Best Practice Guidance for Surgical Aspects of Paediatric Spine Surgery in the UK

Executive Summary

Paediatric deformity spine surgery represents a low-volume, high-complexity (LVHC) area of spinal practice with a well-established and accepted governance processes

These standards are based on British Scoliosis Society and British Association of Spine Surgeons standards of care and are reflected in the Complex Spine Surgery Service Specification. Elements of this document are essential, such as the adherence to service specifications, job planned two consultant operating and adequately resourced MDT and British Spine Registry compliance. The document otherwise supports clinical judgement within structured governance frameworks.

1. All centres providing paediatric spine surgery must adhere to the Complex Spine Surgery Service specification found here.

2. To have a practice in paediatric spine surgery, the surgeon must have had at least 12 months of training in a paediatric deformity fellowship, followed by at least 12 months of mentorship period with an established paediatric spine surgery consultant.

3. All paediatric spine surgical cases must be discussed in a local MDT and surgical planning meeting. The membership of this is found in the main document. The minuted outcome should be shared with the patient and GP.

4. Regional and national Surgical Case review meetings may be used in the following situations:

- Extremely rare deformities
- Highly complex congenital anomalies (e.g. complex cranio-cervical anomalies, complex deformity in spinal dysraphism, congenital dislocation of the spine, neurofibromatosis with complex deformity)
- Cases requiring novel or non-standard techniques
- Situations where no clear consensus or agreement in treatment plan was achieved at local or regional level
- Nationally commissioned services

5. Complexity is multifactorial.

6. As a guide the following should be considered high risk / high complexity cases

- Any case identified at MDT to be high risk or particularly complex
- Any spine deformity that is identified at MDT to need corrective osteotomies beyond posterior based osteotomies.

- Any spine deformity needing anterior and posterior single staged surgery.
- Any spine deformity predicted at MDT as needing 6 or more hours of surgery.
- Any child 18 years or younger deemed at MDT to be at high risk from an anaesthetic, medical or surgical point of view.
- Any revisional deformity surgery requiring extensive further instrumentation or deformity correction.
- Any complex cranio-cervical, cervical or cervicothoracic deformity correction

7. Two consultant operating, (defined as both surgeons scrubbed), is already established in paediatric spine surgery.

8. The following guidance helps for operative planning:
- During the initial mentorship period of the primary surgeon, two consultant operating is needed with an established paediatric spine surgeon (preferably with at least 5 years' experience)
- MDT decision that two consultant operating would provide a better outcome in paediatric spine surgery requires two consultant operating.
- High risk/ high complexity needs two consultant operating – e.g. complex revisional surgery needing three column osteotomy.
- Moderate risk/ moderate complexity can be considered for post mentorship single consultant operating with a qualified assistant – e.g. flexible idiopathic scoliosis <80° Cobb angle.
- Low risk/ low complexity can be carried out by a single consultant operating with a qualified assistant.

9. All complications must be discussed in a local governance meeting, and a summary of findings should be discussed at the Surgical Case review meetings meeting with the aim of learning and improving practice.

10. Full compliance with the British Spine Registry is mandatory.

Background

Complex paediatric spinal deformity surgery encompasses a diverse range of congenital and acquired conditions requiring individualised treatment strategies. As in other LVHC specialties, management in paediatric spinal surgery often involves multiple potential surgical strategies, requires complex intra-operative decision-making, carries significant risk of complications and can be technically challenging. Best practice is therefore based on collaborative decision-making, peer-review and multiprofessional team working rather than individual practice

Principles

- Adherence to the Complex Spine Surgery service specification is considered mandatory for units undertaking complex spine surgery
- Complexity is multifactorial and context-dependent
- Experience, competence and capability thresholds are difficult to define
- Mentorship through the early phases of a consultant career should be supported
- Care should be delivered through collaborative practice models
- Peer review/ multidisciplinary team (MDT) discussion is central to best practice
- Governance should enable safe innovation and continuous improvement
- Participation and full compliance with the British Spine Registry is mandatory for units undertaking complex spinal surgery
- Job planning and adequate resourcing facilitates better compliance
- This guidance supports but does not replace clinical judgement

Purpose

The main aims of this document are to:

1. Define a paediatric spine surgeon operating on patients 18 years old or younger
2. Provide guidance on defining complexity in paediatric spine surgery
3. Support clinical decision-making and standardised governance processes
4. Promote patient safety and quality of care
5. Identify where enhanced MDT/Surgical Case Review discussion may be helpful
6. Identify situations where two consultant operating may be beneficial
7. Explore job planned mentorship roles within the NHS in this discipline

Sources informing this guidance:

- GIRFT spinal surgery recommendations
- Complex Spine Surgery service specification
- The Management of Spinal Deformity in the United Kingdom Guide to Practice 2001 (British Scoliosis Society)
- Established tertiary scoliosis centre pathways
- Existing complex spine MDT models
- Current UK clinical practice

To aid the decision making in complex paediatric spine surgery, this document will explore complexity, multidisciplinary and professional working and governance structures.

Defining a paediatric spine surgeon

To maintain standards and provide optimal care, a practising paediatric spine surgeon should have achieved the following:

- Fellowship training in spine deformity surgery (including paediatric spine surgery) of at least 12 months duration
- A minimum of 12 months of initial mentorship with a local experienced paediatric spine deformity consultant (ideally with at least 5 years of experience)
- Demonstrable regular exposure to paediatric spine deformity surgery (minimum 10 cases per year)
- Evidence of attendance and contribution at spine MDT and M&M meetings
- A rate of complications or significant events within the range expected on peer comparison (British Spine Registry and NCIP data)
- Compliance with the British Spine Registry
- Evidenced CPD for paediatric spine and deformity surgery assessed via Annual Appraisal

Mentorship is a key aspect of ensuring that expertise is shared rapidly and patients benefit from the best care possible. NHS Trusts should ensure mentorship is valued and remunerated through job planning. All new spine deformity consultant appointments must have a 12-month mentorship period for all deformity surgery and have an honest appraisal with their mentors at that point to confirm independent operating is appropriate.
To prevent a loss of senior input and experience in a unit, sessions specifically for mentorship and for operating as second surgeon should be provided by senior consultant surgeons when approaching retirement

Multiprofessional working and Multidisciplinary team meetings (MDT)

In the UK, multiprofessional working in paediatric spine surgery is already well established. The key professionals are outlined in the Complex Spine Surgery service specification.

MDT meetings

There should be regular, timetabled, job planned and adequately resourced MDT meetings with a defined attendance list. It is mandatory that all complex spine surgery is discussed, and treatment plans are agreed in a local MDT. All paediatric spine surgery is defined as complex as per the service specification.

A good functioning MDT adheres to the following principles:

- Provides a forum for open discussion with the principles of appropriate challenge of ideas without repercussion and in the best interest of the patient. All voices should be heard equally. Consensus does not have to be achieved in each case, but there should be agreement that the proposed treatment has merit and will provide a similar

or superior outcome to other options. Where this is not achieved, the case can be referred to the Surgical Case review meetings or referred for a further opinion.

- MDT runs at least monthly
- MDT membership for paediatric spine surgery cases must consist of:
    - MDT administrator / coordinator
    - at least 3 deformity trained consultant spine surgeons and the surgical team
    - radiologist
    - clinical nurse specialists / advanced care practitioners
    - paediatrician (where appropriate)
    - anaesthetist / intensivist (where appropriate)
    - oncologist, neurologist, oncologist, other specialty (where appropriate)
    - orthotist, occupational therapist, physiotherapist (where appropriate)
    - pain specialist (where appropriate)
    - microbiologist, infectious diseases (where appropriate)
    - other professional as appropriate
- MDT presentations must be made with the treating consultant surgeon present and following a recent assessment
- The recent clinical status, individualised concerns, treatment plans and imaging should be presented
- All treatment options should be explored (including non-surgical options)
- Attendance is mandatory for surgeons as an important direct clinical care session
- There must be reliable and resourced administrative support to coordinate cases and to record minutes and outcomes, which must be attached to the patient record. Actions must be followed through and tracked by the admin staff until completion.
- It is good practice to send a copy of the MDT outcome to the patient and other treating clinicians

Best practice options include:

- A separate deformity MDT
- Attendance by theatre coordinators to confirm upcoming procedures, special equipment requests and particular concerns as part of the surgical planning aspect of the meeting
- Review of all postoperative imaging and discussion of inpatient progress
- Postoperative outcomes for complex and unusual cases for discussion and learning
- Regular peer review of MDT process

National / Supra-regional / Regional Surgical Case Review

The purpose of cross-centre / national discussion is to support optimal decision making in rare and challenging cases, facilitate shared expertise across centres and promote consistency in highly specialised care. Regional Surgical Case Review can be facilitated by the regional spine networks. Some may involve national expert groups. Regional Surgical Case Review meetings are currently not fully resourced.

This should be reserved for rare and complex cases only and is not required for all paediatric spine surgery cases. These must be used to support, not delay, patient care.

Paediatric spinal conditions may warrant national or supra-regional discussion in the following circumstances:
• Extremely rare deformities
• Highly complex congenital anomalies (e.g. complex cranio-cervical anomalies complex deformity in spinal dysraphism, congenital dislocation of the spine, neurofibromatosis with complex deformity)
• Cases requiring novel or non-standard techniques
• Situations where no clear consensus or agreement in treatment plan was achieved at local or regional level
- Nationally commissioned services

Complexity

Recognising and defining the complexity of patients is important as it will determine potential perioperative optimisation, multiprofessional input requirements and management strategies. Complexity also has an impact on the risk profile of any surgical management. Complexity is determined by multiple factors, all of which need to be considered.

1. General patient factors

Paediatric spine patients may have syndromes or comorbidities associated with their scoliosis that will influence the best pathway of care and the ultimate surgical management. Some of these comorbidities may make surgical treatment higher risk in terms of morbidities and even mortality. The need for multiprofessional input is amplified in these patients. Even without defined comorbidities, patient factors such as nutritional status and mental health may impact on the complexity and risks of surgery. The age of the patient and aetiology of the spine disorder also needs to be considered when evaluating for complexity.

Consider the following patient factors when assessing complexity:
• Comorbidities
• General status
• Aetiology
• Age

2. Disorder specific factors

The majority of paediatric spine surgery patients will have a spine deformity to manage. A more severe, stiffer curve may need several surgical strategies and stages to effectively correct and maintain correction of curvatures. Adjuncts may be required perioperatively and more complicated, technically challenging surgery such as osteotomies may be needed. Rarer problems such as high-grade spondylolisthesis or tumour related conditions add another dimension of complexity.

Consider the following deformity factors when assessing complexity:
• Severity and stiffness of curve
• Underlying bony anomalies

- Vulnerable cord and high risk of neurological deficit
- Longer instrumentation requirements
- Fixation into additional spine regions (cervical or pelvis)
- Predicted high blood loss
- Revision surgery

3. Surgical factors

Often tied in with other factors, the surgery required varies depending on the spine problem presented. The need for extensive instrumentation, varying degrees of osteotomies or multiple stages at a single sitting all increase the complexity of surgery. Revision surgery is more challenging especially with altered anatomy, as is instrumentation in the very small child with smaller, softer bone.

Consider the following surgical factors when assessing complexity:

- Long instrumentation
- Need for osteotomies (releases) and degree of osteotomy (e.g. three column osteotomy)
- Fixation to pelvis
- Fixation to cervical spine
- Multistage surgery and single sitting multistage surgery
- Predicted long operative time (>6 hours)
- Predicted high blood loss
- High risk of neurological deficit
- Revision surgery
- Bony anchor concerns (size, type, bone status)

4. Surgeon factors

Experience, competence and capability all vary from surgeon to surgeon. All three characteristics tend to improve with time and exposure to the same problem repeatedly. However, recognition of each patient and patient problems as individual is paramount in good surgical decision making. There is no doubt that more mishaps occur when decisions are surgeon centred rather than patient centred. Modern spine surgery practice has made us all more open to shared decision making in MDT meetings and with patients. MDT and governance meetings have improved peer review as an embedded aspect of spine surgical practice. The surgeon should always ensure that the patient comes first, and where experience in a particular pathology or surgical technique is not high, it should be recognised that, to that surgeon, this is a complex case. Support in this scenario should be readily available. Experienced surgeons are at risk of underestimating complexity or the need for support, hence an MDT discussion of cases to explore all aspects is important. The surgeon should also recognise that complex surgery will have better outcomes when operating with a colleague to reduce surgeon fatigue and allow better management of intraoperative variances and complications with a second experienced colleague.

Consider the following surgeon factors when assessing complexity:

- Surgeon’s training and post CCT experience

- Surgeon experience with that patient category or condition
- Surgeon experience with that surgical technique
- MDT discussion of potential issues
- Surgeon fatigue (e.g. long surgical time, single sitting multi-staged operations)
- Risk of intraoperative variances

5. Organisational Factors

The Complex Spine Surgery service specification clearly outlines the organisational requirements for performing this sort of surgery. These are mandatory and varying from them can put patients at risk.

Appropriate job planning for MDT and other aspects highlighted in this document are also important to reduce variability in practice between units.

Complexity assessment should be revisited where there is a significant interval between listing and surgery. In skeletally immature patients, clinical progression, remaining growth and interval imaging should be considered where these may alter prioritisation, operative strategy, risk or the need for additional expertise.

6. High risk / high complexity

Complexity should consider all the factors mentioned previously. As a guide the following should be considered high risk / high complexity cases

- Any case identified at MDT to be high risk or particularly complex
- Any spine deformity that is identified at MDT to need corrective osteotomies beyond posterior based osteotomies (facet, Ponte or chevron osteotomies) for example 3 column bony osteotomies.
- Any spine deformity needing anterior and posterior single staged surgery.
- Any spine deformity predicted at MDT as needing 6 or more hours of surgery.
- Any child 18 years or younger deemed at MDT to be at high risk from an anaesthetic, medical or surgical point of view.
- Any revision deformity surgery requiring extensive further instrumentation or deformity correction.
- Any complex cranio-cervical, cervical or cervicothoracic deformity correction.

Reviewing outcomes and complications

Learning from complications, near misses and system failures are an important part of improving surgical care for patients. Similarly learning from successes and disseminating best practice is an essential part of good practice.

A good functioning unit must empower all members of the team to record all complications (anonymously if needed) for presentation at a Morbidity and Mortality meeting (M&M). Each case should be discussed to determine the following:

- There was appropriate decision making and planning

- An appropriate surgical technique was utilised and was within the experience of the operating surgeon(s)
- The complication or variance was identified appropriately
- Appropriate steps were taken to remedy the situation
- The ongoing management is appropriate
- In the case of mortality, the CEPOD grading should be recorded (https://www.ncepod.org.uk/grading.html)
- Departmental and national policies were followed (e.g. antibiotic prophylaxis)
- Could the complication have been avoided
- Lessons learnt for future situations are recorded and disseminated and departmental policy changes made as appropriate
- A summary of M&M findings should be shared and discussed at Regional Spine Network governance meetings for a wider discussion and learning

Significant complications should be reviewed as part of AAR / PSIRF as per NHS policy, and any relevant findings disseminated to the wider team, including the network.

All procedures and any complications must be recorded on the British Spine Registry.

Two Consultant Operating

Two consultant operating (defined as two consultants scrubbed in theatre) is an established practice in paediatric spine deformity surgery.
The benefits include:
- Sharing expertise and decision making intraoperatively
- Reducing operative time
- Reducing complications
- Minimising fatigue and burnout
- Enhancing safety
- Inbuilt peer review
- Part of mentorship

The disadvantages of two consultant operating include:
- Scheduling challenges
- Resource implications
- Impact on trainees

There is certainly a need for two consultant operating in UK paediatric spine deformity practice. It is not mandatory for every case, and once a deformity consultant is beyond their 12 months of initial mentorship, operating with a suitably skilled assistant (such as a suitably trained spine fellow) is reasonable.

Case complexity will be one driver for two consultant operating. As a guide, see the section on complexity here.

As a guide, two consultant operating is preferable in the following situations:

- **High risk/ high complexity** (e.g. revisional deformity correction requiring osteotomy)
    - The management plan must be discussed at the local MDT with a minimum of 3 deformity trained surgeons. If agreement is not achieved, then further discussion should happen at a regional Surgical Case Review meeting with 4 deformity surgeons capable of managing that problem. There should be a defined outcome of the meeting, and a discussion of the outcomes from surgery at subsequent meetings.
    - The surgery should be carried out by two consultants with deformity fellowship training at least one of who is beyond their first year and has post-mentoring experience to undertake the surgery.
- **Moderate risk/ moderate complexity** (e.g. AIS with a flexible curve <80°)
    - The management plan needs to be discussed and agreed at local MDT level
    - The surgery can be carried out by one consultant with deformity fellowship who is beyond their first year and has post-mentoring experience to undertake the surgery with a suitably qualified assistant e.g. complex spinal fellow
- **Low risk/ low complexity** (e.g. lumbar discectomy or uninstrumented decompression)
    - The management plan needs to be discussed and agreed at local MDT level
    - One consultant with deformity fellowship training with a qualified assistant, e.g. complex spinal fellow
- **During the initial mentorship period of the primary surgeon**
    - The period may vary, but is usually the first 12 months of a consultant career
    - Any deformity correction in this period should be two consultant operating
    - Routine risk procedures such as discectomies, growing rod lengthening do not require two consultants even in the mentorship period if the surgeon has evidence of capability in the procedure
- **MDT decision that two consultant operating would provide a better outcome**
    - This may be due to complexity, length of surgery, ability or other factors

Summary

This document proposes a best practice framework to support:

- Patient safety
- Clinical decision-making
- Governance
- National consistency and reduction of variability

This framework is not intended to mandate practice, but to support high-quality complex spinal care which is patient centred.

References

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