Anastomotic Leak Pathophysiology and pH: WHAT'S THE CONNECTION?



Tissue ischemia

Anastomotic leaks (AL) are a dreaded reality in gastrointestinal surgery, and remain a pervasive issues despite advances in other areas of modern medicine and surgical techniques. FluidAl's Stream[™] Platform offers real-time monitoring of drainage fluid for anastomotic leaks, utilizing key biomarkers such as pH to provide prediction of leak risk by postoperative day 2 – far earlier than current standard-of-care practices. The pathophysiological evidence connecting decreased pH and a leaking anastomotic site is significant, showing the biological interplay between pH and this serious complication.

pH and acute inflammation

While some inflammation is to be expected following a major surgery, excessive inflammation – and corresponding drops in pH of bodily fluids – are a red flag for postoperative complications, such as AL

- At the anastomotic site, decreases in pH can be attributed to local increases in the concentration of lactic acid produced by leukocytes (white blood cells that are key components of the immune system)
 - Following the trauma of surgery, fluid will leak out of blood vessels into nearby tissues, with a pH that decreases over time and has been shown to reach a minimum around 72 hours after surgery
- During the inflammatory response associated with a leak, a large number of cells, cytokines, ions, and inflammatory mediators move from the body's blood supply into the surrounding tissue
- These inflammatory cells can produce damaging substances called 'free radicals,' 'superoxide' and 'nitric oxide,' which combined with the low pH environment, can lead to further tissue injury impeding healing

Local blood flow is a critical aspect of successful healing of an anastomosis. Tissue ischemia at the anastomotic site (for instance, due to excessive tension, poor vascularization, etc.) plays a role in the appearance of an early and intense inflammatory response – and corresponding low pH value in the surrounding tissue

- In both human and animal models, the healing process is impaired by decreases in anastomotic tissue oxygen tension
- Decreased anastomotic intramucosal pH levels during the postoperative period are significantly associated with increased risk of dehiscence. Poor perfusion of an anastomosis starts early and increases the risk of severe complications such as leaks

Continuous monitoring of drainage fluid pH, and real-time alerts for patients whose values become pathologically low, allows a non-invasive 'window' into what is occurring, at the cellular level, around the surgical site. Given the direct association

> between decreased pH and AL, Stream[™] Platform allows for early prediction of this complication – leading to earlier intervention and improved outcomes for patients.

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Other immune effects

Acute inflammatory responses induce the activation of other white blood cells called 'neutrophils,' and 'macrophages'

- Macrophages, which normally act to kill microorganisms and remove dead cells, are upregulated in environments of low pH. Rather than supporting with normal immune function, abnormal upregulation can cause tissue injury associated with AL and impaired healing.
- Low pH in tissues around the surgical site also increases activity of immune cells called 'dendritic cells'
- While a strong immune system is a good thing, creating environments that lead to overactivity can be extremely harmful, **impeding**
- natural healing and contributing to AL