**Post-Event Pain Algorithm (CCHMC)**

Pain is a personal, multidimensional experience in which genetic biomarkers has a main role in determining pain sensitivity, perception and tolerance. Pain is a major concern for surgical patients and post-operative pain management still present a major challenge both in inpatient or outpatient settings. Apart from genetic factors, there are many other variables that may affect pain perception for example, pretreated patients may require less post-surgical medications, and they may recover more quickly. Although there are no gold standard, numeric rating scale (NRS 0–10) are regularly used in postoperative pain treatment. The estimated tolerable postoperative pain before operation is median of NRS 4.0 (0–10). Patients who would need more analgesics reported significantly higher average pain since surgery median NRS 5.0 compared with those without this request NRS 3.0 (1).

In this algorithm we assess NRS scores in two major pediatric surgeries including scoliosis and pectus excavatum as well as a focus study on sickle cell crisis for African-American ancestry.

**Case: (post-operative)**

1. Any individuals above age 6 years old who undergone one-time surgery for scoliosis or pectus excavatum (Table 1, Diagnosis) repair and with CPT code of spine-deformity surgery and pectus excavatum (Table 3a/3b and Table 4). The exclusion criteria are listed in Table 2. These individuals should have at least three and above (>=3) NRS scores in records (same encounter) in which will be assessed using standard descriptive statistics including mean, standard deviation (SD) and range.

**Table 1. Case Inclusion Diagnosis Criteria**

|  |  |  |
| --- | --- | --- |
| **Description** | **ICD-9** | **ICD10** |
| Scoliosis | 737.3\* 754.20 | M41.\*Q67.5\*Q76.3\*Q76.42\* |
| Pectus Excavatum | 754.81 | Q67.6 |

**Table 2. Case Exclusion Criteria**

|  |  |  |
| --- | --- | --- |
| **Description** | **ICD-9** | **ICD10** |
| <6 years old |  |  |
| Pectus carinatum | 754.82 | Q76.7 |
| Intellectual delay or disability (spastic quadriplegia, cerebral palsy, mental retardation | 318.\*319.\*342.\*343.\*344.\* | F71-F79G80.\*G81.\*G82.\* |
| Obesity or BMI>30 |  |  |
| More than one surgery for scoliosis or pectus excavatum |  |  |
| Other severe long term illness including those on dialysis, malnutrition or starvation. | V56.\*263.\* | Z49.\*E44.\* |
| Pretreated narcotic medications-up to 48 hours before surgery |  |  |

**Table 3a. CPT codes for spinal surgery**

|  |  |
| --- | --- |
| **Description** | **Code** |
| Arthrodesis, posterior, for spinal deformity, with or without cast; up to 6 vertebral segments | 22800 |
| Arthrodesis, posterior, for spinal deformity, with or without cast; 7 to 12 vertebral segments | 22802 |
| Arthrodesis, posterior, for spinal deformity, with or without cast; 13 or more vertebral segments | 22804 |
| Arthrodesis, anterior, for spinal deformity, with or without cast; 2 to 3 vertebral segments | 22808 |
| Arthrodesis, anterior, for spinal deformity, with or without cast; 4 to 7 vertebral segments | 22810 |
| Arthrodesis, anterior, for spinal deformity, with or without cast; 8 or more vertebral segments | 22812 |
| Kyphectomy, circumferential exposure of spine and resection of vertebral segment(s) (including body and posterior elements); single or 2 segments | 22818 |
| Kyphectomy, circumferential exposure of spine and resection of vertebral segment(s) (including body and posterior elements); 3 or more segments | 22819 |
| Posterior segmental instrumentation (eg, pedicle fixation, dual rods with multiple hooks and sublaminar wires); 3 to 6 vertebral segments (List separately in addition to code for primary procedure) | 22842 |
| Posterior segmental instrumentation (eg, pedicle fixation, dual rods with multiple hooks and sublaminar wires); 7 to 12 vertebral segments (List separately in addition to code for primary procedure) | 22843 |
| Posterior segmental instrumentation (eg, pedicle fixation, dual rods with multiple hooks and sublaminar wires); 13 or more vertebral segments (List separately in addition to code for primary procedure) | 22844 |
| Anterior instrumentation; 2 to 3 vertebral segments (List separately in addition to code for primary procedure) | 22845 |
| Anterior instrumentation; 4 to 7 vertebral segments (List separately in addition to code for primary procedure) | 22846 |
| Anterior instrumentation; 8 or more vertebral segments (List separately in addition to code for primary procedure) | 22847 |

**Table 3b. ICD-9-PROC** **codes for spinal surgery**

|  |  |
| --- | --- |
| **Description** | **Code** |
| Spinal fusion | 81.0\* |
| Refusion of spine  | 81.3\* |
| Other procedures on spine | 81.6\* |

**Table 4a. CPT codes for pectus excavatum**

|  |  |
| --- | --- |
| **Description** | **Code** |
| REPAIR PECTUS EXCAVATUM/CARINATUM OPEN | 21740   |
| REPAIR PECTUS EXCAVATM/CARINATM MINLY W/O THRSC | 21742   |
| REPAIR PECTUS EXCAVATM/CARINATM MINLY W/THRSC | 21743   |

**Table 4b: ICD-9-PROC codes for pectus excavatum**

|  |  |
| --- | --- |
| **Description** | **Code** |
| Repair of pectus deformity | 34.74   |

**Covariates:**

1. BMI
2. Age
3. Gender
4. Race
5. Length of stay in hospital (LOS)
6. Medication including route and dosage at the time of NRS records
7. # POD NRS (Number of Post-Operative Days of NRS scores in an encounter), max of all surgical encounters, if multiple.

**Sickle Cell Pain**

**Inclusion Criteria**

**Case (Post sickle cell crisis):**

1. African American individuals with ICD-9 codes (Table 1a) who were admitted to hospital at the time of crisis with documented NRS scores. it will be reviewed using standard descriptive statistics including mean, standard deviation (SD) and range.
2. Case2: African American individuals with the same ICD-9 codes as above but with admission, but **no available history** of obtaining NRS scores.
3. Case3: African American individuals with the same ICD-9 codes as above but with **no available history** of obtaining NRS scores, nor admission.

**Control:**

1. African American individuals with SS but with no history of any crisis events (Table 1b). The control group should not have any ICD-9 codes mentioned in the cases.

**Table 1a—Case Inclusion**

|  |  |  |
| --- | --- | --- |
| **Description** | **ICD-9** | **ICD10** |
| Sickle Cell | 282.62282.64 282.69 | D57.0\*D57.21\*D57.41\*D57.81\* |

**Table 1b—Control Inclusion**

|  |  |  |
| --- | --- | --- |
| **Description** | **ICD-9** | **ICD10** |
| Sickle Cell | 282.61 282.63 282.68 | D57.10D57.20D57.40D57.80 |

**Table 1c—Control Exclusion**

|  |  |  |
| --- | --- | --- |
| **Description** | **ICD-9** | **ICD10** |
| Sickle Cell | 282.62282.64 282.69 | D57.0\*D57.21\*D57.41\*D57.81\* |

**Table 2--Exclusion list:**

|  |  |
| --- | --- |
| **Description** | **Code** |
| <6 years old |  |
| Intellectual delay or disability | 318.\*319.\*F71-F79 |
| Cancer | 140-239C01-D49 |
| Other severe long term illness including those on dialysis, malnutrition or starvation. | V56.\*Z49.\*263.\*E44.\* |
| Pretreated narcotic medications-up to 48 hours before surgery |  |

**Covariates:**

1. History of conditions (Table 3)
2. Age
3. Gender
4. Race/ethnicity (primarily African-American)
5. Length of stay in hospital
6. Medication including route and dosage at the time of NRS records
7. # POD NRS (Number of Post-Operative Days of NRS scores in an encounter), max of all event encounters, if multiple.

**Table 3—Covariate Diagnoses:**

|  |  |  |
| --- | --- | --- |
| **Description** | **ICD-9** | **ICD10** |
| Tuberculosis of limb bones | 015\* | A18.03 |
| Diagnosis of Hemoglobin F condition | 282.7 | D56.4 |
| Stroke  | 434.\*V12.54 | I63\*I66\* |
| Infarction | 410.\*V12.53 | I21.\*Z86.73Z86.74 |
| Acute Chest Pain | 413\*786.5786.50786.59 | R07.82R07.89R07.9 |
| Gallstone (cholecystitis) | 560.31574.\*575.0575.1\*576.0 | K56.3K80.\*K81.0K81.1K81.8K81.9K91.5 |
| Dactylitis | 282.61 282.63 282.68 | D57.10D57.20D57.40D57.80 |

**Reference:**

1. Gerbershagen HJ, Rothaug J, Kalkman CJ, Meissner W.Determination of moderate-to-severe postoperative pain on the numeric rating scale: a cut-off point analysis applying four different methods.Br J Anaesth. 2011 Oct;107(4):619-26. doi: 10.1093/bja/aer195. Epub 2011 Jun 30.