MANAGEMENT IN CONFIDENCE

CLINICAL PRIORITIES ADVISORY GROUP
04 12 2018

Agenda Item No	02.1
National Programme	Cancer
Clinical Reference Group	Specialised Cancer Surgery
URN	1675

Title
Surgery for pectus deformities (all ages)

Actions Requested	1. Support the adoption of the policy proposition.
	2. Recommend its approval as an IYSD.

Proposition
This policy proposition recommends that surgery for pectus deformities should not be routinely commissioned. It should be noted that surgery for pectus deformities is currently available as a treatment option but access arrangements vary across the country. Implementation of a clinical commissioning policy will ensure there is an equitable access position across the country. Development of the policy proposition has considered the impact of surgery on both psychological and physiological outcomes, and found insufficient evidence to support the routine commissioning of this treatment.

Clinical Panel recommendation
The Clinical Panel recommended that the policy progress as a not for routine commissioning policy.

The committee is asked to receive the following assurance:	
1.	The Head of Clinical Effectiveness confirms the proposal has completed the appropriate sequence of governance steps and includes an: Evidence Review; Clinical Panel Report.
2.	The Head of Acute Programmes / Head of Mental Health Programme confirms the proposal is supported by an: Impact Assessment; Stakeholder Engagement Report; Consultation Report; Equality Impact and Assessment Report; Clinical Policy Proposition. The relevant National Programme of Care Board has approved these reports.
3.	The Director of Finance (Specialised Commissioning) confirms that the impact

	assessment has reasonably estimated a) the incremental cost and b) the budget impact of the proposal.
4.	The Operational Delivery Director (Specialised Commissioning) confirms that the service and operational impacts have been completed.

The following documents are included (others available on request):	
1.	Clinical Policy Proposition
2.	Consultation Report
3.	Evidence Summary x2
4.	Clinical Panel Report
5.	Equality Impact and Assessment Report

The Benefits of the Proposition – Before and after surgery comparison		
No	*Metric*	*Summary from evidence review*
1.	Survival	Not measured
2.	Progression free survival	Not measured
3.	Mobility	Not measured
4.	Self-care	Not measured
5.	Usual activities	Not measured
6.	Pain	Not measured
7.	Anxiety / Depression	**Anxiety** is not defined in the papers included in this rapid evidence review, but usually means a feeling of worry, nervousness or unease. Luo et al 2017 report a pre-surgery (7 days before surgery) mean score of 1.73 (out of a total score of 5, where 1 equals 'no' symptoms and 2 equals 'mild' symptoms) and a post-surgery (1 year after surgery) mean score of 1.58, an improvement of 0.15, p = 0.025. This suggests that the procedure may reduce anxiety, but the low reliability of Luo et al 2017 casts doubt on this. The result was not statistically significant after adjustment for the multiple tests reported by Luo et al 2017. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Reduced anxiety would be of benefit to patients, but Luo et al 2017 does not provide a secure basis for conclusions about this outcome.

		Depression is not defined in the papers included in this rapid evidence review, but usually means feelings of severe despondency and dejection. Luo et al 2017 report that the proportions of participants above a threshold for diagnosis of depression were preoperative 153/266 (57.5%) and postoperative 76/266 (28.6%), an improvement of 28.9%, $p < 0.001$. This suggests that the procedure may reduce the prevalence of depression, but the low reliability of Luo et al 2017 casts doubt on this. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Reduced prevalence of depression would be of benefit to patients, but Luo et al 2017 does not provide a secure basis for conclusions about this outcome.
8.	Replacement of more toxic treatment	Not measured
9.	Dependency on care giver / supporting independence	Not measured
10.	Safety	Sacco et al 2013 reported eight patients had bar removal after an average period of 30.3 months. No pectus excavatum (PE) recurrence, bar displacement, or upper sternal depression was reported in 7 patients. Post-operatively, 1 patient exhibited pectus carinatum (PC) after a separate spinal fusion surgery for scoliosis. One patient died of unrelated cardiac complications before bar removal.
11.	Delivery of intervention	There are two types of procedure available: • The Nuss procedure, which is a minimally invasive intervention generally only used to treat cases of PE. It involves placing one or two steel bars under the breastbone with the aim of raising it and correcting the abnormal shape. Each bar, bent into a curve to fit the patient's chest, is inserted through small openings in the chest. The bar (or bars) is/are usually removed within a few years of placement; and • The Ravitch procedure, which can be used to treat both PE and PC. In this technique the rib cartilages are cut away on each side and the sternum is flattened so that it will lie flat. One or more permanent bars or struts are inserted to ensure the sternum keeps its new shape.

Other health metrics determined by the evidence review: Before and after surgery comparison		
No	Metric	Summary from evidence review
1.	Somatisation	Somatisation is not defined in the papers included in this rapid evidence review, but usually means the manifestation of psychological distress by the presentation of bodily symptoms. Luo et al 2017 report a pre-surgery (7 days before surgery) mean score of 1.57 (out of a total score of 5, where 1 equals 'no' symptoms and 2 equals 'mild' symptoms) and a post-surgery (1 year after surgery) mean score of 1.23, an improvement of 0.34, p = 0.001. This suggests that the procedure may reduce somatisation, but the low reliability of Luo et al 2017 casts doubt on this. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Since symptoms were below "mild" before treatment, the improvement may be of little value. Reduced somatisation would be of benefit to patients, but Luo et al 2017 does not provide a secure basis for conclusions about this outcome.
2.	Interpersonal sensitivity	Interpersonal sensitivity is not defined in the papers included in this rapid evidence review, but usually means the ability to read other people's feelings and states, and to respond appropriately. Luo et al 2017 report no significant change in patients' interpersonal sensitivity, after Bonferroni correction for the use of multiple tests. This suggests that the procedure does not affect interpersonal sensitivity. Improved interpersonal sensitivity would be of benefit to patients, but Luo et al 2017 does not indicate that the procedure improves it.
3.	Role/social limitations: emotional, emotional difficulties	Role/social limitation: emotional is defined in Lomholt et al 2016 as a limitation in school work/play with friends due to sadness/worry in the last four weeks. Lomholt et al 2016 report patients' mean scores pre-surgery of 90.6 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 96.5, an improvement of 5.9, p=0.002, and 6

		months post-surgery of 98.7, an improvement of 8.1, p<0.0001. This suggests that the procedure may improve emotional health. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved emotional health would be of benefit to patients, but Lomholt et al 2016 does not provide a secure basis for conclusions about this outcome.
4.	Mental health problems	Mental health problems are defined in Lomholt et al 2016 as amount of time feeling unhappy, lonely, nervous and worried in the last four weeks. Lomholt et al 2016 report patients' mean scores pre-surgery of 82.6, (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 85.7, an improvement of 3.1, p=0.07 and 6 months post-surgery of 86.2, improvement of 3.6, p=0.04. Lomholt et al 2016 report parents' mean scores pre-surgery of 84.9, 3 months post-surgery of 87.6, an improvement of 2.7, p=0.14 and 6 months post-surgery of 87.9, an improvement of 3.0, p=0.04. This suggests that the procedure may improve mental health problems. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved mental health problems would be of benefit to patients, but Lomholt et al 2016 does not provide a secure basis for conclusions about this outcome.
5.	Role/social limitations: behavioural	Role/social limitation: behavioural is defined in Lomholt et al 2016 as a limitation in school work/play with friends due limits in behaviour in the last four weeks. Lomholt et al 2016 report patients' mean scores pre-surgery of 94.8 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 97.6, an improvement of 2.8, p=0.2 and 6 months post-surgery of 99.2, an improvement of 4.2, p=0.004. This suggests that the procedure may improve role/social: behavioural. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective.

		Improved role/social: behavioural might be of benefit to patients, but Lomholt et al 2016 does not provide a secure basis for conclusions about this outcome.
6.	Role/social: emotional and behavioural combined parental score	Role/social limitation: emotional is defined in Lomholt et al 2016 as a limitation in school work/play with friends due to sadness/worry in the last four weeks. Role/social limitation: behavioural is defined in Lomholt et al 2016 as a limitation in school work/play with friends due limits in behaviour in the last four weeks. Lomholt et al 2016 report parents' mean scores pre-surgery of 89.6 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 94.8, an improvement of 5.2, p=0.06 and 6 months post-surgery of 98.5, an improvement of 8.9, p=0.001. This suggests that the procedure may improve role/social: emotional and behavioural might be of benefit to patients. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved role/social: emotional and behavioural function might be of benefit to patients, but Lomholt et al 2016 does not provide a secure basis for conclusions about this outcome.
7.	Behaviour	Behaviour is defined in Lomholt et al 2016 as the extent of bad behaviour compared to other children of the same age in the last four weeks. Lomholt et al 2016 report patients' mean scores pre-surgery of 87.4 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 88.5, an improvement of 1.1, p=0.66 and 6 months post-surgery of 89.9, an improvement of 2.5, p=0.05. Lomholt et al 2016 report parents' mean scores pre-surgery of 85.8 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 87.3, an improvement of 1.5, p=0.28 and 6 months post-surgery of 87.4, an improvement of 1.6, p=0.30. This suggests that the procedure may improve behaviour. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective.

		Improved behaviour would be of benefit to patients, but Lomholt et al 2016 does not provide a secure basis for conclusions about this outcome.
8.	Self-esteem	Self-esteem is defined in Lomholt et al 2016 as satisfaction with appearance, activities and interaction with friends/family in the last four weeks. Lomholt et al 2016 report patients' mean scores pre-surgery of 83.0 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 87.1, an improvement of 4.1, p=0.004 and 6 months post-surgery of 89.3, an improvement of 6.3, p<0.001. Lomholt et al 2016 report parents' mean scores pre-surgery of 77.0 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 80.7, an improvement of 3.7, p=0.0 and 6 months post-surgery of 83.7, an improvement of 6.7, p=0.003. This suggests that the procedure may improve self-esteem. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved self-esteem would be of benefit to patients, but Lomholt et al 2016 does not provide a secure basis for conclusions about this outcome.
9.	Family activities	Family activities are defined in Lomholt et al 2016 as limitations in family activities due to behaviour/health in the last four weeks. Lomholt et al 2016 report patients' mean scores pre-surgery of 88.0 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 91.5, an improvement of 3.5, p=0.13 and 6 months post-surgery of 95.2, an improvement of 7.2, p=0.001. Lomholt et al 2016 report parents' mean scores pre-surgery of 89.0 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 95.1, an improvement of 6.1, p<0.001 and 6 months post-surgery of 95.2, an improvement of 6.2, p<0.001. This suggests that the procedure may improve family activities. The clinical significance of a change of this size

		is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved family activities would be of benefit to patients, but Lomholt et al 2016 does not provide a secure basis for conclusions about this outcome.
10.	Family cohesion	Family cohesion is defined in Lomholt et al 2016 as the family's ability to get along with one another. Lomholt et al 2016 report patients' mean scores pre-surgery of 79.7 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 81.4, an improvement of 1.7, p=1.00 and 6 months post-surgery of 81.5, an improvement of 1.8, p=1.00. Lomholt et al 2016 report parents' mean scores pre-surgery of 79.1 (out of a total score of 100, where 0 equals worst health and 100 equals best health), 3 months post-surgery of 82.0, an improvement of 2.9, p=0.33 and 6 months post-surgery of 84.8, an improvement of 5.7, p=0.03. This suggests that the procedure may improve family cohesion from the perspective of parents but not patients. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved family cohesion would be of benefit to patients, but Lomholt et al 2016 does not provide a secure basis for conclusions about this outcome.
11.	Psychosocial functioning	Psychosocial functioning is not defined in the papers included in this rapid evidence review, but usually means the interrelation of social factors and individual thought and behaviour. Kuru et al 2015 report patients' mean scores pre-surgery of 22.5 (out of a total score of 48, where higher scores mean better health status) and 6 months post-surgery of 33, an improvement of 10.5, p=0.00. Kuru et al 2015 report parents' median scores pre-surgery of 20 (out of a total score of 44, where higher scores mean better health status) and 6 months post-surgery of 24, an improvement of 4, p=0.00. This suggests that the procedure may improve psychosocial functioning. The clinical significance of a

		change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved psychosocial functioning would be of benefit to patients, but Kuru et al 2015 does not provide a secure basis for conclusions about this outcome.
12.	Body Image	Body image is not defined in the papers included in this rapid evidence review, but usually means a person's perception of the attractiveness of their own body. Kelly et al 2008 report patients' median scores pre-surgery of 2.3 (out of a total score of 4, where lower scores mean better health status and 1 = very happy) and 1 year post-surgery of 1.4, a standardised effect size of 1.70. $p<0.0001$. This suggests that the procedure may improve body image. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved body image would be of benefit to patients, but Kelly et al 2008 does not provide a secure basis for conclusions about this outcome.
13.	Emotional difficulties	Emotional difficulties are not defined in the papers included in this rapid evidence review. Kelly et al 2008 report parents' mean scores pre-surgery of 1.81 (out of a total score of 4, where lower scores mean better health status and 1 = very happy) and 6 months post-surgery of 1.24, a standardised effect size of 1.02, $p<0.0001$. This suggests that the procedure may improve emotional difficulties from parents' perspectives. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Reduced emotional difficulties would be of benefit to patients, but Kelly et al 2008 does not provide a secure basis for conclusions about this outcome.
14.	Social self-consciousness	Social self-consciousness is not defined in the papers included in this rapid evidence review, but usually means one's heightened sense of self-awareness or preoccupation with oneself. Kelly et al 2008 report parent's mean scores pre-surgery of

		2.86 (out of a total score of 4, where lower scores mean better health status and 1 = very happy) and post-surgery of 1.33, a standardised effect size of 1.75, p<0.0001. This suggests that the procedure may improve social self-consciousness from parents' perspectives. The clinical significance of a change of this size is not reported and unclear, making the result hard to interpret from a patient's perspective. Improved social self-consciousness would be of benefit to patients, but Kelly et al 2008 does not provide a secure basis for conclusions about this outcome.
15	Surgical impact on cardiovascular reserve	Maagaard et al 2013 highlighted the following: 1. Preoperatively, patients had lower forced expiratory volume in the first second of expiration (Forced Expiratory Volume (FEV1); 86% ± 13%) as compared with controls (94% ± 10%), p = 0.009. Postoperatively, no difference was found in FEV1 between the 2 groups. 2. Preoperatively, patients had lower maximum cardiac index, mean ± SD, 6.6 ± 1.2 l·min(-1)·m(-2) compared with controls 8.1 ± 1.0 l·min(-1)·m(-2) during exercise (p = 0.0001). One year and 3 years postoperatively, patients' maximum cardiac index had increased significantly and after 3 years there was no difference between patients and controls (8.1 ± 1.2 l·min(-1)·m(-2) and 8.3 ± 1.6 l·min(-1)·m(-2), respectively [p = 0.572]).
16	Surgical volumes and outcomes	Johnson et al, 2014 found no linkage between ages of operative treatment with outcomes. There was no clear difference in outcomes between the Nuss and Ravitch populations across all age groups, but slightly better outcomes in the Nuss paediatric group as compared to all other groups. Nasr et al, 2010 found no difference in patient satisfaction between both techniques among studies looking at this outcome. A meta-analysis of 2476 cases (1555 Nuss, 921 open surgery) from 23 international studies (Chen et al, 2012) reported more improvement in physiological measures of lung function with the Nuss procedure compared to open surgery, with best results 3 years after surgery. Authors also reported that cardiovascular function after surgery improved by greater than one-half standard deviation. However, no supporting analysis was included in the publication. This meta-analysis was powered to compare physiological pulmonary function change by type of pectus procedure performed and time after surgery.

		Other large case series (Kelly et al, 2013. Žganjer et al, 2011) report positive improvement of chest wall in varying degrees as well as improvement in pulmonary function. Most studies report 80-90% good to excellent anatomic surgical outcomes. Given the limitations in the study design, the overall evidence in this 3 cases (1555 Nuss, 921 open surgery) from 23 international studies (Chen et al, 2012) reported more improvement in physiological measures of lung function with the Nuss procedure compared to open surgery, with best results 3 years after surgery. None of the studies had a healthy (non-pectus) or no-intervention comparator arm or linked the physiological lung function with clinical presentation (dyspnoea, chest pain, exercise intolerance) pre- and post-surgery. Hence, it cannot be used to draw an inference on the clinical effectiveness of pectus procedure on lung function. Authors also reported that cardiovascular function after surgery improved by greater than one-half standard deviation.
17	Evidence relating to eligibility and thresholds for surgery	Leading US centres report inclusion criteria for surgery as severe pectus excavatum that fulfils two or more of the following: Computed Tomography (CT) index greater than 3.25, evidence of cardiac or pulmonary compression on CT or echocardiogram, mitral valve prolapse, arrhythmia, or restrictive lung disease (Kelly et al, 2007. Kelly et al 2010)

Considerations from review by Rare Disease Advisory Group
Not applicable.

Pharmaceutical considerations
Not applicable.

Considerations from review by National Programme of Care
1) The proposal received the full support of the Cancer PoC Board on 18th October 2018.