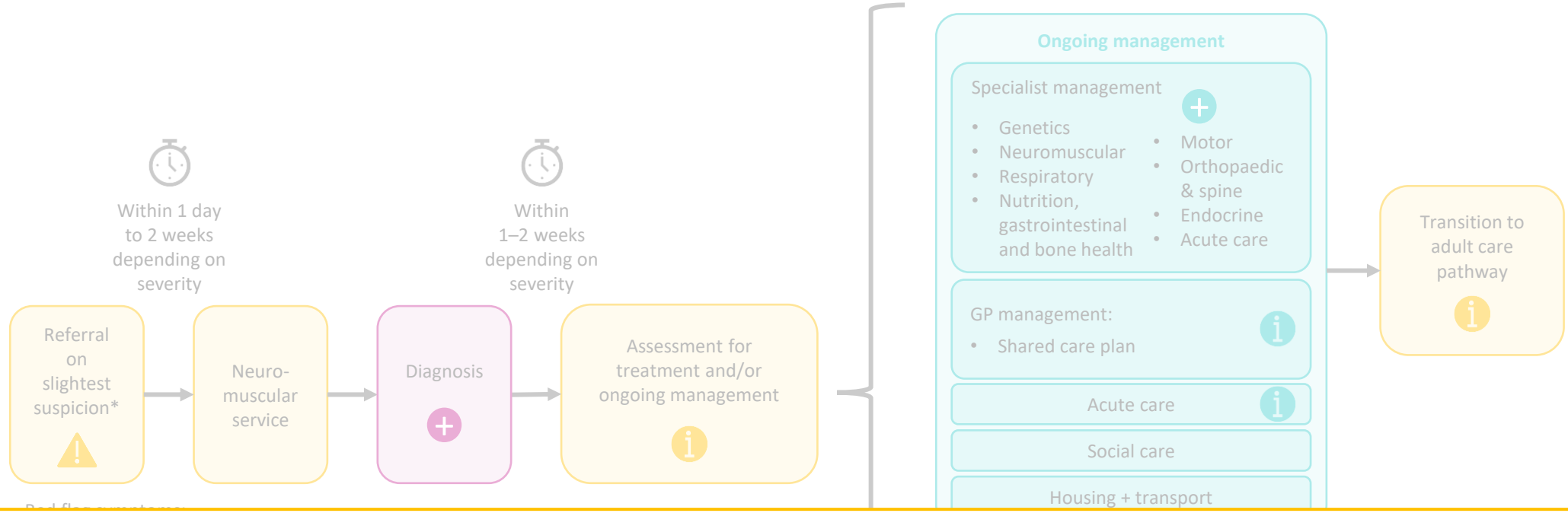


Psychological support and genetic counselling

What to expect from treatment and management.

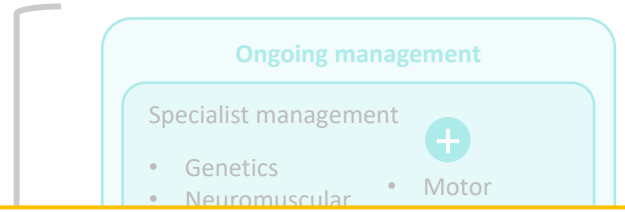
Parents' concerns and managing their expectations:

- Will my child be able to walk?
- Will my child's development be comparable to other kids of their age?
- Will my child breathe and eat normally?
- I saw on social media that…



Children's palliative care services

Palliative care is an active approach to care that supports physical, emotional and practical needs in order to achieve the best quality of life for both children and families. This includes the provision of short breaks / respite care. Children's palliative care teams provide care for children with life-limiting conditions in hospitals, hospices and at home. Palliative care teams employ a number of different health and social care professionals, including specialist nurses, support workers and play therapists.



GP role

While the GP is not the primary point of contact for patients because they lack the necessary expertise, they can play a role in SMA care and the relationship is key in terms of delivering a quality service throughout a patient's life. Currently patients tend to bypass GPs altogether and go straight to the paediatric / neuromuscular specialist centre for help. However, with GP education and a comprehensive care plan, GPs can certainly be more engaged in supporting SMA patients with:

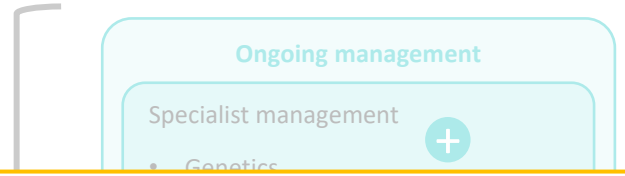
- Vitamin D and nebuliser prescription.
- Importance of vaccinations including the specific types (e.g. RSV vaccine, although a change in national guidance is also needed here).
- Antibiotic prescriptions (GPs need training on the longer period recommend for these patients [10–14 days] and the low threshold for prescription for patients with frequent chest infections).

Each patient should have a shared care plan in place which indicates which symptoms they should contact their GP about (with accompanying advice for the GP) and which should be directed towards the paediatric/specialist centre.

Each patient should have a separate emergency care plan.

Community nurses can assist with: providing suction, be available to do swabs or take samples if required, NG replacement, and providing nebuliser machine.

Currently it appears that service level agreements (SLAs) are informal and shared-care records (SCRs) are not in place. This needs to change if there is to be effective working between the specialist centre and local teams.



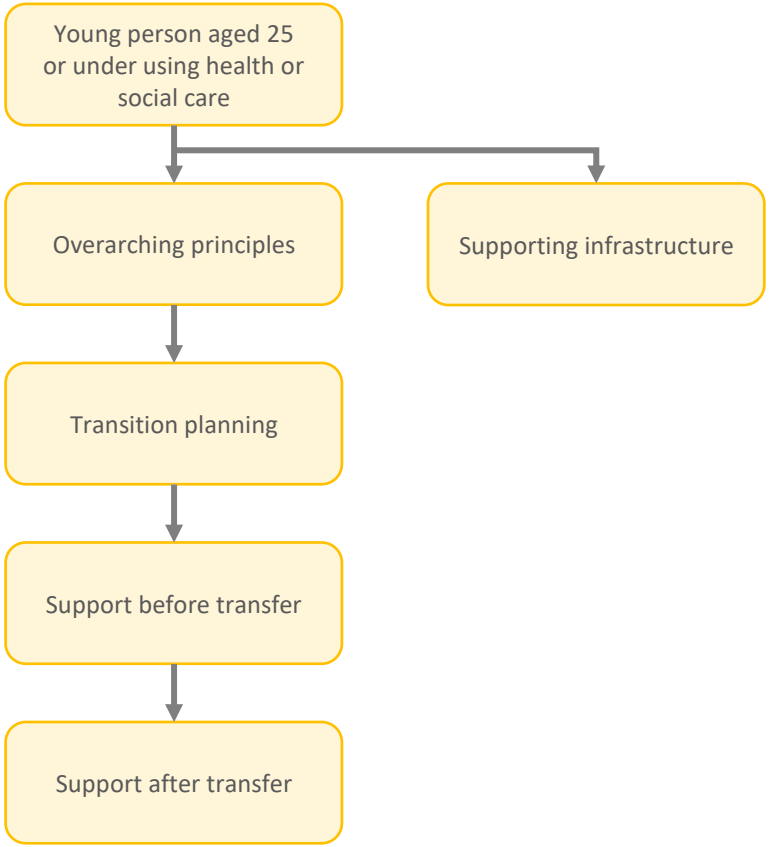
Transitioning from paediatric to adult care

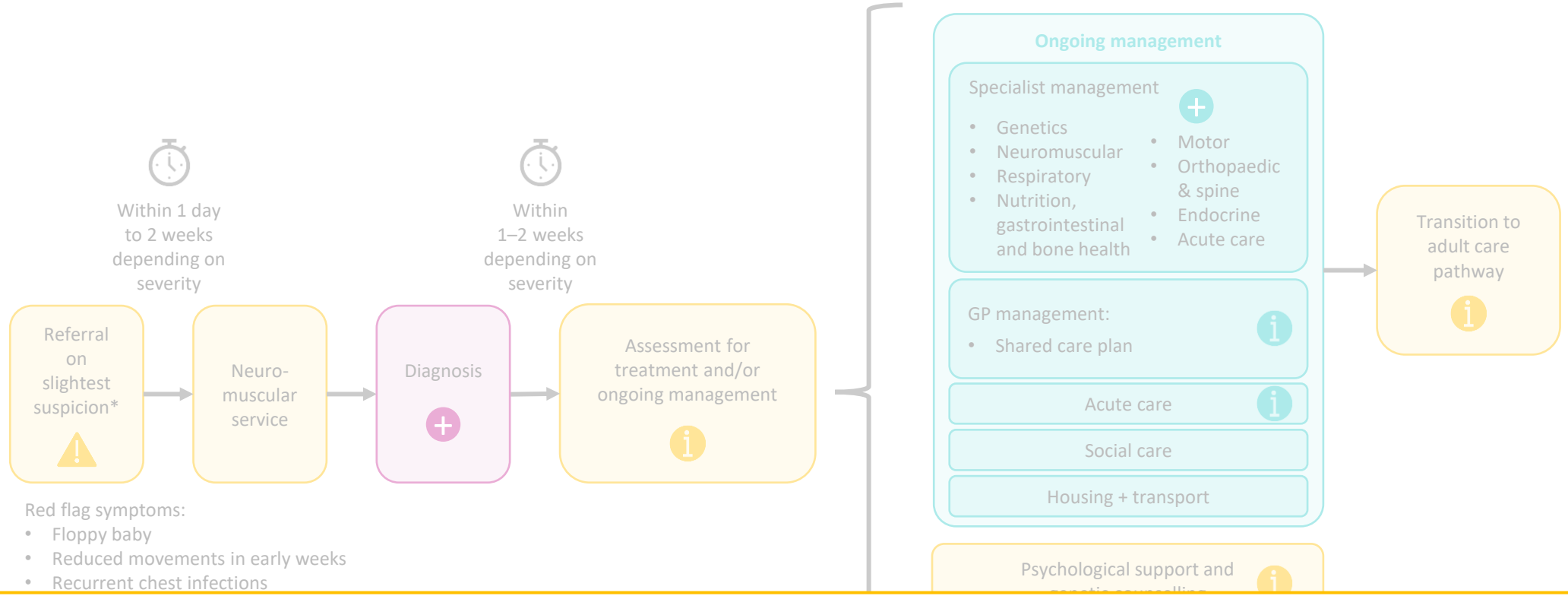
In young people with chronic disabilities like SMA, the transition from paediatric to adult care is often difficult if structured and supportive transition programmes are not in place. The transition to adult care is often described as 'challenging and scary'.

- Learning to navigate a new and complex healthcare system.
- Differences in information provision and expectations.
- Engaging with unfamiliar specialists.
- Difficulty identifying and accessing specialists and multidisciplinary clinics.
- Difficulty accessing funding and equipment.
- Major resource gaps and lack of support navigating the system.
- Ensure timely introduction of new/alternative equipment

See also:

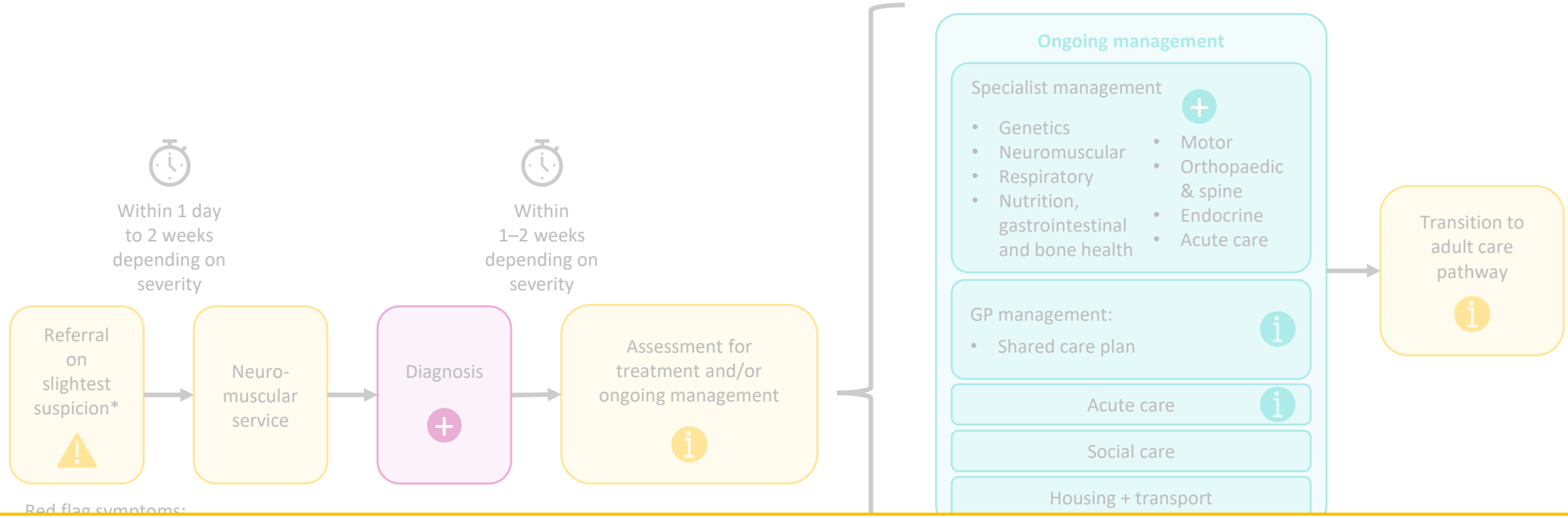
- Care Quality Commission (2014) From the pond into the sea: Children's transition into adult health services
- NICE (2016) Transition from children's to adults' services for young people using health or social care services [NG43]





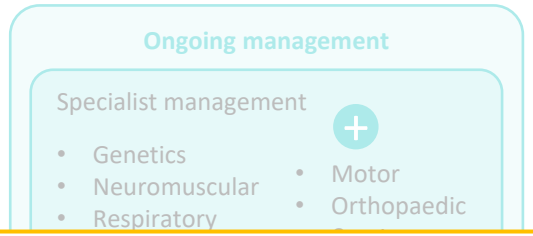
Objectives for SMA service

1. Provide a specialist multidisciplinary neuromuscular service for diagnosis and ongoing management.
2. Initiate appropriate pharmacological and non-pharmacological treatments for infants and children with SMA.
3. Reduce morbidity and mortality due to SMA including reducing hospitalisation.
4. Ensure equity of access to specialised therapies.
5. Oversee all aspects of care that fall outside the expertise of local units.
6. At an individual level ensure the commissioning service is responsible for minimising disease impact in SMA.



Audit points

- Timing of referrals:
  - Urgent referral within 1 day to 3 weeks depending on severity.
- Family satisfaction questionnaire (local document) covering:
  - Patient made aware of identified timeframes.
  - Contact details at first consultation are made available to patient and their carers.
  - Patient received list of patient Information at first consultation.
  - Infant/child referred for specialist medication (if appropriate) and family received information leaflet about the medication detailing side effects and instructions about monitoring.



Key performance indicators

- Identified benefit to infant and family.
    - Equity of access.
    - Appropriate referral pathway based on evidence-based clinical assessment.
    - Access to the specialist team.
    - Family has realistic expectations of diagnostic process.
    - Family has understanding of prognosis, available treatment and outcomes.
- Benefit to health professionals and organisation.
    - Appropriate referral and prioritisation of patient care achieved.
    - Standardisation of assessment and referral process.
    - Relevant investigations and patient information available, reducing delayed in patient journey later in pathway.
    - SMA MDT coordinator where available to liaise and respond directly with health professional and family/carer regarding referral enquiry, waiting list management and liaise with the appropriate SMA team member to provide supportive information.
    - Cost and time effective management.
    - Clearly defined diagnostic process to follow.
    - Appropriate use of professional expertise and designated discussion time.
    - Clearly defined roles and responsibilities of the health professionals involved in the pathway.

Treatment options
There are three first-line treatments for paediatric SMA. Treatment will depend on clinical assessment and patient/family preference.

Nusinersen (Spinraza)

Risdiplam (Evrysdi)
Risdiplam is recommended as an option for treating 5q SMA in people aged ≥2 months with a clinical diagnosis of SMA types I, II or III or with pre-symptomatic SMA and 1–4 SMN2 copies. It is provided under a MAA and recommended only if the MAA conditions are followed.

Onasemnogene abeparvovec (Zolgensma)
Onasemnogene abeparvovec is a gene therapy treatment delivered by IV injection designed to address the root cause of SMA and limit the progression of the condition by replacing the faulty or missing SMN1 gene. This provides an alternative source of SMN protein in these cells, which is expected to

Managed Access Agreements (MAA)

MAAs are a version of conditional reimbursement or coverage with evidence development used in the NHS. They constitute agreements between NHS England and sponsors of new technologies manufacturers that enable new interventions (usually drugs) to become available for a limited time period at a discounted price. These arrangements are co-ordinated by NICE. Clinicians and patient advocacy groups are involved as well as clinical representatives of NHS England.

MAA refers to an arrangement that addresses a significant area of uncertainty in the evidence base as identified by the technology evaluation committee at NICE. MAAs have been used in many single technology appraisals (STAs) and are anticipated for most highly specialised technologies (HST). MAA proposals include an agreed rationale and duration for the arrangement, populations covered (in particular where they come in the care pathway), clear criteria for starting and stopping the new therapy, definition of outcomes, methods of data collection and frequency of reporting, together with a commercial proposition (price discount), financial risk management plans and an understanding of what will happen if reimbursement is eventually withdrawn.

Source: Managed Access Agreement (2016) York; York Health Economics Consortium

Read more about:

- The MAA for nusinersen
- The MAA for risdiplam

Managed Access Agreement (MAA) for nusinersen

The MAA for nusinersen will last for five years, from 24 July 2019 to 23 July 2024. The MAA data collection period will last for a minimum of three years and automatically cease at the end of the fifth year (July 2024), unless NICE guidance is published sooner.

The MAA has been designed to allow enough time for additional evidence to be generated for NICE. At the end of the MAA period, NICE will review the new evidence and review its guidance to indicate whether the medicine should be recommended for use in the NHS – this may result in a difference to what the NHS will pay for the drug for example. While most topics recommended for managed access go on to be recommended for routine use in the NHS, there is no guarantee that it will be recommended when it is reviewed by NICE.

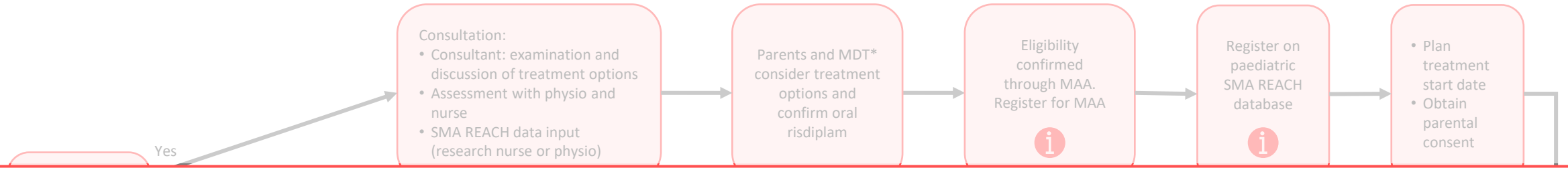
When Biogen resubmits the new evidence available to NICE it will include the data that has been collected from patients throughout the MAA. Patient groups and clinicians can also contribute to this process and make submissions.

The NICE appraisal committee will then evaluate the evidence submissions. They will consider both the clinical and cost effectiveness of the drug and make a final decision on whether nusinersen should continue to be funded in the NHS after the MAA has expired.

- NICE (2019) Managed Access Agreement – nusinersen 5q SMA
  - Contract variation agreement 1, May 2021
  - Contract variation agreement 2, February 2022

Read more about:

- The MAA for risdiplam
- MAAs in general



Managed Access Agreement (MAA) for risdiplam

How long will the risdiplam MAA last and what happens then?

It's anticipated that the Roche will resubmit the new evidence available to NICE in March 2024. The submission will include the data that has been collected from patients throughout the MAA.

The NICE appraisal committee will then evaluate the evidence submissions. They will consider both the clinical and cost effectiveness of the drug and make a final decision on whether risdiplam should continue to be funded on the NHS after the MAA has expired.

- NICE (2021) Managed Access Agreement: Risdiplam for treating spinal muscular atrophy in children and adults [ID1631]

Read more about:

- The MAA for nusinersen
- MAAs in general

SMA REACH

SMA REACH UK is a study funded by a grant from SMA UK to Great Ormond Street Children's Charity. The project is a collaboration between existing UK SMA registries – the UK SMA Patient Registry and SMArtNet Clinical Network UK sponsored by Muscular Dystrophy UK and SMA UK (formerly The Jennifer Trust). The SMA REACH UK project is led by the study team based at the Dubowitz Neuromuscular Centre, UCL.

The primary aim is to establish the first national clinical and research network named SMA REACH UK (SMA research and Clinical Hub UK) to promote a national agreement on clinical and physiotherapy assessment and standards of care. The plan is to design, pilot and expand an electronic database created to streamline the collection of data for patients with SMA. This UK SMA database is a unique infrastructure started at Great Ormond's Street Hospital and Newcastle which is accessible to specialist centres across the UK who treat patients with SMA.

The secondary aim of the project is to utilise the SMA REACH UK database as a longitudinal data store where information can be audited and reviewed. This provides clinicians and researchers a rich resource of available information on a large collection of SMA patients. SMA REACH are collaborating with the Catholic University Rome, an international centre of excellence in SMA research and treatment, with the shared goal to facilitate translational research for this common neuromuscular disease in preparation to design national and international clinical trials.

This work is an invaluable tool for upcoming multicentre randomised clinical trials in SMA type I, II and III and ensure that the functional scales used are suitable and clinically relevant for future trials.

SMA REACH is the UK's SMA research and clinical hub focused on improving standards of care and translational research. It aims to establish national agreement on medical and physiotherapy assessments, and standards of care for patients with SMA in preparation for future clinical trials in the UK.

Read more on the SMA REACH website

SMA REACH UK acknowledges the Neurology Academy care pathway is a helpful review of the 2018 recommendations for paediatric care in SMA.

Since guidelines were last reviewed, and as disease-modifying therapies are now available to patients with SMA, in order to provide additional guidance for the management of the evolving SMA phenotype the SMA REACH network has been working with patient advocacy groups, with the support of NHS England and industry to launch an SMA CareUK initiative. SMA CareUK seeks to build on existing practice and emerging evidence to develop a consensus regarding standards care for all those living with SMA, which are applicable across the UK. In this context the Neurology Academy provides a helpful review which SMA CareUK will develop further and tailor for the specific needs of the UK population affected by SMA.

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Homecare

Homecare can be used to supply the drug. Homecare for risdiplam is available via Polar Speed Homecare. This is a dispense and delivery service available to all patients prescribed the drug. Patients are enrolled via their referring centre and contacted by Polar Speed within five days.

The homecare company can reconstitute the drug powder and deliver the resultant oral solution to the patient using cold chain storage. If risdiplam is supplied by the specialist treatment centre, they will:

- Provide sufficient risdiplam to take at home/outside of hospital setting.
- Provide instructions on how bottles can be transported home.
- Provide instructions on how to store and take the medication.
- Supply oral syringes for medicine administration.

If risdiplam is supplied by homecare pharmacy, they will:

- Deliver sufficient risdiplam to the home or previously agreed address.
- Manage the ongoing home deliveries and prescriptions liaising with patients and centres as required.

The patient is also provided with an “Instructions for use for patients/parents and carers” booklet. This booklet gives detailed instructions on how to prepare the dose volume with the re-usable oral syringes provided, and take the medicine either: by mouth, through a gastrotomy tube, or through a nasogastric tube.

Eligibility for onasemnogene abeparvovec

Eligibility for SMA type I babies <7 months:

- On no other SMA drug treatment.
- AND permanent ventilation for >16 hours per day or a tracheostomy is not needed.
- Eligible but requires referral to national MDT.

Eligibility for SMA type I babies aged 7–12 months:

- Eligibility discussed following referral to national MDT.
- AND permanent ventilation for >16 hours per day or a tracheostomy is not needed.

Eligibility for pre-symptomatic 5q SMA babies with a bi-allelic mutation in the SMN1 gene and up to 3 copies of the SMN2 gene:

- Recommended only if the conditions in the patient access scheme are followed:
  - Patient does not display any clinical manifestations that are strongly suggestive of SMA.
  - Patient has not received any prior treatment with nusinersen or risdiplam.
  - Patient has confirmed anti-adeno-associated virus 9 (anti-AAV9) antibody titres below 1:50.
  - Onasemnogene abeparvovec will be otherwise used as set out in its summary of product characteristics.
- Patient access scheme necessary for pre-symptomatic patients and these are currently usually identified by those individuals having an affected sibling. In future this will probably be through newborn screening.

Resources:

- NICE (2021) Onasemnogene abeparvovec for treating spinal muscular atrophy. Highly specialised technologies guidance [HST15]
- NICE (2023) Onasemnogene abeparvovec for treating presymptomatic spinal muscular atrophy. Highly specialised technologies guidance [HST24]
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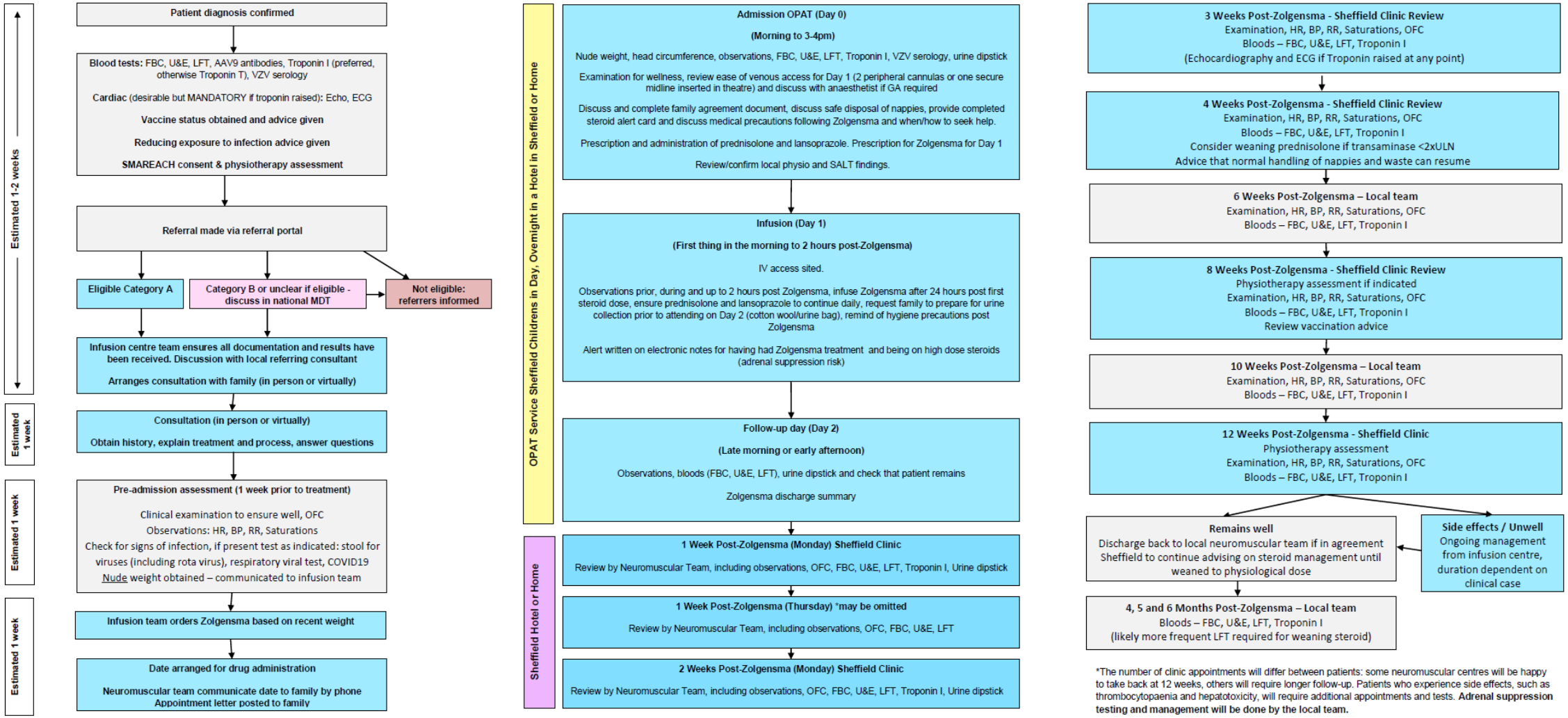
Best practice example: Sheffield Children's Zolgensma pathway



*The number of clinic appointments will differ between patients: some neuromuscular centres will be happy to take back at 12 weeks, others will require longer follow-up. Patients who experience side effects, such as thrombocytopaenia and hepatotoxicity, will require additional appointments and tests. **Adrenal suppression testing and management will be done by the local team.**

Acute care

Chest infections and breathing issues are the most frequent problems that require acute or emergency care.

There should be an emergency healthcare plan or illness plan in place written by the medical team including the following information:

- Brief summary of the individual's diagnosis/es and the parents' or child's understanding of it.
- What are the warning signs or indications that the child should be taken to hospital?

Anaesthetics

If the patient requires an anaesthetic the GP should alert the hospital if this is an elective admission to ensure the specialist team in charge undertake:

- A review of the heart by a cardiologist (only if there is known to be a pre-existing problem).
- A full assessment before any anaesthetics are used. This may include a sleep study and involvement of a dietitian.
- Assessment of difficulties in intubating that may be caused by:
    - Tightening of the jaw
    - Limited neck mobility
    - Difficulties in positioning.
- Monitoring blood carbon dioxide and oxygen at all times, whatever anaesthetic method is used.
- Anticipating any other possible needs such as use of NIV and other breathing interventions.
- Medication for pain management may be needed after an operation.

Considerations of local anaesthesia or regional analgesia; as a general rule anaesthesia does bring challenges.

Anaesthetics may be used for planned surgery as well as for other reasons, such as administering new drug treatments.