

## **Discussion paper: Appendicitis in Children. Implementing commissioning guidance and improving outcomes for all children in the South Thames Paediatric Network**

The South Thames Paediatric Network (STPN) Surgery in Children working group has representatives from across the region from specialist children's surgery, general surgery, adult urology, paediatric and adult anaesthesia, paediatric nursing and commissioners. In 2020 the STPN working group proposed that children under the age of 5 years should be transferred to tertiary paediatric surgery/urology centres for management of appendicitis. Children older than 5 years should be treated in their local centre. Children with complex needs or particular clinical challenges older than 5 years of age, that need transfer to tertiary centres, should still be transferred immediately.

### **1. Proposal**

The STPN General surgery in Childhood Group and the STPN Board propose that all children with appendicitis over the age of 5 years of age should have their surgery in the first hospital they attend unless there are complicating medical reasons requiring transfer to a tertiary center.

Children under the age of 5 years with suspected appendicitis should be transferred to the specialist tertiary centres.

### **2. Introduction**

Appendicitis is a common condition in children. In general, around 10,000 children require an appendectomy each year in England and 1200-1300 in the South Thames region.

In order to explain the process behind the ODNs proposal we will look at the issues impacting general paediatric surgery in the DGHS, the historical trends and the evidence relating to the best possible outcome for children.

#### What is Appendicitis?

Appendicitis is a common condition. However, it can be difficult to diagnosis and differentiate other causes of acute abdominal pain in younger children or other causes of non-specific abdominal pain. Non-specific abdominal pain can present with recurrent symptoms, diffuse pain, no associated symptoms and can be apyrexial, mobile and non-tender on examination.

Classical symptoms of appendicitis consist of central abdominal pain which is intermittent in nature which then migrates to the right iliac fossa where it becomes constant in nature. Patients can have anorexia, vomiting, pyrexia and significant discomfort on movement. Dysuria, diarrhoea and pallor can also occur.

General Paediatric surgery (GPS) is the surgical management of relatively common, non-specialised conditions in general surgery and urology in children who do not require complex perioperative care. Examples of procedures include inguinal herniotomy, hydrocele repair, circumcision and orchidopexy, as well as emergency operations such as appendicectomy, exploration for testicular torsion and repair of irreducible inguinal hernia. (1)

The migration of general surgery of childhood been district general hospitals (DGHS) to tertiary centres is well recognised. The shift has predominantly occurred in elective day case procedures and inpatient children's surgery. Emergency surgery still remains in the DGH. This is both a positive and negative factor in health care.

The argument of where paediatric surgery and specialist children's surgery should occur has been going on in the UK for years (2). In the 1990s and early 2000s there was a distinct push

to centralise complex paediatric surgery as it was argued that there would be a concentration of expertise, more appropriately skilled staff on call, availability of support and specialist services and improved training. The major disadvantages were identified as the impact of travel on the family and the loss of expertise at the local DGH level. While it was clear that neonatal surgery, specialist surgery and neonatal anaesthesia should be performed in specialist centers by specialists there was a distinct lack of thought on the impact of elective work in district general hospitals. This was further compounded by the removal of inpatient surgery beds from numerous DGHs to create day case surgery only facilities for children. A lack or absence of training in paediatric surgery for the younger consultants, the retirement of older surgeons with significant paediatric surgery experience and the diminishing elective general surgery of childhood workload combined with a huge ongoing emergency surgery requirement in the DGHs has led to a further chaos for the patient. (2)

It is critically important to listen to the child, the family and clinicians in this debate. Sadly, evidence regarding the patient and family's views are lacking in the literature. In 2012 NCEPOD surveyed clinical practice and opinions of consultant surgeons and anaesthetists caring for children in order to inform the needs for training, commissioning and management of children's surgery in the UK.

555 surgeons and 1561 anaesthetists completed the questionnaire.

Their findings are worth quoting in full. (3)

*'32.6% of surgeons and 43.5% of anaesthetists considered that there were deficiencies in their hospital's facilities that potentially compromised delivery of a safe children's surgical service. Almost 10% of all consultants considered that their postgraduate training was insufficient for current paediatric practice and 20% felt that recent Continued Professional Development failed to maintain paediatric expertise. 45.4% of surgeons and 39.2% of anaesthetists considered that the current specialty curriculum should have a larger paediatric component. Consultants in non-specialist paediatric centres were prepared to care for younger children admitted for surgery as emergencies than those admitted electively. Many of the surgeons and anaesthetists had <4 hours/week in paediatric practice. Only 55.3% of surgeons and 42.8% of anaesthetists participated in any form of regular multidisciplinary review of children undergoing surgery.'* (3)

Historically there was a concern raised that too many patients were being transferred from the DGHs to the tertiary centres thus decreasing the skills of staff in the DGHs, increasing travel and inconvenience for the family and filling the tertiary units with non-complex patients so there was limited bed space for complex paediatric surgery patients who were awaiting admission. This has not been proven to be wholly correct in the STPN region. The evidence shows that the vast majority of work is preserved in the DGH units and should be encouraged to remain there as it is of high quality.

### **3. Alternative suggestions**

In any proposal there are clearly other options that have been debated and reviewed. In the following sections we will discuss the pros and cons of the alternatives.

#### **A. Alternative ages for the transfer of children to tertiary centres.**

Numerous ages have been suggested over the decades relating to what is safe to be done in the DGH which has led to historic variations existing in different DGHs. Even within the SW ICS there has been marked variations on the ages in which appendicectomies have occurred in DGHs even over the last seven years. The difference in pathology between children younger than 5 years and older children is the most significant factor in early identification of patients with potentially complex appendicitis.

#### **B. Lowering the age of transfer to 2 years old.**

A number of arguments have been made nationally that 2 years of age should be the lower age for this operation in the DGH. This is due to the fact that official anaesthetic training produces consultants who should be able to care for a child down to the age of 2 years. This truism somewhat ignores the fact that general surgeons are not particularly trained to operate upon this age group. More importantly the disease and pathology are different in children less than 5 years with a much higher incidence of appendicitis abscesses and collections. Therefore, the STPN does not recommend that children less than 5 years old have this surgery in their local DGH centre.

#### C. Removal of appendicitis from DGHs.

One postulated response to the problems of providing appropriate cover and infrastructure for the management of children in the DGHs is to transfer the problem to the tertiary specialist centres. The proposed advantages of centralisation would be that the tertiary centre would be responsible for the care of all children with appendicitis and therefore radiology would be available and specialist review would be in place therefore leading to a better outcome for the child.

Thus, the flow diagram of the children's pathway with abdominal pain would consist of a combination of immediate treat and transfer from the emergency department in the local centre, redirection in order to prevent ambulances bringing the child to their local centre and bringing them to the tertiary centre and review of all patients in ED by both the general surgeons and the paediatricians.

In reality the majority of children with abdominal pain do not have appendicitis thus a huge number of children would need to be transferred for review and potentially returned to the DGH for ongoing management of a non-surgical condition.

The presence of large numbers of emergency operations on children such as appendicectomy and acute scrotum in the DGH maintains skills of both anaesthetics staff and general surgery and urology teams. To fully shift appendicitis and the appendicectomy in children from the DGHs would produce a hollowed-out service without minimal exposure to paediatrics. This would further destabilise the provision of surgery in childhood in the community resulting in less engagement from the adult general surgery and anaesthetics. Practically a consultant anaesthetist or anaesthetic trainee would have only the elective day case exposure in order to learn general paediatric and to maintain their competencies. Children's surgical emergency management in the DGHs would be compromised even further.

#### **4. Improving the Outcomes for children with appendicitis**

The STPN firmly agrees that the evidence demonstrates that safe surgery can occur in the local DGH for the vast majority of children with appendicitis over the age of 5 years.

In order to improve the outcomes for children with appendicitis we should be assessing a number of factors.

#### **5. The management of complex/complicated appendicitis**

Complex/ complicated appendicitis is reported in national studies to occur in 33% of all cases. By definition a complicated appendicitis diagnosis is due to a perforation of the appendix with either localised inflammation in the pelvis and generalised peritonitis. Thus, complicated appendicitis is associated with a perforated or ruptured appendix, appendix abscess, prolonged inpatient stay and higher risk of wound infection or post-operative pelvic abscess collection. In general, complex appendicitis is managed in tertiary centres due to the tendency for it occur in younger children less than 5 years old and the need for interventional radiology and specialist surgery to manage the expected complications such as the pelvic abscesses. Occasionally the child with complicated appendicitis is only identified in the intraoperative or post-operative phase. In such cases delayed transfer to a tertiary centre should occur.

In 2007 Landar et al compared paediatric appendicectomy practice in a specialist paediatric centre (SPC) with a district general hospital (DGH) over two year period. The median ages were similar at 10-11 years. The two major differences were that complicated perforated appendicitis occurred more commonly in tertiary centres 37% vs 18% in DGHs and that the negative appendectomy rate in tertiary centres was lower at 4% compared to 20% in DGHS. (4)

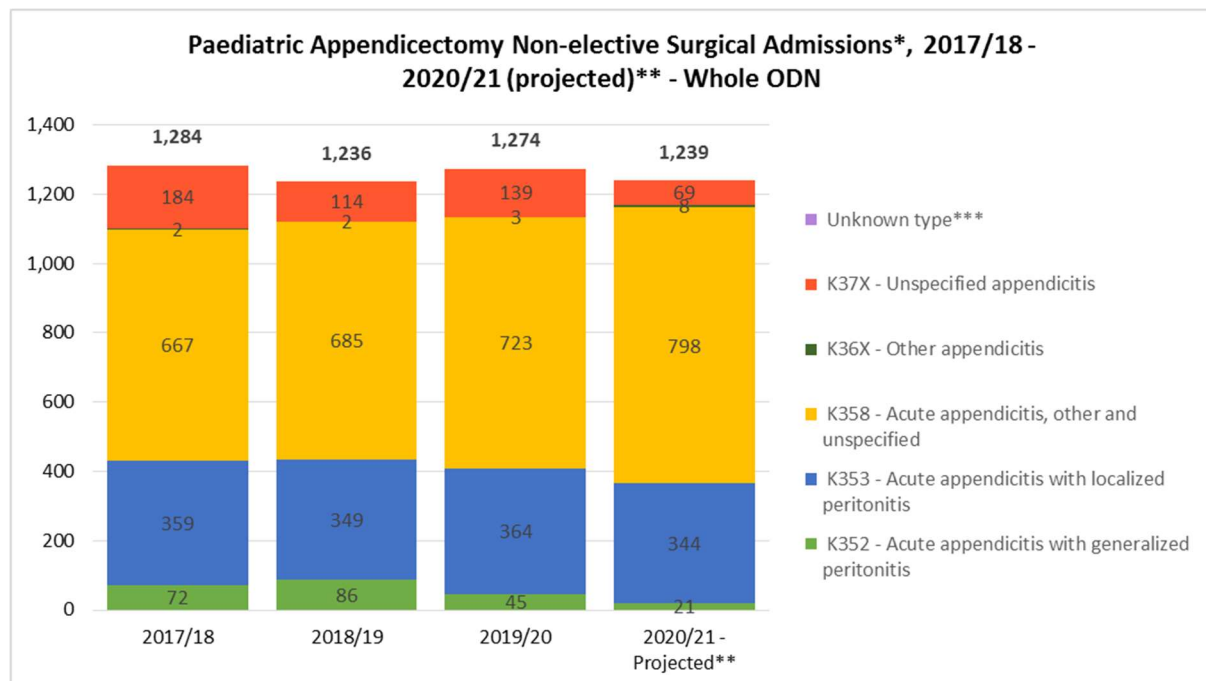


Table 1.

In table 1 the entire appendicitis cohort in children less than 16 years old in the STPN is described. In diagnostic codes most children either have complicated appendicitis with either localised or general peritonitis or simple acute appendicitis. The HES data shows a decrease across the entire region of complicated appendicitis from 431 in 2017/2018 to 365 in 2020/2021. This decrease in complexity which is presently unexplained and under investigation further demonstrates the importance of facilitating care closer to home, argues against centralisation for children with simple appendicitis and encourages the surgical skills to be maintained locally.

## 6. The number of negative appendectomies

A negative appendectomy is defined as the findings of a normal appendix at the time of surgery for suspected appendicitis and which is also confirmed as normal by histology. GIRFT acknowledges that a low negative appendectomy rate (NAR) in a unit demonstrates good diagnostic care pathway and as such is an indirect marker of the quality of the service. Adolescent girls have a higher negative rate due to ovarian pain mimicking appendicitis.

DGHs have been found through the GIRFT report to have a higher incidence of NAR which is thought to be related to the low use of imaging, less specialist paediatric surgery involvement acutely with the child and less paediatrician involvement in the care pathway. Ultrasonography is accepted as the gold standard radiological tool for assessment and diagnosis of appendicitis in children. This radiological tool needs to be available after office hours for children in order to minimize negative appendectomies. Kenny et al found similar results in 2010 the evidence pointed to higher readmission rates in DGHs which appeared linked to the lack of formal care pathways in appendicitis in DGHs. (5)

Further studies have demonstrated that elective surgery in DGHs compares favourably to outcomes measured in tertiary centres so we should be confident that the population groups are comparable. (6)

There is limited evidence that transferring children with abdominal pain to specialist centres for review improves their overall experience. Appendicitis is not the commonest cause of abdominal pain in children. Most cases of children presenting with abdominal pain have mild to moderate pain which is self-limiting in nature. It can be recurrent. Clinical pathways and combined with experienced staff in the emergency department can minimize the number of children admitted with abdominal pain for assessment.

The increasing tendency for ambulatory paediatric medicine and surgery means that children with recurrent pain who are less likely to have true appendicitis can be assessed, reviewed and cared for in an appropriate paediatric ambulatory clinic.

Overall the STPN seeks to reduce the NAR to 8% throughout the entire region within one year and 4% after three years.

### 7. Why 5 years old.

The management of appendicitis in the child less than 5 years can be immensely challenging. Firstly, children in this age range tend to present late to hospital. This is due to a number of factors

Children less than 5 years old have a higher incidence of peritonitis, abscess formation or the presence of an appendix mass on initial presentation. They have a higher incidence of drain insertion to empty pelvic collections as compared to uncomplicated older children.

It is well recognised that the appropriate management of children less than 5 years old in the DGH is more complicated. After initial resuscitation and commencement of antibiotics the local supporting tertiary centre should be notified and the patient transferred in a safe and prompt fashion. Abdominal ultrasound and occasionally CT or MRI cross sectional imaging are warranted occasionally.

2018/2019	% of Admissions by Provider That Are "Simple"	Appendicectomy performed locally		Predicted change based on patient's CCG		Volume change	
		MIN	MAX	MIN	MAX	MIN	MAX
HOSPITAL							
KINGSTON HOSPITAL	80%	98	98	103	103	5	5
ST HELIER HOSPITAL	58%	43	43	43	44	0	1
CROYDON UNIVERSITY HOSPITAL	42%	33	33	35	37	2	4
EPSOM HOSPITAL	0%	1	5	1	5	0	0
ST PETER'S HOSPITAL	58%	75	75	76	82	1	7
ST GEORGE'S HOSPITAL (TOOTING)	14%	101	101	90	94	-11	-7

We have assessed the potential impact of the formal change that children over 5 years remain in the primary trust for the SWICS and the other trusts that flow into St George's. The chart shows the number of uncomplicated appendicitis which was managed operatively in each trust. The second column demonstrates the total number of appendectomies in children less than 16 years old in each trust in the period 2018-2019. The third column predicts the minimum or maximum cases that would occur in each trust following implementation of the rule of 5 years.

As the data shows there is potentially a relatively small increase in the cases in DGHs and a concentration of complex/ complicated cases in the tertiary centre.

## 8. Next Steps

In reality the argument for transferring all children to specialist centres is somewhat moot. The key steps for improving the child's outcome and experience during appendicitis are already recognised.

1. There should be a clear agreed care pathway in the plan for assessment, diagnosis and management of children presenting with abdominal pain and suspected appendicitis for all hospitals in the STPN.
2. Ultrasonography is a useful tool in determining the other causes of abdominal pain and confirming appendicitis in difficult patients and should be available 24/7.
3. Once the diagnosis is definitely made, appropriate resuscitation, intravenous fluids and intravenous antibiotics should be commenced.
4. Children less than 5 years old or with complex medical needs or complicated appendicitis should be transferred to the agreed tertiary centre.
5. Online and in-situ regular education programs should be in place to ensure quality teaching for both paediatricians, anaesthetists and general surgeons in DGHs to maintain skills, competence and confidence.
6. There needs to be agreed reporting to the ODN and the local ICSs. Presently there is an online audit tool developed by the STPN which each unit needs to complete to assess the clinical governance risk.
7. A clear single transfer document such as the STOPP tool should be in place to facilitate prompt transfer.
8. A pragmatic future facing ODN led review of localised services and ensure plans are in place for training exposure for adult general surgeons and anaesthetic services to paediatrics elective and emergencies.

## 9. Quality Assessment tools

As per the commissioning guidance and recent ODN discussions there are a number of quality metrics that the STPN would evaluate and share with the relevant ICS.

- What percentage of patients have surgery within 6 hours to operate?
- What percentage of patients have pre-operative antibiotics and when were they given?
- Incidence of negative appendectomy (target less than 8%.)
- Monitor the complete length of stay in all centres and combined stays
- Reoperation rates.
- Number of children transferred to tertiary centres
- Number of children requiring surgery from ambulatory care/review
- Number of children of children operated upon following attendances at ED and discharge
- Number of children readmitted within 28 days

The STPN propose that children under the age of 5 years should be transferred to tertiary paediatric surgical for management of acute appendicitis. Children older than 5 years should

be treated in their local centre. Children with complex needs or particular clinical challenges older than 5 years of age, that need transfer to tertiary centres, should still be transferred immediately.

### References

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