Evidence Based Practice for POCT
pH Guidelines

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pH Literature Searches

- pH “OR” pH paper
- Narrowed with ocular, emergency, lavage, wash, tears, chemical burns, acid reflux, GERD, gastric, pH monitoring, achlorhydria, Sleuth, Gerchek, NG tube, nasogastric tube, gastroccult, gastric occult blood,
- Number of hits 81 – 226 abstracts

Evidence Based Practice for POCT pH Guidelines I

- **Does the use of pH paper to diagnose and monitor treatment of chemical exposure in the Emergency Department and Urgent Care patient populations improve length of stay and severity of burn compared to empirical treatment (no monitoring)?**
- *We note that pH paper may have utility in monitoring the treatment of chemical exposure in the Emergency Department and Urgent Care patient populations, but there is insufficient evidence to make a strong recommendation for or against its routine use. pH testing poses no risk to the patient and the minimal cost of testing have led to its common availability. However, a systematic examination should be conducted to determine if pH testing has an incremental benefit during irrigation therapy after chemical exposure that outweighs the time and expense required to maintain test quality training and documentation. (Grade of Evidence: III – clinical experience, descriptive studies, case reports and opinion)*

Evidence Based Practice for POCT pH Guidelines I

- Studies addressing skin and eye splashes, ingestion, and use of pH in prevention of surgical aspiration pneumonia (raise gastric pH) and differential diagnosis of diarrhea were found in literature search.
- Many studies (mostly animal studies) utilize pH testing to monitor changes during irrigation therapy after acid/base exposure, as a goal or therapy endpoint rather than as a means to improve patient outcome
- Irrigation duration and types of fluids varied, but continuous washing ASAP was a critical intervention to prevent permanent tissue damage
- Difficult to ascertain if pH measurement had any incremental benefit over simply irrigating area
- "Generally accepted pH of eye returns to normal before discontinuing therapy, if prolonged irrigation doesn't normalize pH then particulate matter possibly remains."

Evidence Based Practice for POCT pH Guidelines I

- Type of exposure important consideration when using pH paper, extremes of acid/base, some organics, protein, bile, and drugs can alter paper and may not be adequately measured
- Inaccuracies of 1.7 units or more may alter treatment decisions, although outcomes not examined.
- A wide range pH paper 1-12 and also paper with extended 12-14 range recommended (some papers found in ED are too narrow to be useful for evaluating caustic ingestions)
- Proper storage and QA/QC recommended and cost of keeping training and documentation on unit should be balanced with clinical benefit

Evidence Based Practice for POCT pH Guidelines II

- **Does the use of pH paper for assisting the placement of nasogastric tubes, compared to clinical judgment (air, pressure) improve the placement of tubes on inpatient, endoscopy, home care and nursing home patients?**
- *We recommend the use of pH testing to assist in the placement of nasogastric tubes. The choice of measuring pH with an intragastric electrode or testing tube aspirates with a pH meter or pH paper will depend on consideration of the clinical limitations of each method, and there is conflicting evidence over which method is better. (Class II – prospective comparative trials and expert opinion)*

Evidence Based Practice for POCT pH Guidelines II

- Assuring correct NG or NI tube placement:
  - Measure length of tube
  - Direct visualization of oropharynx
  - Auscultation of stomach by air insufflation
  - Aspiration of gastric contents
  - Irrigation of tube with 10 to 50 mL water
  - Direct palpation of tube within stomach during intra-abdominal procedures
- Gold Standard - Abdominal roentgenogram to confirm position
- pH may be faster, safer and more economical

Evidence Based Practice for POCT pH Guidelines II

- Gastric contents more acidic
- Neuman – pH < 4 can reduce need for x-rays (PPV 100%, Sens 100%, Spec 88% for N = 46 patients and 78 placements.) pH>4 not useful – respiratory or duodenal.
- Acid suppressors increase gastric pH and 6.0 may be a better cutoff (81% pH 1 – 4, 88% intestinal >6.0, pulmonary >6.5). Confounds aspirate pH 4 – 6.
- pH of gastric fluid may replace 85-95% of x-ray cases. Significant decrease radiation exposure

Evidence Based Practice for POCT pH Guidelines II

- Method to determine pH controversial
- Continuous monitor or pH tipped NG tube preferred for those patients that are equipped, but expensive.
- Question whether pH probes are measuring gastric contents or cell surface pH
- Aspirate pH may not generate sufficient volume, may differ from intragastric pH, as antacid, drug salts, protein and bile may interfere with some methods.
- pH meter more accurate than pH paper, but paper simpler (0.5 – 1.0 increments), cheaper, easier to use and quality assure, and can be performed bedside.
- X-ray confirmation still the “gold standard” and recommended in indeterminate cases.

Evidence Based Practice for POCT pH Guidelines III

- **Does continuous gastric pH monitoring, compared to random gastric pH determinations, improve patient symptoms and severity in the management of achlorhydria and gastric reflux in inpatient and endoscopy patients?**
- *We recommend against the intermittent use of pH paper on gastric aspirates in the diagnosis of gastric reflux disease in favor of continuous monitoring. The role of pH testing to manage acid suppression therapy is controversial. Although the use of pH testing is common on critical care units, there is a lack of evidence that pH monitoring to adjust drug dosage improves either morbidity or mortality in these patients. (Class II – well designed case controlled and correlation trials and consensus opinion)*

Evidence Based Practice for POCT pH Guidelines III

- Continuous pH monitoring is the gold standard for diagnosis of reflux (GER).
- Software calculates:
  - Cumulative acid exposure
  - Number of episodes
  - Average duration
  - Number of episodes > 5 mins
  - Longest episode of pH < 4.0
- Sensitivity = 88% and Specificity 98% for GER compared to endoscopy, manometry, barium esophagogram, reflux scintigraphy, cinematography or reliance on symptoms.

Evidence Based Practice for POCT pH Guidelines III

- pH paper limitations for GER
  - May not be able to aspirate sufficient volume for pH
  - Aspiration may precipitate a reflux episode
  - Intermittent aspiration vs continuous monitoring
  - Timing critical to detecting reflux
  - Gastric contents heterogeneous
  - Bias compared to meter, clinically relevant?
  - Antacids, salts, protein, bile may interfere
  - Limits use of pH paper for diagnosis and monitoring antacid or H2 blocker therapy, newer therapies more effective and may not need dose titration.

Evidence Based Practice for POCT pH Guidelines IV

- **Is one brand of pH paper better than another brand in improving patient symptoms and time to treatment of chemical burns in emergency and urgent care patients, and in improving the accuracy of nasogastric tube placement in inpatient, endoscopy, home care and nursing home patients?**
- *We cannot recommend one brand of pH paper over another brand of pH paper for use in the treatment of chemical burns or placement of nasogastric tubes. (Grade III – case reports and opinion)*

Evidence Based Practice for POCT pH Guidelines IV

- Two studies compared pH results between different brands of pH paper
- Products with more than one color change, or multiple overlapping scales detected more subtle pH changes, and were preferred by staff
- Accuracy (±1.0 unit) of single color pH papers ranged from 20 – 83% compared to pH meter
- Single color pH papers had deficiencies detecting pH 4.0 while multiple colors had problems at 1.0
- Effects of these inaccuracies on patient outcome were not examined.
- Studies old, market has changed since

Evidence Based Practice for POCT pH Guideline Take Home Messages

- pH paper useful on Critical Care, GI, and OB/GYN units
- pH paper not useful for diagnosis of GER or monitoring antacid/H2 therapy – use continuous pH monitoring
- Multiple color scales more accurate than single color pH paper compared to meters, effect on patient outcome not explored.
- No support for use in ED for acid/base exposure.

Evidence Based Practice for POCT pH Paper Summary

- pH paper is inexpensive and may be considered inconsequential to clinicians, but inaccuracies in pH can lead to inappropriate treatment (ie feeding tube placement) with the potential for serious and costly patient consequences.
- Need for strict QA.
- Further studies are needed that directly examine the effects of pH testing on patient outcome.