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A Unified Treatment Algorithm and Admission Order Set for Pediatric Acute Pancreatitis

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Pediatric acute pancreatitis (AP) has increased over the last two decades (1) with the most recent incidence being 12.3/100,000 persons per year (2); and inpatient costs alone exceeds $100 million/year (2–5). Data on best practices in children are limited and practice varies widely across the US and even within the same pediatric institution (6). To bring uniformity to the diagnosis and treatment of pediatric AP, the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) and European Pancreas Club/ Hungarian Pancreatic Study Group (EPC/HPSG) published pediatric AP management recommendations (7, 8). Given the effectiveness of evidence-based clinical guidelines to improve clinical care (9), several pediatric hospitals have independently developed center-specific pediatric AP-focused treatment algorithms and admission order sets.

We analyzed the AP treatment algorithms and admission order sets at four tertiary/ quaternary care children's hospitals in the U.S. (Cincinnati Children's Hospital Medical Center, Lucile Packard Children's Hospital at Stanford, Seattle Children's Hospital, University of Iowa Stead Family Children's Hospital) to reach a consensus for delivering consistent and evidence-based care in pediatric AP. Each institution had previously developed their own products, with Cincinnati being the first in 2013 (10). All institutions had admission order sets, while Seattle and Stanford also developed treatment algorithms. Treatment algorithms provide practical guidance to physicians on how to implement clinical guidelines in a user-friendly manner (11). All protocols focused on initial diagnosis and assessment of clinical status, frequency of vitals checks, "early aggressive" intravenous fluids, early nutrition (enteral vs. intravenous), and pain (non-opioid and opioid)

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management. Overall, there were minor differences between protocols, for example: types of fluids chosen, presence or absence of fluid bolus as standard management (vs. as needed), and specific opiates used for pain. Most products included teaching points for provider education. Admission order sets and treatment algorithms from the four institutions were harmonized with current NASPGHAN and EPC/HPSG recommendations (7, 8), and where applicable, the American Gastroenterological Association (AGA) AP guidelines (12). For broader consensus these were sent to all authors of the NASPGHAN Clinical Report on management of pediatric AP (7). There was broad excitement and consensus with the major tenets of the algorithm and order set, with no objections or major concerns from any of the authors. Minor comments were incorporated, as appropriate.

In summary, we generated a standardized and unified pediatric AP admission order set (Supplemental Digital Content) and treatment algorithm (Figure 1) that are in-line with the current NASPGHAN, EPC/HPSG and AGA AP guidelines. While these products were reviewed and approved by other pediatric pancreatologists, it should be noted that these are based on minimal evidence and expert opinion, given the paucity of relevant pediatric-specific data. We recognize that there may be institution-specific variation and accommodations made based on patient-specific circumstances, however, we hope that these resources will further standardize the treatment of pediatric AP, which in turn will improve outcomes and generate pediatric-specific data on best clinical practices for AP.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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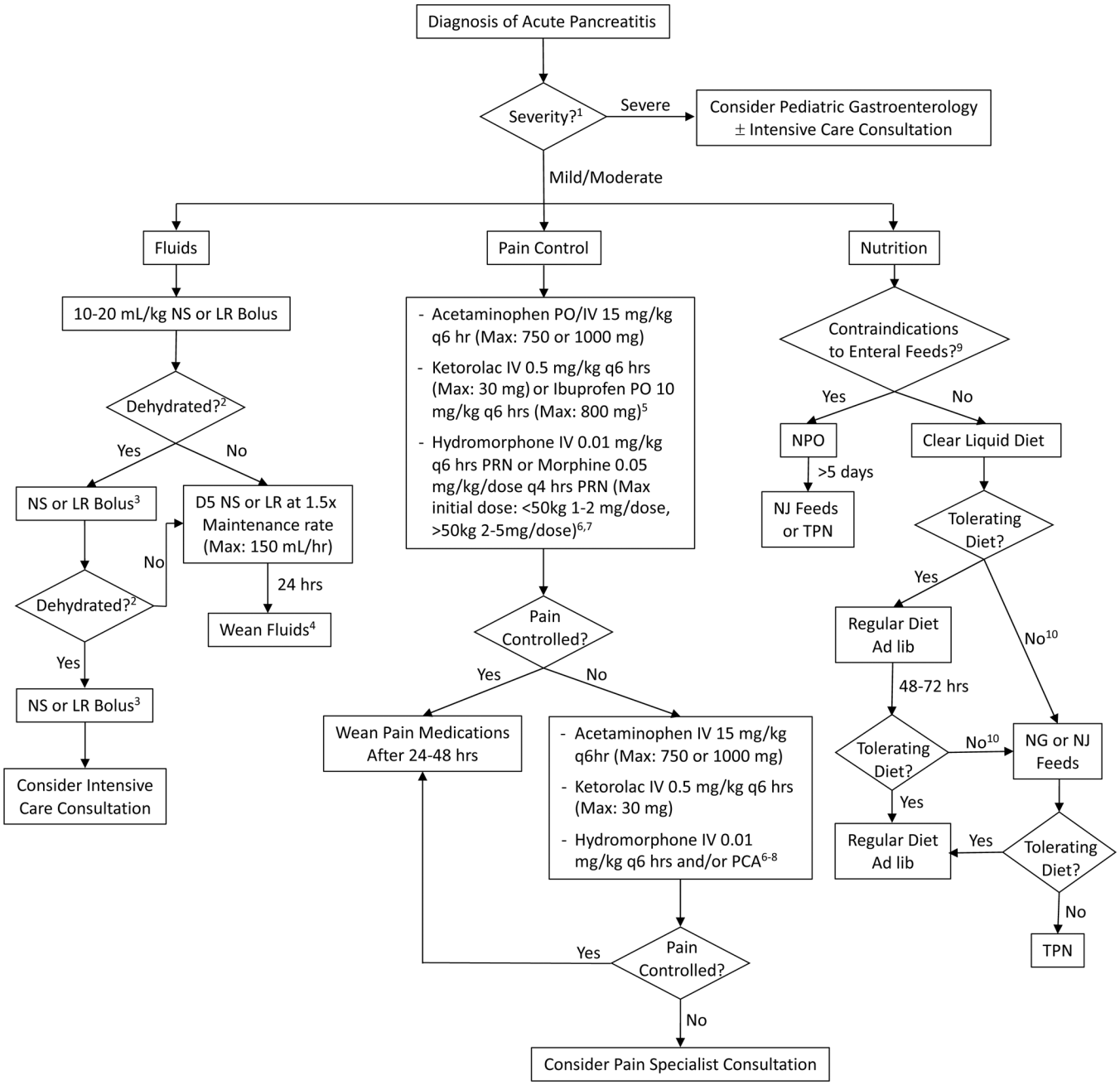

Figure 1. Treatment algorithm for pediatric AP.

Abbreviations: NS=normal saline, LR=lactated Ringers, D5=5% Dextrose, PO=per os, IV=intravenous, PRN: *pro re nata* (as needed), PCA: patient controlled analgesia, NPO: *nil per os* (nothing by mouth), NJ=nasojejunal, NG=nasogastric, TPN=total parental nutrition. [1] To help guide management, determine severity of AP (13). [2] Need for continued boluses determined by: signs of dehydration: Urine output < 1 cc/kg/hr, tachycardia, hypotension, delayed capillary refill, and poor skin turgor. Avoiding aggressive fluids and use of goal-directed fluid therapy is essential to preventing complications such as pulmonary edema. [3] 10–20 mL/kg, based on clinical status. Monitor for signs of fluid overload or third-spacing.

Consider LR over NS if metabolic acidosis is present. [4] Wean based on clinical status and enteral intake. [5] Use non-steroidal anti-inflammatory drugs only if BUN and creatinine are normal. [6] Other opiates may be substituted based on patient needs and institutional preferences. [7] When using opioids, place patient on laxatives. Recommend: Polyethylene glycol 3350 1g/kg/day (divided once or twice daily) if no stools in 24–48 hrs. May increase to achieve goal of at least one soft stool daily. [8] Consult pain service when on PCA, if service available. [9] Examples of contraindications to enteral feeding include, but are not limited to: disrupted pancreatic duct, intestinal obstruction, and ileus. [10] If not tolerating adequate diet within 48–72 hrs, consider if pain and/or nausea adequately controlled. For antiemetics, recommend: IV or PO ondansetron 0.15 mg/kg/dose q6–8 hrs as needed for nausea and emesis. Maximum dose of 8 mg q8 hrs. Also consider imaging to evaluate for complications from pancreatitis (e.g. pancreatic fluid collection/necrosis or pancreatic duct stricture/stones). Recommend: IV contrast enhanced CT or MRCP if biliary/pancreatic duct abnormalities are suspected (with IV secretin if available for pancreatic duct evaluation).