

Children's Mercy Kansas City

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Clinical Pathways

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1-2023

### Pectus Excavatum With Bar Placement ERAS

Children's Mercy Kansas City

These guidelines do not establish a standard of care to be followed in every case. It is recognized that each case is different and those individuals involved in providing health care are expected to use their judgment in determining what is in the best interests of the patient based on the circumstances existing at the time. It is impossible to anticipate all possible situations that may exist and to prepare guidelines for each. Accordingly, these guidelines should guide care with the understanding that departures from them may be required at times.

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## Pectus Excavatum Repair with Bar Placement Enhanced Recovery After Surgery

### Pectus Excavatum Repair with Bar Placement ERAS Algorithm

**Abbreviations (laboratory and radiology studies excluded):**  
 3W - three west floor  
 PACU- post anesthesia care unit  
 PO - by mouth  
 PRN - as needed  
 PTX - pneumothorax  
 TIVA - total intravenous anesthesia

#### Preoperative Care

- Preoperative Care:**
- Scopolamine Patch (1 mg transdermal), ordered in SDS
  - Carbohydrate-rich drink up to 2 hours before surgery
  - Anxiolysis - midazolam per anesthesia team

#### Intraoperative Care

- Maintenance of Anesthesia:**
- **Volatile** or TIVA at discretion of anesthesiologist
  - **Normothermia:**
    - Utilize Bair Hugger
    - Goal intraoperative temperature 36° - 38° C
  - **Euvolemia:**
    - Goal directed management with target euvolemia and avoidance of unnecessary over-administration
      - Isotonic fluids at 3-7 ml/kg/hr

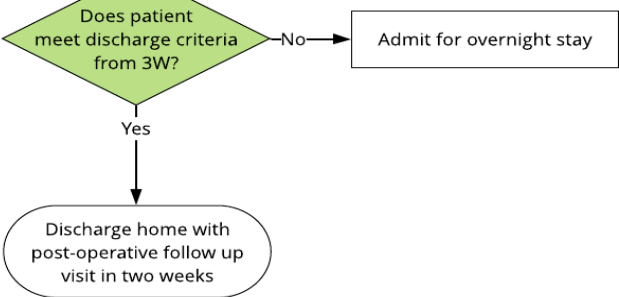
- Intraoperative Pain Management Protocol:**
- **Cryoablation of intercostal nerves performed by surgeon**
    - Pain lowering effects of cryoablation may be delayed in the immediate post-operative period
  - **Multimodal Analgesia:**
    - IV acetaminophen 10 -15 mg/kg at beginning of case
    - Ketamine 0.5 mg/kg - 1 mg/kg bolus at beginning of case
    - Dexmedetomidine infusion 0.5 mcg/kg/hr
    - Fentanyl prn during procedure
    - Ketorolac 0.5 mg/kg (max 15 mg) at end of case
    - Hydromorphone 10 mcg/kg X 1 at end of case

- **Antibiotics:**
  - Discuss at huddle
  - Administer before incision
- **Antiemetics:**
  - Dexamethasone 0.1mg/kg (max 8mg) **and** ondansetron 0.15 mg/kg (max 4mg)

#### PACU - 3 West

- PACU Pain Medications:**
- Fentanyl 0.5 mcg/kg q5 min PRN pain
  - Hydromorphone 5 mcg/kg q5 min PRN pain
  - Diazepam 0.05 - 0.1 mg/kg (max 5 mg) IV x 1 PRN muscle spasm
- Chest x-ray to confirm correct bar placement position**

- Discharge Criteria from 3W**  
 Following a 6-Hour observation time, medical staff to determine patient's discharge status based on:
- Pain well controlled
  - Able to tolerate clears
  - Stable respiratory status (Patients at risk for PTX)



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## Objective of ERAS Model

The Pectus Excavatum Repair with Bar Placement Enhanced Recovery After Surgery (ERAS) pathway aims to minimize the variation of care for the patient undergoing pectus excavatum repair with bar placement surgery, starting with the Center for Pectus Excavatum and Pectus Carinatum Clinic visit through hospital discharge. This includes optimizing pre-operative nutrition/metabolism, decreasing adverse medication side effects, promoting earlier return of bowel function, improving wound and anastomotic healing, and reducing overall hospitalization length of stay. In the last several decades the application of ERAS principles has shown significant improvements in various surgeries regarding length of stay, opioid use, pain control, and return to diet (Liu 2017).

## Background

Pectus excavatum is the most common pediatric chest wall deformity and can become visible anytime from infancy through puberty. It occurs in approximately 1/1,000 children and is four times more common in males versus females. Options for surgically correcting this deformity began in the early 1900s with development of a less invasive approach in the 1980s. Children's Mercy Kansas City (CMKC) modified the procedure further with a central incision for the passage of a steel bar across the chest. The bar assists with reshaping the child's chest as they grow. As this surgery continues to evolve, Children's Mercy has adopted the use of the Enhanced Recovery After Surgery pathway, which was developed to standardize perioperative care to accelerate recovery for pectus excavatum surgery patients.

## Target Users

- Anesthesiologists
- Pediatric surgeons
- Nurse practitioners
- OR nurses

## Target Population

### **ERAS Inclusion Criteria**

- Patients presenting for pectus excavatum repair with bar placement surgery

## Core Principles of ERAS (Melnyk et al., 2011)

- Pre-operative education of patients and family with an introduction to ERAS
- Reduced pre-operative fasting, with clear liquid oral carbohydrate loading until 2 hours prior to surgery
- Goal-directed strict intra-operative intravenous fluid therapy guidelines to avoid hypo- or hypervolemia
- Avoidance of pre-operative mechanical bowel preparation
- Avoidance of routine nasogastric tube use
- Minimizing long-acting opioid analgesia, in favor of regional anesthesia with epidural and/or local anesthesia for intra-operative and post-operative pain control when appropriate and using alternative non-opioid medications when appropriate (e.g., non-steroidal anti-inflammatories or acetaminophen)
- Early post-operative mobilization
- Early post-operative enteral feeding

## ERAS Management Recommendations:

### **Preoperative Care**

- The beginning of this ERAS pathway begins well before the surgical date. The concept of ERAS is presented to the patient/family at the initial surgical appointment and reinforced pre-operatively.
- The patient and family are provided with educational items at the initial surgical appointment, including pre-op diet restrictions, risks of anesthesia, and pain management strategies.
- Also discussed are some of the core concepts of ERAS, including the emphasis on early post-op PO intake and a multimodal pain management approach. Expectation management is crucial in the pre-operative phase. A handout (Appendix A), approved by CMKC's Health Literacy Committee, is given to the family prior to departing their pre-surgery appointment. The ERAS overview handout is available in Spanish as well (Appendix B).

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- Patients and families are provided contacts for the Pectus Clinic to answer any questions they may have prior to the procedure.
- On the morning of surgery, the patient drinks carbohydrate-rich clear fluids up to two hours before procedure start time.
- A 1 mg transdermal scopolamine patch is ordered and applied in same day surgery
- Anxiolysis is determined by the anesthesia team and midazolam is used as needed

**Intraoperative Care**

The principal goals during the intraoperative care of these patients are:

- Multimodal approach to pain management
  - IV acetaminophen at beginning of case
  - IV ketamine bolus X 1 at beginning of case
  - IV ketorolac at end of case
  - IV hydromorphone X 1 at end of case
  - Cryoablation of intercostal nerves performed by surgical team
- Post-operative nausea and vomiting prophylaxis with dexamethasone and ondansetron
- Fluid management goal of euvoemia
- Ensure that antibiotics are administered prior to surgical incision
- Maintain normothermia throughout the entire procedure
- Cryoablation of nerves by the surgical team

**Postoperative Care**

The principal goals during the postoperative care of these patients are:

- Transition from IV to oral medications as soon as possible
- Achieve good pain control utilizing a combination of medications to treat pain
- Prevention of nausea
- Getting out of bed as soon as possible after surgery
- Tolerate oral intake
- Review postoperative instructions including recommended pain and bowel medication regimen
- Stable respiratory status; no oxygen requirement
- Focus on early discharge from hospital with individualized home instructions.

**Additional Questions Posed by the CPM Committee**

No clinical questions were posed by this committee.

**Key Metrics To Be Monitored:**

Preop	Intraop	Postop
Carbohydrate-rich drink	IV acetaminophen	PACU PONV score
	PONV prophylaxis	Average pain score
	ABX prior to incision	Long-acting opioids
	Ketorolac	Length of stay
	Ketamine	
	Normothermia	

**Value Implications**

The following potential improvements may reduce costs and resource utilization for healthcare facilities and reduce healthcare costs and non-monetary costs (e.g., missed school/work, loss of wages, stress) for patients and families.

- Decreased inpatient length of stay
- Decreased unwarranted variation in care

**Potential Organizational Barriers and Facilitators**

**Potential Barriers**

- Challenges with follow-up faced by some families

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**Potential Facilitators**

- Collaborative engagement across care continuum settings during ERAS development
- High rate of use of ERAS pathways within the hospital setting

**Power Plans**

- General Surgery Post Op Pectus Excavatum Repair
- General Surgery Same Day Pectus Excavatum

**Associated Policies**

There are no associated policies with this ERAS pathway.

**ERAS Model Preparation**

This care process was prepared by the Department of Evidence Based Practice (EBP) in collaboration with content experts at Children’s Mercy Kansas City. Development of this care process supports the Division of Quality Excellence and Safety’s initiative to promote care standardization that is evidenced by measured outcomes. If a conflict of interest is identified the conflict will be disclosed next to the committee member’s name.

**Implementation & Follow-Up**

Once approved, this ERAS pathway was presented to appropriate care teams and implemented. Care measurements will be assessed and shared with appropriate care teams to determine if changes need to occur. This ERAS pathway is scheduled for revision in January 2023.

**Pectus Excavatum Repair with Bar Placement ERAS Committee Members and Representation**

- Tolulope Oyetunji, MD, MPH | Surgery | Committee Co-Chair
- Emily Weisberg, MD, FASA | Anesthesiology | Committee Co-Chair
- Christian Taylor, MD | Anesthesiology | Committee Member
- Amy Pierce, MSN, APRN, PPCNP-BC | Surgery | Committee Member
- Beth Orrick, APRN, FNP-BC | Surgery | Committee Member
- Diane Rash, MSN, RN, CPNP-AC, PC | Surgery | Committee Member
- Azita Roberson, MSN, RN, CPN, APRN, FNP-C | Department of Anesthesiology | Committee Member

**EBP Committee Members**

- Todd Glenski, MD, MSHA, FASA | Anesthesiology, Evidence Based Practice
- Andrea Melanson, OTD, OTR/L | Evidence Based Practice
- Megan Gripka, MT (ASCP) SM | Evidence Based Practice

**Additional Review & Feedback**

- The ERAS pathway was presented to each division or department represented on the ERAS committee as well as other appropriate stakeholders. Feedback was incorporated into the final product.

**ERAS Development Funding**

The development of this guideline was underwritten by the EBP, Anesthesiology, and Surgery Departments.

**Approval Obtained:**

Department/Unit	Date Approved
Anesthesiology	August 2022
Surgery	August 2022
Evidence Based Practice	August 2022

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**Version History**

Date	Comments
September 12, 2022	Initial version
January 12, 2023	Updates to pre-operative care discussed and approved by committee – incorporated into documents with webpage updated

**Disclaimer**

When evidence is lacking or inconclusive, options in care are provided in the ERAS algorithm(s) and the power plans that accompany the guideline.

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## References

- Liu, V.X., Rosas, E., Hwang, J., Cain, E., Foss-Durant, A., Clopp, M., et al. (2017). Enhanced recovery after surgery program implementation in 2 surgical populations in an integrated health care delivery system. *JAMA Surg, 152*, e171032. <https://doi.org/10.1001/jamasurg.2017.1032>
- Melnyk, M., Casey, R. G., Black, P., & Koupparis, A. J. (2011). Enhanced recovery after surgery (ERAS) protocols: time to change practice? *Canadian Urological Association Journal = Journal de l'Association des urologues du Canada, 5(5)*, 342–348. <https://doi.org/10.5489/cuaj.11002>

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**Appendix A**  
**Pectus ERAS Pathway Overview**

**ERAS**

**Pectus Excavatum Repair with Bar Placement Enhanced Recovery After Surgery Pathway**



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**Pectus Center**

<p><b>BEFORE SURGERY</b></p>	<ul style="list-style-type: none"> <li>✓ Attend preop visit on the diagnosis, treatment and management of pectus excavatum (<a href="http://www.childrensmercy.org/pectus">www.childrensmercy.org/pectus</a>)</li> <li>✓ Sign up for the patient portal</li> <li>✓ Perform daily pectus exercises</li> <li>✓ Take 1 capful of MiraLAX once daily starting 3 days prior to surgery</li> <li>✓ Bathe or shower the night before or morning of surgery. No lotions, oils, powders, or creams after the bath/shower</li> </ul>	<p><b>PECTUS CLINIC</b></p> <hr/>  <p><b>HOME</b></p>
<p><b>DAY OF SURGERY</b></p>	<ul style="list-style-type: none"> <li>✓ Do not eat solid food six hours before surgery</li> <li>✓ Finish drinking a carbohydrate-rich drink 2-3 hours before surgery – you must not eat or drink anything a full 2 hours before surgery</li> <li>✓ Take pre-operative medication for anxiety, if needed</li> </ul>	 <p><b>PRE-SURGICAL AREA</b></p>
<p><b>DURING SURGERY</b></p>	<ul style="list-style-type: none"> <li>✓ Cryoablation will be performed to freeze the intercostal nerves on each side prior to placing the bar. This will temporarily decrease pain transmission through these nerves.</li> <li>✓ Multiple approaches to treat pain and reduce opioid need</li> <li>✓ Prevention of post-operative nausea</li> </ul>	 <p><b>OPERATING ROOM</b></p>
<p><b>AFTER SURGERY</b></p>	<ul style="list-style-type: none"> <li>✓ Transition from IV to oral medications as soon as possible</li> <li>✓ Combination of medications to treat pain</li> <li>✓ Prevention of nausea and tolerate oral intake of food</li> <li>✓ Getting out of bed as soon as possible after surgery</li> <li>✓ Achieve good pain control</li> <li>✓ Review postoperative instructions including recommended pain and bowel medication regimen</li> </ul>	 <p><b>OBSERVATION UNIT</b></p>
<p><b>FOLLOW UP</b></p>	<ul style="list-style-type: none"> <li>✓ Monitor recovery and appearance of incisions</li> <li>✓ Follow recommended medications and methods for pain control</li> <li>✓ Complete the satisfaction survey</li> <li>✓ Attend follow-up clinic visit in approximately 2 weeks after surgery</li> </ul>	 <p><b>HOME</b></p>

Developed by Departments of Surgery and Evidence Based Practice  
9.10.22

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**Appendix B**  
**Pectus ERAS Pathway Overview – Spanish**






# ERAS

Vía de recuperación mejorada después de la cirugía de reparación del pectus excavatum con colocación



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## Centro de pectus

<p><b>ANTES DE LA CIRUGÍA</b></p>	<ul style="list-style-type: none"> <li>✓ Asista a la visita preoperatoria sobre el diagnóstico, tratamiento y manejo del pectus excavatum (<a href="http://www.childrensmercy.org/pectus">www.childrensmercy.org/pectus</a>)</li> <li>✓ Inscribese en el portal del paciente.</li> <li>✓ Realice los ejercicios diarios para el pectus.</li> <li>✓ Tome 1 tapa llena de MiraLAX una vez al día comenzando 3 días antes de la cirugía.</li> <li>✓ Báñese o dúchese la noche anterior o la mañana de la cirugía. No use lociones, aceites, polvos o cremas después del baño/ducha.</li> </ul>	<p>CLÍNICA PECTUS</p>  <p>EN LA CASA</p>
<p><b>EL DÍA DE LA CIRUGÍA</b></p>	<ul style="list-style-type: none"> <li>✓ No ingiera alimentos sólidos desde seis horas antes de la cirugía</li> <li>✓ Tómese una bebida completa, rica en carbohidratos, entre 2 y 3 horas antes de la cirugía; no debe comer ni beber nada desde 2 horas antes de la cirugía</li> <li>✓ Tome el medicamento preoperatorio para la ansiedad, si es necesario</li> </ul>	 <p>ÁREA DE PRECIRUGÍA</p>
<p><b>DURANTE LA CIRUGÍA</b></p>	<ul style="list-style-type: none"> <li>✓ Se realizará una crioblación para congelar los nervios intercostales de cada lado antes de colocar la barra. Esto disminuirá temporalmente la transmisión del dolor a través de estos nervios.</li> <li>✓ Múltiples enfoques para tratar el dolor y reducir la necesidad de opiáceos</li> <li>✓ Prevención de las náuseas postoperatorias</li> </ul>	 <p>SALÓN DE OPERACIONE</p>
<p><b>DESPUÉS DE LA CIRUGÍA</b></p>	<ul style="list-style-type: none"> <li>✓ Transición de medicamentos intravenosos a medicamentos orales lo más pronto posible</li> <li>✓ Combinación de medicamentos para tratar el dolor</li> <li>✓ Prevención de las náuseas y tolerancia a la ingesta de alimentos por vía oral</li> <li>✓ Levantarse de la cama lo más pronto posible después de la cirugía</li> <li>✓ Lograr un buen control del dolor</li> <li>✓ Revisar las instrucciones postoperatorias, incluyendo el régimen</li> </ul>	 <p>UNIDAD DE OBSERVACIÓN</p>
<p><b>SEGUIMIENTO</b></p>	<ul style="list-style-type: none"> <li>✓ Monitorear la recuperación y la apariencia de las incisiones</li> <li>✓ Tomar los medicamentos y seguir los métodos recomendados para el control del dolor</li> <li>✓ Responder la encuesta de satisfacción</li> <li>✓ Asistir a la visita clínica de seguimiento aproximadamente 2 semanas después de la cirugía</li> </ul>	 <p>EN LA CASA</p>
<p>Preparado por los Departamentos de Cirugía y Práctica Basada en Evidencias 10.09.22</p>		

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