

Management of Children with Major Trauma

NHS Clinical Advisory Group Report

February 2011

Clinical Advisory Group for Children with Major Trauma - Context

This document contains advice offered by the NHS Clinical Advisory Group (CAG) for Children with Major Trauma to their colleagues in NHS England. It is intended to support the recommendations from the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010) with specific reference to children involved in major trauma and should be read in conjunction with this. That report was in principle written to address the adult service need; the contributors to this supplementary report recognise that there are already established networks for seriously ill children based around Paediatric Intensive Care and the number of seriously injured children is insufficient to justify major restructuring of those networks. This advice is therefore intended to be implemented as a pragmatic overlay onto local paediatric intensive care network arrangements and the proposed Regional Trauma Network structure for adults.

The volume of major trauma affecting children is small and therefore the Network structure should remain the same as for adults, with agreed mechanisms for delivering additional specialist expertise in managing children and young people affected by major trauma within a trauma network.

The recommendations produced by the children's CAG for the programme will be based upon robust epidemiological and clinical evidence or, where a robust evidence base does not exist, built on the best evidence available plus a broad consensus on best practice.

The recommendations and advice do not necessarily represent the views of the Department of Health.

Clinical Advisory Group Membership

The NHS Children's Clinical Advisory Group was formed to advise on the development of strategic activities to support NHS England in designing bespoke networks that will deliver optimal care to children who suffer major trauma.

Members of the CAG were drawn from medical, nursing, health professionals, and those with a strong involvement in the care of sick children and their families. They were appointed from across all SHAs for their personal experience and expertise, and not to represent any organisation or faction. The diversity of membership was intended to enrich contributions and provide a soundly based family-centred approach to improving services and outcomes for children suffering from Major Trauma. Please see the acknowledgements section towards the end of this report for the members who contributed to this report.

For the purposes of this document, children and young people are defined as younger than 19 years of age¹. Individual networks may have configured services along alternative age ranges for delivery or due to statutory obligations. The CAG would encourage such flexibility of implementation, provided there is locally defined clarity on definitions across the spectrum of trauma services within each network. The key is to ensure no young person receives inappropriate care by falling between defined age groups.

Introduction

Children account for nearly 25% of the UK population.² Major trauma remains the leading cause of death in children over one year of age³, and the Confidential Enquiry into Maternal and Child Health found that 47% of all non-natural deaths in children aged from 28 days to under 18 years were due to road traffic accidents.⁴ Despite the devastating consequences that this has for the child and family, the overall number of incidents is relatively small when compared to the adult data. Data from TARNlet (children's component of the national clinical audit – the Trauma Audit Research Network) covering 183 hospitals recorded 23,771 incidents of trauma in children between 1988- 2010. Of these, 30% were classed as major trauma, with an injury severity score of >15. This equates to approximately 300 children involved in major trauma in the UK per annum.⁵ This may represent an underestimate as PICANET data suggests that 500 children each year between 2003-2008 were admitted to paediatric intensive care with traumatic brain injury, although not all of these will be major trauma.⁶ This Injury severity data for children demonstrates a consistently low number of the most severely injured.⁷ Even accepting that there may be an underestimate of the true numbers of children involved in trauma (because many organisations do not currently participate in audit), this contrasts with the statistics in the adult population. As a result, organisation of trauma networks for children requires a different approach. There is a conflict between the small number of child injuries (indicating that fewer Children's Major Trauma Centres are required) and the geographical and transport difficulties that would ensue if that model were instituted. This is compounded by the differences in child service provision across NHS England, with some being integrated with adult services on the same medical campus and others in dedicated children's hospitals or as isolated services.

Pragmatic solutions will need to be found locally, usually using the same pre-hospital networks but determining the destination Major Trauma Centre (MTC) based on on-site or supporting children's services. Maintenance of high-quality paediatric trauma resuscitation, imaging, emergency decision-making and surgical skills specific to trauma must not be compromised by distributing services over too many sites. To achieve the best survival rates, concentrating expertise and experience is no less important in major trauma in children than it is for adults, and indeed the low numbers of injured children increases the risk of poor outcomes due to occasional practice. There is no evidence to suggest that children following the high case-volume adult major trauma pathway with paediatric expertise on-site do less well than a low case-volume route to a children only hospital. The system of a network delivery of care to injured children should improve not only the outcomes of those severely injured children but also those with lesser injury.

In comparison with the adult population, children sustain different injury patterns, with a higher proportion of children having head injuries or burns. Traumatic brain injury is the leading cause of emergency hospital admissions and the most common cause of morbidity, mortality, disability and lost years of productive life in children.^{8,9} Despite this, the need for urgent neurosurgical decompression is rare and a less common intervention than in adults.¹⁰ There is however, an equivalent urgency to access intracranial pressure monitoring.

Burns are most common in children under 3 years old. Approximately 500 children per year in the UK under 16 years old are burned to a severity that requires fluid resuscitation.¹¹ The National Burn Care Review recommends that all burn injuries requiring hospitalisation should be admitted under the care of specifically trained specialist staff.

Owing to the small numbers of children affected by major trauma and the nature of the injuries they sustain, there are implications for workforce planning and training, designation of appropriate lead centres and maintaining quality of care. Establishing Trauma Networks explicitly for the management of children will enable the injured child to benefit from the collective competence of trained staff with an understanding of the unique anatomical and physiological characteristics of the injured child.³ The recommendations of this report should be implemented in alignment with current guidance on delivering specialist paediatric services.¹²

The adult clinical pathway of care and network strategy has been used as a template for children's services, whilst bearing in mind some key differences in approach. This template comprises five stages; pre-hospital care, acute care & surgery, ongoing care & reconstruction, rehabilitation and network organisation. An underlying principle should be to provide "family friendly" care as close to home as possible, ensuring that it is safe and sustainable to do so and provides the best possible outcome for patients.

At every stage of the trauma pathway, the importance of safeguarding children is paramount. Vulnerable children or those from an area of high social deprivation are over-represented as a group. Specific recommendations on implementation of safeguarding standards are beyond the remit of this document. Commissioners are encouraged to co-operate with local authorities, the police and Public Health, and support investment in injury prevention programmes (e.g. health visitors) as an integral part of the joined-up management of major trauma in children.

Rehabilitation and re-ablement must be a priority in designing Network services, and should be an integral part of the planning process for the managed care of the injured child. Social and educational needs of the child must be explicitly addressed in designing Major Trauma Networks for children. This must include early planning and timely and appropriate provision of assessments and tailored interventions for the social, psychological and educational needs of the seriously injured child.

Children and young people are usually part of a family unit and they need their families to be involved in their care. The presence of families who are well informed and participating in care is beneficial to the recovery of the child. In some instances the child may not be the only member of the family to be seriously injured. Even when the family are physically unharmed, the psychological impact is widespread and long-lasting. It is well recognised that children who suffer major trauma often have learning or behavioural difficulties and some come from dysfunctional families.¹³ Such parents may have poor coping mechanisms. This impacts on parents' relationships with staff caring for the child and they will require additional resources to help these families.¹⁴

Commissioners should take an active management approach to all aspects of the wellbeing of the families of seriously injured children. Active social and psychological support must be considered for these families and it must continue right through transition into rehabilitation and eventual care at home. Please refer to the Psychosocial and Mental Health Care section (1.4.5) of the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010) for detailed information. The importance of the family must not be forgotten in all aspects of the planning and delivery of Major Trauma Networks.

Definition of Terms

Trauma Network – A managed collaboration between the providers commissioned to deliver trauma care services in a geographical area.

Children’s Major Trauma Centre - A facility optimised for the provision of care for *all* types of injury in a seriously injured child only.

Combined Major Trauma Centre – A facility which is able to draw upon competencies and skill-sets required in the provision of care for *all* types of injury in both children and adults following major trauma.

Adult Major Trauma Centre – A facility optimised for the provision of care for *all* types of injury in a seriously injured adult, but with no *specific* expertise in the management of the seriously injured child.

Trauma Unit (TU) – A hospital in a Trauma Network which can provide care for *most* injured patients (children and adults), and has systems in place to rapidly move the most severely injured to a hospital that can manage their injuries.

Local Emergency Hospital (not designated as a TU) – A facility which does not routinely receive acute trauma patients (excepting minor injuries that may be seen in a minor injuries unit (MIU)), and has systems in place to rapidly move the most severely injured to a hospital that can manage their injuries. It may have a role in the rehabilitation of children affected by trauma and the care of children with minor injuries.

Enhanced Care Team – A specialist pre-hospital assessment and treatment team with advanced skills in airway management and stabilisation of the critically injured patient.

For a more detailed definition of some of these terms, please refer to the main document “NHS Clinical Advisory Group Report Regional Networks for Major Trauma.”

Network Coordinator – Responsible for the management of transfer between providers with a co-ordinating function to ensure the provider, transferring ambulance service, imaging transfer and all specialties involved are fully informed about priority, destination and the needs of the injured child. This role is likely to be based within a Major Trauma Centre but this will vary with local implementation. The coordinator will be responsible for admission into the Network.

Trauma Network Director of Rehabilitation – Responsible for the overall management of the rehabilitation pathway of each patient.

1 Pre-hospital care and inter-hospital transfer

Clinical Advisory Group report summary

It is important that children with Major Trauma are accurately and rapidly identified so that they are able to benefit from Major Trauma Centre (MTC) care. Children are often triaged inaccurately (both over and under triaged). Triage tools for children are less reliable owing to the many variances in the physiological criteria used in common triage tools.¹⁵

A UK survey revealed a geographical disparity in pre-hospital paediatric care due to variation of resources and availability of staff with key skills. Most paramedic staff receive little specific paediatric training and owing to the small number of children involved in major trauma there is a problem with de-skilling of the workforce.¹⁶ Transfer is a time when children are particularly vulnerable, and geographical constraints will mean that some critically injured children will have long journeys to hospital.

Evidence suggests that when children with multiple injuries are treated in a Children's MTC or at a Combined MTC they have better outcomes.¹⁵ Therefore the underpinning strategy is correct, but when over triage is recognised to have occurred there should be arrangements in place to treat the child at their most capable local centre when appropriate.

Recommendations:

(Please read in conjunction with section 2.3 of the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010))

- Guidelines to specifically identify children involved in Major Trauma should be developed by each Network.
- Physiological criteria in children are more challenging to obtain and interpret. Emphasis should be placed on accurate physiological monitoring and assessment in the management of the seriously injured child. Changes in parameters should be interpreted with care, in the context of knowledge of how the physiology of children differs from adults.
- Improvements should be made in equipping ambulance staff with skills necessary to care for the seriously ill or injured child. Triage criteria which are clear and simple to use in the field should be developed and implemented locally as a Network responsibility.
- Improvements should be made to ensure availability of appropriate equipment for the resuscitation and monitoring of children.
- Improvements should be made in the training in and delivery of analgesia in children, particularly in the pre-hospital and acute settings. Guidance for this should be developed locally in consultation with paediatric anaesthetic and pain management services.
- The frequency of major trauma to children is low and there may be insufficient personnel with appropriate experience to justify a paramedic with specific paediatric experience being present in the Ambulance Control room 24/7. However, within the network there should be 24/7 access to telephone advice from a consultant with pre-hospital experience of the management of children with Major Trauma, who could advise the Ambulance Control Centre and on-scene personnel on the best care provision for each child. (See section 2.3.1 of the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010))

Pre-hospital transfer

- If, in the pre-hospital phase an Enhanced Care Team is part of the Network structure, its members must have knowledge of the emergency care of the severely injured child. This could be supported by a consultant in paediatric critical care (or paediatric emergency care consultant in liaison with paediatric critical care) available for telephone advice.
- A local service dealing with children's emergencies should be integrated into the network. The network should be developed over time to ensure that all children with injuries suggestive of Major Trauma should be taken to a designated Children's MTC or a Combined MTC if the journey time is under 45 minutes. For those taken to the local TU and fulfilling the criteria for transfer to the MTC, secondary transfer should occur promptly.

Secondary transfer

- The child's onward journey and reception should be safe, timely and planned. Any secondary transfer of children must be overseen jointly by a consultant in the receiving unit and the trauma lead consultant from the secondary centre. It is the Network's responsibility to ensure that all those involved in these transfers work to guidelines and be specifically trained and equipped for their task. Children should be transferred directly from the referring hospital to the appropriate MTC. For the secondary transfer of injured children, commissioners need to ensure that the Network has clear and realistic operational structures which take into account the workforce implications for both the secondary and receiving centres. Paediatric neurosurgeons at a senior level must be involved early in the decision to transfer all children with severe traumatic brain injury in consultation with regional paediatric intensive care unit.
- Generic competencies appropriate to a level 8 practitioner in Enhanced Care teams (as set out in section 2.3.3 of the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010) are insufficient to perform extended inter-hospital transfers for a critically injured child. Supplementary, specific training in competencies required in managing a critically injured child, particularly in the management of paediatric airways, should be implemented to reflect the additional expertise required.¹⁷
- Retrieval by paediatric intensive care should only occur where there are justifiable circumstances and should take place after discussion with the appropriate clinician at the receiving centre. For children with head injuries this would be a consultant paediatric neurosurgeon and a paediatric intensive care consultant. Transfers and retrieval should be carried out using the recommendations of the Paediatric Intensive Care Society, the Association of Anaesthetists, Royal College of Anaesthetists and the Society of British Neurological Surgeons.^{10,17,18,19}
- Networks should utilise a flexible approach to develop local policy to guide ambulance services decision-making regarding appropriate receiving units for injured children, taking into account local geography, travelling time and the available hospital facilities.²⁰
- All components of the Trauma Network including Pre-hospital services should be mandated to submit data for all Major Trauma patients to the children's Trauma Audit Research Network (TARNlet).
- There should be further research into what is needed in the pre-hospital phase to create a safer and better service for children, especially with regard to the need for enhanced care teams.

- There will be a proportion of children over-triaged. These children once treated or stable will be able to return home or may require ongoing treatment at a unit closer to home.
- There will unfortunately be occasions, such as when children have suffered very severe head injury or other severe major trauma, where despite all appropriate care having been given the child may be already irrecoverable or proceeding to brain stem death. The clinicians directly involved, in consultation with the Trauma Network Coordinator, should ensure that in such instances the family and child should be spared the distress of an unnecessary and futile secondary transfer where no clinical benefit is likely to arise. Advice should be available to the network 24/7 on end of life management and organ donation.

2 Acute care and surgery

Clinical Advisory Group report summary

Recognising that the acute needs of children with major injury are different to adults the CAG addressed the issues in relation to reception of children involved in major trauma (and staffing to support this); assessment, including imaging; emergency and specialist surgical interventions, including neurosurgery and spinal cord injury and critical care.

Recommendations

(Please read in conjunction with section 3.3 of the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010))

- It is not within the remit of the CAG to detail which services will need to be co-located at each Combined MTC or Children's MTC, this will be determined locally within the Network. For immediate life-saving treatment of children with major trauma, the key competencies for all age groups must be available in the specialties of: emergency medicine, critical care, surgery, paediatric surgery, orthopaedic surgery, neurosurgery, maxillofacial surgery, paediatric ENT, plastic surgery, paediatrics, anaesthetics, radiology and interventional radiology. There must be available relevant skills specifically for paediatric airway management (including the skills necessary to establish a surgical airway) and anaesthesia.
- For the immediate reception of a child with major injuries, a trained trauma team should be present 24/7. All staff should undergo and update skills training specific to the assessment and initial treatment of major trauma in children. In a Combined or Children's MTC the trauma team should be led by a consultant. In a Trauma Unit the trauma team at certain times may be initially led by a suitably trained registrar of grade ST4 or above, in which case a consultant must be available within 30 minutes.
- All seriously injured children must be resuscitated and assessed in a clinical area with the necessary paediatric equipment readily available. If this is a combined facility with adults then measures should be place to respect the specific needs of the child as a patient.²¹
- Emergency life-saving trauma procedures should be performed by a consultant surgeon with training and skills in such procedures. More common procedures (e.g. neurosurgical interventions) should be performed by a consultant familiar with the care of children and who regularly updates these skills. Rare procedures (e.g. emergency thoracotomy) will be performed by the most experienced doctor present.
- Time-critical interventions (such as evacuation of a rapidly expanding intracranial haematoma) will be performed by the most skilled person present, as for any trauma case, adult or child. Time-critical abdominal surgery may have to be commenced by a non-paediatric surgeon but a consultant paediatric surgeon should be available to the MTC within 30 minutes. This advice is in line with current recommendations on delivering safe and effective care for children in secondary care settings.²⁰
- Following assessment, imaging, stabilisation and prioritisation of the treatments required it may become clear that secondary transfer to a hospital with higher paediatric capability is necessary.
- If further emergency surgery or critical care is needed, it should take place in hospitals with children's inpatient facilities and with access to paediatric intensive care. The

availability of paediatric intensive care has an effect on the outcome of children with major injury, with those having access faring better.²² This means that transfer of patients to another facility is more likely to be required in the first hour or two of care in children than it is in adults (provided the benefits of transfer are greater than the concomitant risks).¹⁰ There may be a case for stabilisation and early transfer of such cases by non-PIC teams from the referring hospital for definitive emergency surgery, or for early emergency surgery by non-paediatric neurosurgical and surgical teams in life threatening situations prior to transfer for further definitive care.

- Any hospital (Children's MTC, Combined MTC or TU) receiving children with major trauma should be able to deliver high dependency level care for children.¹⁸ All services accepting children with major trauma should have access to a high-dependency service supervised by a consultant team experienced in paediatrics within the Network. .
- Network guidelines should assure the safe, rapid and direct secondary transfer of children to specialist care, with a named clinician for each child to be responsible and accountable for their management, referral and transfer of care to a specialist centre.
- Paediatric neurosurgery consultants should be available for consultation and care to the Trauma Network 24/7 and should be involved in all decisions to operate for traumatic brain injury.
- CT scanning should be immediately available and staffed 24/7. Time to CT depends on patient factors and likely need for secondary transfer. Children's MTCs, Combined MTCs and TUs are all designated to receive major trauma so should have this capacity. CT scanner suites in hospitals who may receive children with major trauma must be appropriately equipped for the ventilation and monitoring of children of all ages, even if that is not their usual patient group. A structured written report should be issued within an hour of the scan being performed by the on call CT radiologist. There should be immediate verbal reporting of any life threatening injuries.
- Paediatric neurosurgeons need to be informed once the diagnosis of a serious head injury has been made. A management plan should be created for children with severe head injury by the paediatric neurosurgical consultant and consultant in paediatric intensive care within one hour of CT imaging. This should address surgical treatment, intra-cranial pressure monitoring and paediatric intensive care.¹⁰
- The Network should make provisions for 24/7 advice from, and timely transfer to, other acute specialities as the child requires, including: specialist paediatric neurosurgery, neurology, cardiothoracic surgery, interventional radiology, burns, dental surgery, vascular surgery, spinal surgery and rehabilitation services.
- Ongoing care of children with severe head injury (Glasgow Coma Score (GCS) ≤ 8) must be managed in a centre with a paediatric neurosurgical service, irrespective of the need for surgical intervention.²³ Transfer to an appropriate centre, if required, should occur after life-saving critical intervention. Facilities to manage the other injuries and consequences of those injuries must be available.
- There should be 24/7 support from a centre specialising in children's burns to advise on management decisions and transfer of the child if necessary.
- Paediatric intensive care and paediatric high-dependency units should comply with minimum generic standards of the Paediatric Intensive Care Society.¹⁸ There should be the presence of a nominated lead / liaison consultants for paediatric anaesthetics and critical care. Paediatric critical care units must form part of a constituted paediatric

intensive care network and subscribe to a nationally recognised audit process. This will ensure complete reporting and accuracy of data collection.

- Where there are safeguarding concerns these should be addressed simultaneously and rapidly, which will require good communication between the specialist team and the local team responsible for the child protection investigation.

3 Ongoing care and reconstruction

Clinical Advisory Group report summary

This section refers to the period of ongoing care after the first 24 hours. The effective management of this phase of care is crucial to optimising diagnostic, surgical and therapy input and resources. This clarity in management is of considerable benefit to the child's family as they face the considerable stress of providing support for their injured child.

Recommendations:

(Please read in conjunction with section 4.3 of the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010))

- The important role of family should be acknowledged and actively supported. This may include the extended family if the child's parents were involved in the initial accident
- Within any MTC, the child's care should be overseen and coordinated by a Trauma Service. Paediatric neurosurgeons must take the lead with any child with a severe traumatic brain or spinal cord injury.
- All children involved in major trauma should be admitted under the care of one of the Trauma Service consultants. This designated consultant should take responsibility for liaising with specialist centres for advice and transfer of the child as necessary.
- The child's ongoing care should be delivered by specialty teams where required, and overseen by the designated Trauma Service consultant. A consultant paediatrician should be involved throughout.
- Paediatric anaesthesia services should be available for all surgery required for children admitted with major trauma.
- Cross-speciality supporting services and facilities should also include children's and young people's nurses, physiotherapists, occupational therapists, child neuropsychologists, educational psychologists, teachers, clinical psychologists, play therapists, dieticians and speech and language therapists trained in the care of children. There should be flexibility in accessing these across the Network to avoid inequality.
- The Trauma Service should include a care and rehabilitation coordinator (Major Trauma Coordinator) who is responsible for coordination and communication regarding the child's current and future care and rehabilitation. This person should have experience dealing with children and young adults and their specific rehabilitation needs and should be prepared to be flexible about age limitations to treatments so that the optimal rehabilitation schedule can be followed. The coordinator should particularly ensure that the ongoing management of the injured child is planned in a timely fashion, to reduce unnecessary delays along the care pathway.
- Children with multiple injuries should be nursed in dedicated children's surgical wards, when they do not require intensive or high-dependency therapy. They should have access to operating theatres with appropriate equipment and theatre personnel must have the relevant skills to manage a child.
- There should be 24/7 availability of CT, MRI, ultrasound, interventional radiology and angiography in Combined MTCs and Children's MTCs available to the Network as fits local provision, capable of providing this care for children.²⁴

- All hospitals taking children involved in major trauma should have a consultant led acute pain service with experience of assessing and managing children with major injury.²⁵ This should complement the recommendations for a specialist pain service as outlined in the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010) - Section 4.2.3.2.
- Definitive planned surgery for amputations should be performed in consultation with paediatric rehabilitation and prosthetic services.
- There should be cross-network agreements, guidelines and adequate resources to ensure that once specialist medical care has been completed, children can be transferred to the care of a service that is able to meet their ongoing care and rehabilitation needs. The number of transfers should be limited to reduce secondary insults to the child and stress to parents.
- There should be clear and active management plans in place in all Networks for the care of the dying child. Advice should be available to the Network 24/7 on end-of-life management and organ donation. Proactive, appropriate and sensitive support must be provided to family and staff in line with national guidance.²⁶

4 Rehabilitation

Clinical Advisory Group report summary

For children involved in Major Trauma, rehabilitation is essential to address the physical, educational and psychosocial needs that result from their injuries and experiences. The rehabilitation of injured children is often poorly co-ordinated, with staff that are not always fully trained and competent in assessing and planning for their needs. The rehabilitation needs of children following major trauma are complex, diverse, and evolve over time, with specific patterns of difficulty which are unique to injured children (such as behavioural, learning and growth-related challenges). Children need contact with their families, schools and communities; so ideally services should be as close to home as possible. The educational needs of the child must be met during this period to allow full re-ablement and to reduce any loss of their future potential. Maintenance of the link with their school and peers is vital.

Informing and educating parents in paediatric intensive care has been proven to reduce post traumatic stress disorder and reported parental stress.²⁷ The family environment and coping mechanisms also affect outcome.²⁸ Support for parents and families throughout the process is therefore of paramount importance.

Recommendations

(Please read in conjunction with section 5.3 of the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010))

- An arbitrary age cut off for access to rehabilitation is not beneficial to patients. All those involved should work together to provide the best care package for children. Adolescent care requires a different set of skills and facilities to children's or adult rehabilitation care. Some children over the age of 16 may wish to be treated in adult wards, by adult-trained health care professionals. Adult and paediatric services throughout the Network must agree to clearly define pathways of care for children of all ages. This includes the establishment and maintenance of locally agreed and clearly defined transition services, particularly with regard to rehabilitation, both in hospital and in the community.²⁹
- The paediatric rehabilitation team should become involved with the child's care and family support as soon as is appropriate after admission, preferably during the acute phase of care.²⁸ It should continue at the intensity required, and for as long as is necessary, to enable children to achieve their functional potential.
- All children must have equal access to any neuro and physical rehabilitation services they require, regardless of where they received their acute and ongoing care.
- The Trauma Network Director of Rehabilitation should have experience in, or access to advice on, paediatric rehabilitation. They should have clinical oversight of the Network's rehabilitation services.
- Each Network should identify a named lead consultant in paediatric neurodisability, who will provide rehabilitation services where required and act as the source of expert advice for Network local paediatricians and general practitioners and to facilitate the local delivery of services where possible. They will report directly to the Trauma Network Director of Rehabilitation regarding the rehabilitation management of injured children. The CAG recognise the need for flexibility in implementation of this service - it may not be necessary for the tertiary service to be co-located with other major trauma services.

- The clinical remit and geographical boundaries of children's major trauma rehabilitation networks are generally best aligned with existing rehabilitation networks for all children with acquired brain injury (traumatic or non-traumatic).
- There should be children's rehabilitation and care coordinator posts throughout the network. They should work with multidisciplinary children's rehabilitation teams in a networked model to allow care close to home as soon as possible. There should be recognition that the intensity of rehabilitation therapy required in the early post-injury phase, and familiarity with the specific challenges of acquired neurological injury with or without additional polytrauma may require prolonged involvement of specialist services, possibly on an inpatient basis.
- Neuropsychology services should be readily accessible for children and young people with traumatic brain injury, to assess the degree or neurological damage and its impact on learning, memory and mental health. Programmes should then be based on these assessments to improve function in these areas and to provide liaison with educational psychology services and local clinical psychology services for ongoing rehabilitation. Issues of inequalities throughout the Network in rehabilitation services, availability of therapists and equipment provision will need addressing. There should be a nationwide review of all services providing rehabilitation to children who have sustained traumatic injuries.
- There should be a network-wide school re-integration policy for children following major trauma and traumatic brain injury. A specialist rehabilitation team should advise on school needs. Children's MTCs should have school services that are experienced in supporting children following major injury and that will act as liaison for school services in all Network hospitals. Appropriate expertise is likely to be available (albeit with limited capacity) within existing tertiary paediatric neurology/neurodisability services and services should build on, rather than duplicate such expertise.
- Early and regular contact should be made with the local paediatrician, general practitioner and multidisciplinary team so they can be involved in planning the long-term care of the child from an early stage. This must be an inclusive process involving all services and health professionals involved in the child's care.
- Vital rehabilitation equipment, including wheelchairs and mobility devices, should be made available as soon as possible. This must not delay the child's return home. Existing NHS mechanisms for provision of rehabilitation equipment may not be able to respond to a child's rapidly changing needs in early phase rehabilitation and "loan pools" of specialist equipment may be required.
- Networks should actively work with local authorities to ensure a robust and joined-up discharge plan is made for all children following the inpatient phase of rehabilitation.
- There should be a review of outcome measures and assessment tools for major trauma in children. Possible measures include functional independence, health status, school attendance and achievement, survival, social dependency, function, mental health of parents and time out of employment for parents.³⁰ There should be linked data sets for the seriously injured child that run from pre-hospital to the rehabilitation phase.
- A directory of children's services and resources should be developed relating to rehabilitation and ongoing care to facilitate referral and access to services within the Network and beyond.
- Financial flows should encourage innovation and effective pathway development. Possible tariff options are:

1. Pathway Based Tariff: based on the whole or a substantial part of the journey from the point of injury through to the end of rehabilitation. The recognition of the place of early assessment and intervention by rehabilitation services should be reflected in the design of such a tariff.
2. Rehabilitation Cycle Based: Different levels of tariff should be based on clinical complexity and could group into a range of Healthcare Resource Groups; patients' needs should be defined and reassessed at intervals and the appropriate rehabilitation interventions prescribed to include physical, neuropsychological and educational.

5 Network Organisation

Clinical Advisory Group report summary

Children involved in major trauma have different needs to their adult counterparts. Children's services vary throughout the country and differ from those for the adult population. When planning Networks, commissioners must be aware that there are relatively fewer children's specialists and that the numbers of children affected by major trauma are small. The underlying principle should be that the Network must ensure safe receipt and stabilisation of severely injured children, with the recognition that this phase of care, especially life-saving interventions, will often be provided by staff practising mainly in adult practice, albeit often with paediatric expertise.¹⁰

A Network is a managed set of providers of trauma care, particularly pre-hospital services, other hospitals receiving acute trauma admissions, and rehabilitation services.^{30,31} A Trauma Network needs to be able to provide high quality care for all age groups. The centre of each Trauma Network could be either a Children's MTC or a Combined MTC. Where the journey time exceeds 45 minutes to a Children's MTC or Combined MTC, life-saving interventions may have to be performed at an Adult MTC or Trauma Unit, whilst always minimising the delay before transferring to the appropriate unit. There must therefore be flexibility in how local Networks make practical provision for implementing children's major trauma services whilst striving for the best possible practices and outcomes.^{10,31}

Recommendations

(Please read in conjunction with section 6.3 of the NHS Clinical Advisory Groups Report on Regional Networks for Major Trauma (September 2010))

- Trauma Networks should be actively engaged in injury prevention for children.
- The NHS should establish inclusive regional Trauma Networks for Children across England, which may be different to those of the adult population. Owing to the relatively low frequency of major trauma in children, the designated Children's MTCs and Combined MTCs are likely to provide care to a larger population and geographical catchment area than their adult counterparts.
- Nationally accepted designation criteria should be developed for Children's MTCs, Combined MTCs as well as Adult MTCs and Trauma Units, and commissioners should require these units to meet and maintain those standards. This could be taken forward by the proposed National Trauma Board.
- Pragmatically there are two logical network designs based on the established regional arrangement of children's services. Either the seriously injured child follows the same pre-hospital pathway as the adult and is managed in a Combined MTC, or the pre-hospital network is similar but the destination is a dedicated Children's MTC. Where possible they should be aligned closely with existing surgical and anaesthetic networks, pathways to facilitate implementation and continued joint working. The Network must take responsibility for any referrals of major trauma in children.
- The Network should be configured therefore to deliver the seriously injured child to a designated Children's MTC or a Combined MTC directly where possible. It may sometimes be necessary for treatment to be initiated in an Adult MTC or Trauma Unit depending on geography. transfer times and other local determinants – in this case, transfer to a Children's MTC or a Combined MTC should be carried out as required after

initial assessment, optimisation and any life-saving interventions. This will rely on a high level of collaboration and joint working across all services, both within the MTC and with other units in the Network. These will be subject to Network governance – co-location of services alone is not sufficient. The care of the injured child must not be compromised and is the responsibility of all services within the MTC and the Network.

- Co-operation may well be necessary between two or more specialist centres and provisions should be made for this. Personnel from a centre fully competent to manage small children may need contractual and commissioning arrangements to provide receiving Adult MTCs or Trauma Units with appropriate telephone advice availability and (exceptionally) on-site attendance when needed.
- Network coordinators should be available 24/7 to manage the transfer of children between providers. They should be responsible for each part of the child's pathway from pre-hospital care through to the rehabilitation stage.
- Each Network should implement a Performance Framework to underpin quality improvement and to provide assurance to commissioners.
- Trauma Networks should have quality improvement programmes operating at all levels.
- Local feedback systems should be developed throughout the Network so each seriously injured child's care is examined in order to learn and improve future provision. There are greater difficulties in the coordinated care of children than for adults and the case volume is small, therefore each case should lead to direct learning for the future
- Submission of full and accurate data to TARNlet and PICANet must be achieved by all trauma care providers for successful performance management and clinical governance. Commissioners should empower clinicians to drive more comprehensive data collection and reporting of children's trauma, and hold both clinicians and service managers accountable for provision of this data.
- Child injury research should be integrated into the provision of trauma care.
- The scope of the National Trauma Board should formally include the care of the seriously injured child.
- Future regulators of health services should consider a whole network approach, rather than just individual institutions, when examining quality and standards.

6 Overriding essential considerations in the management of trauma in children

The CAG also recommends the following essential elements in the management of children with major trauma:

- Formal arrangements for safeguarding of children must be implemented and organised on a regional level in accordance with guidance contained within the recommendations of the Royal College of Paediatrics and Child Health.³²
- Counsellor or social worker support should be available to liaise with and support families throughout the child's pathway of care.
- Services should be "child friendly" and children and young people should be encouraged to participate in their care and the provision of services.³¹
- Families should have information, encouragement and support to enable them to share in decisions about the child's care and to remain informed about their condition and management. Children and young people must be informed about, and have active involvement in decisions related to their own ongoing care.^{32,33}
- Practical support such as directions and parking information, interfaith and spiritual support, social services, advice on financial support, interpreters, bereavement support and patient advice and advocacy services should all be available to families.
- Arrangements should be made to provide accommodation for families during their child's ongoing care, especially in the acute phase where the geographical distances between an MTC and the family home may be particularly marked.
- Families should have access to information directing them to other sources of support relevant to children's illness, including voluntary sector support groups.
- Injury prevention programmes are an integral part of the commissioning cycle. While the clinical pathway starts at the point of injury, the commissioning cycle starts with a strategic needs assessment of the hazards within the local community, programmes to reduce the hazards or exposure to hazards, coupled with evaluation of these programmes. Injury prevention programmes may be based on health protection, health promotion or health education strategies. The use of emergency department information systems for the purpose of injury surveillance to ascertain local injury patterns and to monitor the impact of interventions should be encouraged.^{33,34}

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