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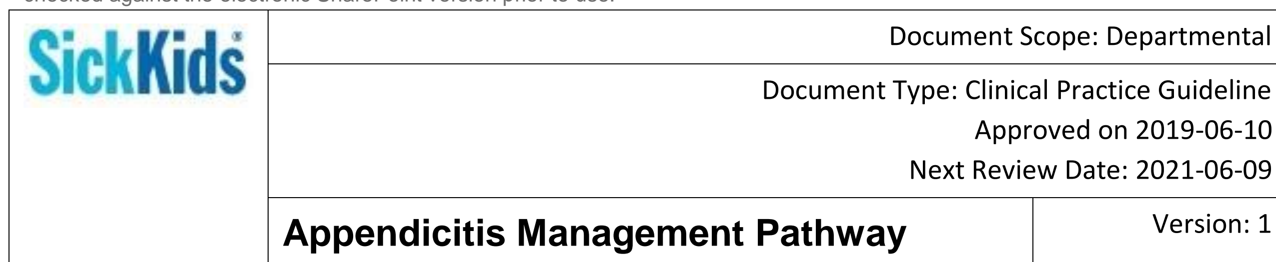

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	Document Type: Clinical Practice Guideline Approved on 2019-06-10 Next Review Date: 2021-06-09	
	Appendicitis Management Pathway	Version: 1

Introduction

This pathway is for use with children aged 2-18 years old with no underlying disease or co-morbidity who have a confirmed diagnosis of appendicitis (either non-perforated or perforated) by the General Surgery Team who require a surgical appendectomy or medical management. Patients are to be removed from this pathway if there are significant postoperative complications (eg. bowel obstruction or prolonged TPN) or a change in diagnosis.

Target Users

- General Surgery Surgeons, Residents, Fellow, Nurse Practitioners, and nurses on the inpatient units

Definitions

- **Non-perforated appendicitis-** Appendix is normal, injected, inflamed or suppurative. Presence of cloudy fluid +/- local fibrinous exudate, or gangrenous appendicitis but with no visible hole in appendix, abscess or free fecalith
- **Perforated appendicitis-** Visible hole in appendix, free fecalith, diffuse peritonitis with fibrinous exudate or abscess
- **Appendectomy-** surgical removal of the appendix
- **Fever-** a fever is defined as any temperature reading greater than 38.3ºC

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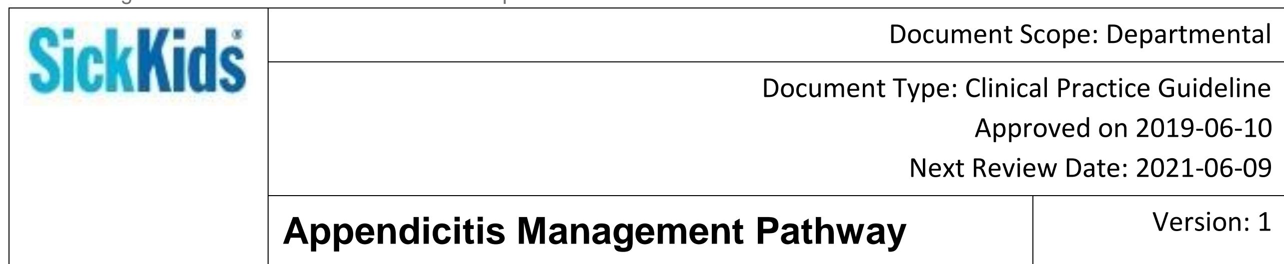

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Appendicitis Management Pathway

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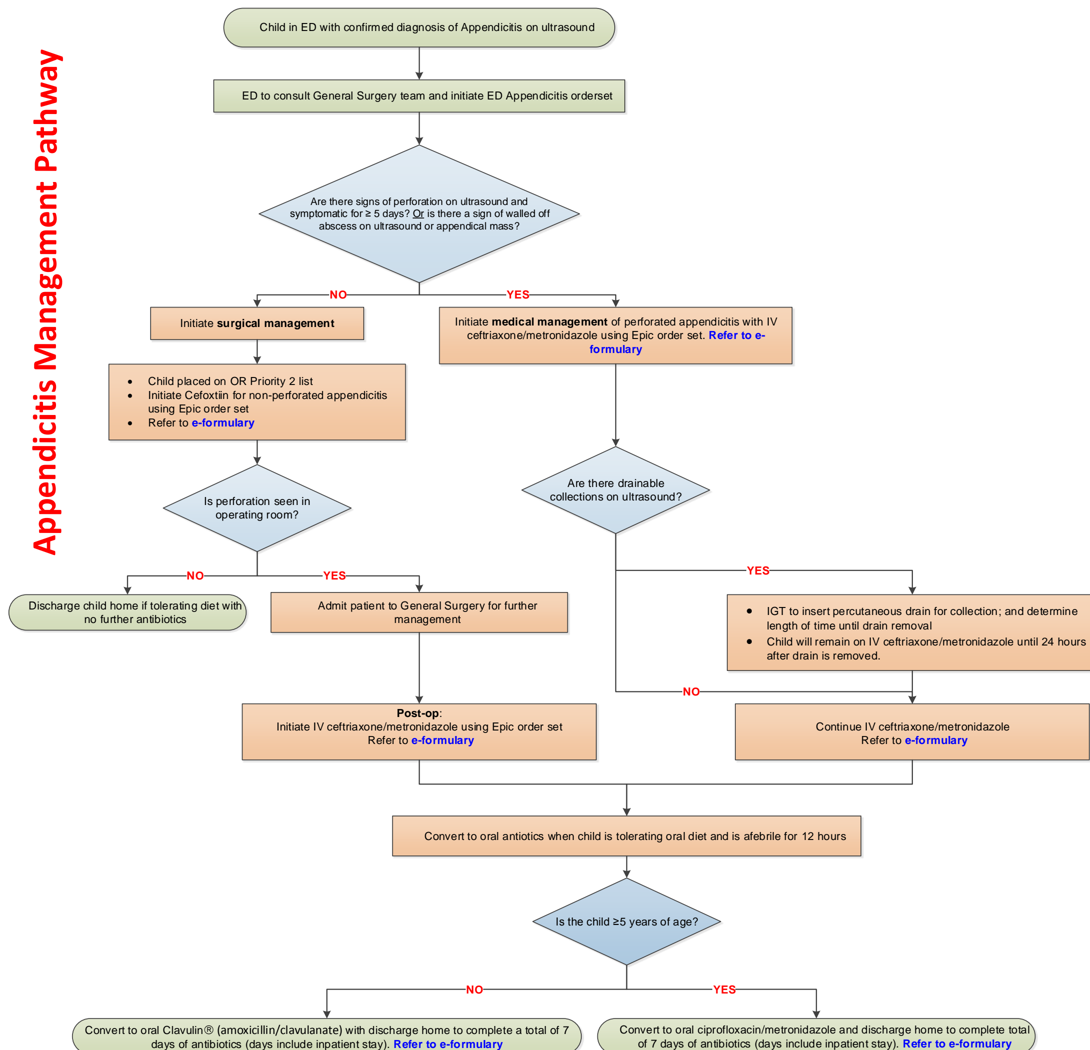
Recommendations



*If the patient clinically worsens, consider upgrade to IV piperacillin/tazobacta. If no ultrasound within the past 2-3 days, repeat in order to evaluate for drainable collection. If collection found, refer to algorithm for patient with drainable collections (IGT).

**At any point, physician of record can break from protocol based on additional factors which influence the patient's hospital course and management.

*** A fever is defined as any temperature reading greater than 38.3º C

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Appendicitis Management Pathway

Version: 1

Inpatient Non-Perforated Appendicitis Care Pathway **Expected Date of Discharge: within 24 hours post-op**

	PRE-OPERATIVE	POST-OPERATIVELY	DISCHARGE: WITHIN 24 HOURS POST-OP
GOALS	1. Hydration maintained 2. Adequate pain control 3. Patient prepared for OR 4. Child/family are advised of pre-op bath. Wipes to be used upon arrival. Refer to procedure document	1. Afebrile 2. Adequate pain control 3. Ambulating 4. Able to tolerate diet (clear fluids to regular diet) 5. Incision intact, no drainage; dry and intact	1. Afebrile X 24 hours 2. Adequate pain control 3. Ambulating 4. Able to tolerate diet 5. Incision dry and intact 6. Child/ caregiver teaching
PHYSICAL EXAM	• Obtain history • Complete physical exam • Assess vital signs • Complete pain assessment (refer to Pain Assessment Guidelines) • Obtain accurate in and out	• Complete pain assessment every 4 hours • Ensure child has adequate pain control (refer to Pain Management Guidelines) • Monitor vital signs as per Bedside PEWS • Obtain accurate in and out • Complete wound assessment • Complete abdominal assessment	
DIET & IV FLUIDS	• Ensure that patient is NPO • Administer D5W and 0.9 NaCl with 20mmol KCl/L at maintenance • Bolus as indicated • Refer to Fluid and Electrolyte Guidelines	• Clear fluids to regular diet as tolerated • IV to maintenance; TKVO once adequate oral fluid intake • Bolus as indicated • Refer to Fluid and Electrolyte Guidelines	
MEDICATION	• Cefoxtin IV; if allergy then Clindamycin or Ciprofloxacin & Metronidazole. Refer to the e-formulary • Pain medication as needed; morphine/ acetaminophen/ NSAIDs. Refer to the e-formulary	• Morphine IV bolus PRN • Acetaminophen as needed for pain/fever • Ketorolac or ibuprofen every 6 hours as needed for pain management	
ACTIVITY & EDUCATION	• Activity: as tolerated • Consent for surgery • Pre-op procedures for child and caregiver • Review parental involvement in care (pre and post-operatively)	**Diet:** • Advance diet as tolerated **Pain:** • Acetaminophen and ibuprofen (if not contraindicated) for 48 hours then as needed • Review need for pain management **Incision care:** • Leave steri-strips until fall off on own or remove after 10 days • Once steri-strips removed, may wash incision gently with soap and water **Signs and symptoms of wound infection:** • Fever • Redness around incision • Drainage from incision • Increasing pain around incision **Bathing:** • May shower or bathe; and swim 48 hours after surgery **Activity:** • Ambulate in hallway at least 5 times • May return to normal daily activities as patient feels able	**When to call surgeon's office:** • Wound infection • Vomiting • Fever • Pain **Follow-up:** • Confirm need for follow-up with Primary Surgeon • Family doctor/pediatrician in 2-4 weeks

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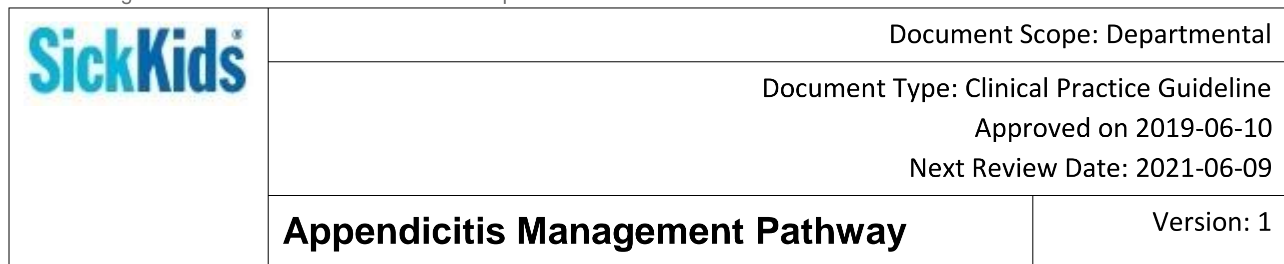

Inpatient Perforated Appendicitis Care Pathway **Expected Date of Discharge: Post-op Day (POD) # 5**

	DAY OF ADMISSION	DAY # 1	DAY # 2 - # 3	DAY # 4	DAY # 5
GOALS	1. Hydration maintained 2. Adequate pain control 3. Patient prepared for OR if surgical management required 4. Child/family are advised of pre-op bath. Wipes to be used upon arrival. Refer to procedure document	1. Afebrile 2. Adequate pain control 3. Ambulating 4. Able to tolerate clears (immediately post-op) 5. Incision intact, no drainage; dry and intact 6. If Nasogastric Tube present, advance from intermittent suction to straight drainage	1. Afebrile 2. Adequate pain control 3. Ambulating 4. Able to tolerate regular diet 5. Incision dry and intact 6. If Nasogastric Tube present, advance from straight drainage to clamp and remove	1. Afebrile 2. Adequate pain control 3. Ambulating 4. Able to tolerate regular diet 5. Incision dry and intact 6. Child and family understand discharge teaching 7. Able to tolerate oral antibiotics	
PHYSICAL EXAM	• History & Physical • Vital Signs • Height and Weight • Pain Assessment (focus on abdominal) every 4 hours • Accurate In & Out	• Vital signs as per Bedside PEWS • Pain assessment (focus on abdominal) every 4 hours • Adequate pain control • Accurate In & Out • Wound assessment (remove surgical dressing, leave steri-strips) Abdominal assessment			
IV FLUIDS	• D5W & 0.9% NaCl with 20mmol KCl/L • Bolus as clinically indicated with 0.9% NS or Lactated Ringer's • Refer to Fluid and Electrolyte Guidelines	• D5W & 0.9% NaCl with 20mmol KCl/L at maintenance • Bolus as clinically indicated with 0.9% NS or Lactated Ringer's • Refer to Fluid and Electrolyte Guidelines	• Maintenance until adequate oral fluid intake and then TKVO		
DIET	• Diet as tolerated • If NPO, ensure that child is receiving IV fluids with D5W • Assess need for TPN therapy				
MEDICATIONS	**Pre-operatively:** • Pain medication as needed (morphine / acetaminophen) • Start once daily dosing of IV ceftriaxone and metronidazole (Refer to e-formulary for dosing) **Post-operatively:** • Morphine IV continuous infusion (as required) • Please check with Primary Surgeon if NSAIDs can be prescribed (Ketorolac vs. ibuprofen). • Acetaminophen as needed for pain/fever • Ranitidine if clinically indicated Once daily dosing of IV ceftriaxone and metronidazole until child is tolerating oral diet and afebrile for 12 hours (Refer to Appendicitis Management Pathway Algorithm (Refer to e-formulary for dosing)	**Pain management:** • If on morphine infusion, wean as tolerated (decrease by 5mcg/hr every 24 hours) • Acetaminophen every 4 to 6 hours for 48 hours then as needed for pain/fever • Ketorolac or ibuprofen every 6 hours for 48 hours (Confirm with Primary Surgeon for scheduled versus or as needed if allowed) **Antibiotics:** • Once daily dosing of IV ceftriaxone and metronidazole • If afebrile for 12 hours and tolerating diet (ex: no emesis, non-distended, and pain managed), consider switching to oral Clavulin (amoxicillin/clavulanate) or ciprofloxacin and metronidazole, to complete a 7day course. • Re-evaluate need for continuing IV antibiotic therapy (then to start pathway again) • Refer to e-formulary • Refer to Appendicitis Management Pathway **If Nasogastric Tube present:** • Ranitidine or pantoprazole IV as clinically indicated			

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Evaluation

- Process measures:
  - Antibiotic utilization
  - Rate of oral antibiotics tolerated (how often)
  - Slicer dicer program utilization in Epic
- Outcome measures:
  - At 6 months and 1 year after implementation compare the hospital length of stay, surgical site infection rate (as defined by the American College of Surgeon National Surgical

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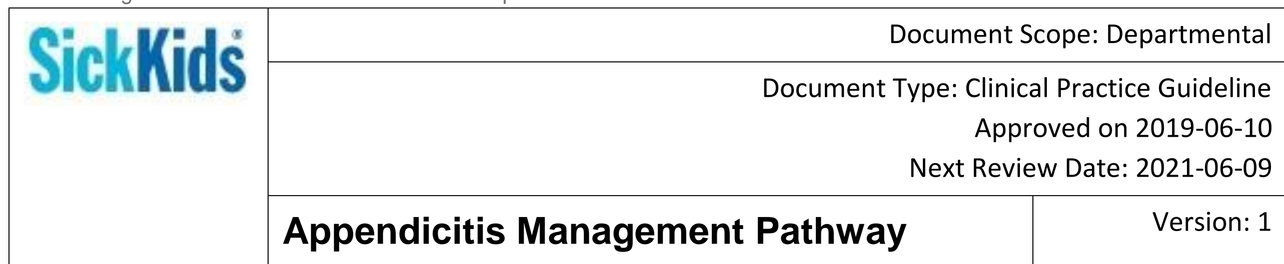

Quality Improvement Project [ACS NSQIP]), organ space infection rate/abscess rate (as defined by ACS NSQIP), and 30-day readmission rate among children being treated for appendicitis, and compare these metrics to historical controls (those children treated for the 6 months prior to the implementation of this pathway); and

- Repeat analysis at 1 year. We will also follow abscess cultures over the course of one year to ensure there is not a large change in the types of bacteria being cultured from our abscess.

References

1. Alloo, J., Gerstle, T., Shilyansky, J. & Ein, S. (2004). Appendicitis in children less than 3 years of age: a 28 year review. Pediatric Surgery International, 19, 777-779.
2. Berrios-Torres, S. I et al., (2017). Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. *JAMA Surgery.* doi:10.1001/jamasurg.2017.0904
3. Bratzler, D. & Houck, P. (2004) Antimicrobial Prophylaxis for Surgery: An Advisory Statement from the National Surgical Infection Prevention Project. Clinical Infectious Diseases, 38, 1706-1715.
4. Children's Hospital of Philadelphia: Appendicitis without Known GI Disease Clinical Pathway- Emergency
5. Children's Hospital of Philadelphia: Appendicitis Clinical Pathway- Inpatients
6. Cincinnati Children's Hospital: Emergency Appendectomy Clinical Pathway
7. Dreznik, Y. (2018). Dual versus Triple Antibiotics Regimen in Children with Perforated Acute Appendicitis. *European Journal of Pediatric Surgery, 28*(06), 491-494
8. Ein, S., Langer, J., & Daneman, A. (2005). Nonoperative managment of pediatric ruptured appendix with inflammatory mass or abscess: presence of an appendiocolith predicts recurrent appendicitis. *Journal of Pediatric Surgery, 40*, 1612-1615.
9. Fraser, J., Aguayo, P., Leys, C., Keckler, S., Newland, J., Sharp, S., Murphy, J., Snyder, C., Sharp, R., Andrews, W., Holcomb, G., Ostlie, D., St. Peter, S. (2010). A complete course of intravenous antibiotics vs a combination of intravenous and oral antibiotics for perforated appendicitis in children: a prospective, randomized trial. *Journal of Pediatric Surgery* 45, 1198-1202.
10. Gee, K., Ngo, S., Burkhalter, L., & Beres, A. L. (2018). Safety and feasibility of same-day discharge for uncomplicated appendicitis: A prospective cohort study. *Journal of Pediatric Surgery, 53,* 988-990.
11. Groter, R. R., Sarah-May, M. L., Groter-Stam, M. A.W., Eker, H. H., Bakx, R., Lee, J. H., & Heij, H. (2017). Systematic review of nonoperative versus operative treatment of uncomplicated appendicitis. *Journal of Pediatric Surgery, 52,* 1219-1227.
12. Inpatient and Surgical Care: Appendectomy for Ruptured Appendix with Abscess or Generalized Peritonitis Care Guideline
13. Lansdale, N., Fryer, S., Stockdale, M., Bancroft, J., Orr, J., Corbett, H., & Kenny, S. (2019). Prospective evaluation of a clinical response directed pathway for complicated appendicitis. *Journal of Pediatric Surgery, 54*, 272-275.
14. Lee SL, Stark R, Yaghoubian A, Shekherdimian S, Kaji A. Does age affect the outcomes and management of pediatric appendicitis? *J Pediatr Surg*. 2011;46(12):2342-2345. doi:10.1016/j.jpedsurg.2011.09.030
15. Lee, S., Islam, S., Cassidy, L., Abdullah, F., Arca, M. (2010). Antibiotics and appendicitis in the pediatric population: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee Systematic Review. *Journal of Pediatric Surgery*, 45, 2181-2185.
16. Lou, T., Falk, G.A., Burnweit, C. A., Ramos, C., Knight, C., & Malvezzi. (2016). Early transition to oral antibiotics for treatment of perforated appendicitis in pediatric patients: Confirmation of the safety and efficacy of a growing national trend. *Journal of Pediatric Surgery, 51,* 903-907.
17. Matthaiou DK, Peppas G, Bliziotis IA, Falagas ME. Ciprofloxacin/metronidazole versus β-lactam-based treatment of intra-abdominal infections: a meta-analysis of comparative trials. *Int J Antimicrob Agents.* 2006. doi:10.1016/j.ijantimicag.2006.04.005
18. Meier, D., Guzzetta, P., Barber, L., & Seetharamaiah, R. (2003). Perforated appendicitis in children: Is there a best treatment?. *Journal of Pediatric Surgery, 38(10),* 1520-1524.
19. Newman, K., Ponsky, T., Kittle, K., Dyk, L., Thropp, C., Gieseker, K., Sills, M. & Gilbert, J. (2003). Appendicitis 2000: Variability in Practice, Outcomes, and Resource Utilization at Thirty Pediatric Hospitals. *Journal of Pediatric Surgery, 38*, 372-379.
20. Rice HE, Brown RL, Gollin G, et al. Results of a pilot trial comparing prolonged intravenous antibiotics with sequential

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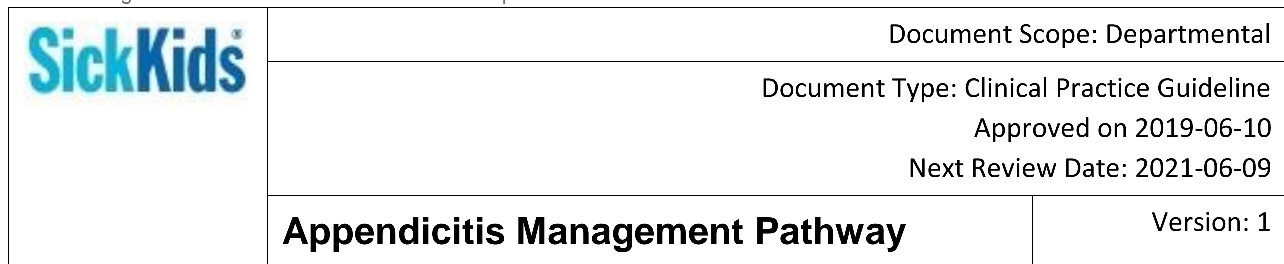

intravenous/oral antibiotics for children with perforated appendicitis. *Arch Surg*. 2001. doi:10.1001/archsurg.136.12.1391

21. RNAO Best Practice Guideline: Assessment and Management of Pain (2007)
22. Saluja, S., Sun, T., Mao, J., Steigman, S., Oh, S., Yeo, H. L., Sedrakyan, A., & Merianos, D. (2018). Early versus late surgical management of complicated appendicitis in children: A statewide database analysis within one-year follow-up. *Journal of Pediatric Surgery, 53*,1339-1344
23. Solomkin, JS, et al. Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America [2]. Clin Infect Dis 2010;50:133-164.
24. St. Peter SD, Tsao K, Spilde TL, et al. Single daily dosing ceftriaxone and metronidazole vs standard triple antibiotic regimen for perforated appendicitis in children: a prospective randomized trial. *J Pediatr Surg*. 2008. doi:10.1016/j.jpedsurg.2008.02.018
25. Sujka, J.A., Weaver, K.L., Sobrino, J.A. et al. (2019). Efficacy of oral antibiotics in children with post-operative abscess from perforated appendicitis. *Pediatric Surgery International, 35,* 329-333 https://doi.org/10.1007/s00383-018-4424-0
26. University Hospitals of Cleveland: Pediatric Appendicitis/Simple Laparoscopic/Open Technique Care Path
27. Vaos G, Dimopoulou A, Gkioka E, Zavras N. Immediate surgery or conservative treatment for complicated acute appendicitis in children? A meta-analysis. *Journal of Pediatric Surgery*. 2018.
28. Warner, B. W., Kulick, R. M., Stoops, M.M, Mehta,S., Stephan, M., & Kotagal, U.R. (1998). An Evidence-Based Clinical Pathway for Acute Appendicitis Decreases Hosptial Duration and Cost.
29. Zani, A., Hall, N. J, Rahman, A., Morini, F., Prato, A. P., Friedmacher, F., Koivusalo, A., Heurn, E., & Pierro, A. (2019). European Paediatric Surgeon's Association Survey on the Management of Pediatric Appendicitis. *European Journal of Pediatric Surgery, 29*(01), 053-061

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Attachments:

non_perf_june 10.pdf

Implementation of CPG.docx

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