Improving Accuracy and Ease in the Evaluation of Adrenal Insufficiency: A Provider-driven Order Set Aimed at Streamlining ACTH-Stimulation Testing

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Problem Definition

The assessment of suspected adrenal insufficiency (AI) in the hospitalized patient can be diagnostically challenging given the complexities of concurrent critical illness, lack of standardization of AI testing and poor reliability of results in such patients. For hospitalized patients without septic shock or an established diagnosis of AI, the role of glucocorticoid therapy must be determined on a case-by-case basis depending on clinical suspicion for AI and level of acuity.

It should be noted that overuse of adrenal function testing in the general hospitalized patient population can lead to misdiagnosis of AI in many cases due the inherent frequency of false positive results, particularly in patients with low protein states. Such adverse events are largely resultant from the complex nature of testing for AI and lack of standardization. Unfortunately, this may result in cost ineffectiveness, inappropriate treatment, patient duress and prolonged length-of-stay (LOS).

Aims For Improvement

It is the purpose of our quality improvement project to assist in identification of patients in whom testing for AI may be most appropriate and to address barriers to performing testing correctly via an inpatient ACTH-stimulation order set.

Intervention

We reviewed available data from adrenal function testing and ACTH-stimulation testing performed within our institution and attempted to analyze the identifiable barriers to appropriate and correct testing. In doing so, we have designed a provider-driven order set to improve ease and accuracy of adrenal function testing.

Measurement and Results

In reviewing data from the chart of 34 patients hospitalized at Thomas Jefferson University Hospital (TJUH) in whom adrenal function and ACTH-stimulation testing were performed, we learned that testing is often incomplete or yields uninterpretable results

- **Timing:** Many random ACTH and random cortisol levels are obtained outside of the '7-10 AM' window in which these tests should be obtained to optimize diagnostic accuracy.
- **Clinical Yield**: 26% (9/34) had a 'failed' test result diagnostic of AI; 74% had an inconclusive or normal test (Figure 1.)
- **Frequent Reasons for Testing**: Frequency of nondiagnostic testing highlights the need to better identify those patients for which alternative diagnoses may be more highly considered and unnecessary testing can be avoided
  - Hypotension was the most common indication (28%, 10/34) for testing. In this group, only one (10%) had a clinically significant or 'failed' ACTH-stim test; the majority were diagnosed with sepsis. (Figure 2.)

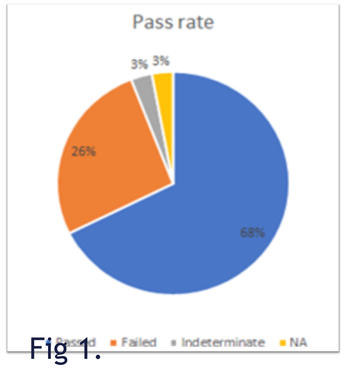

Fig 1.

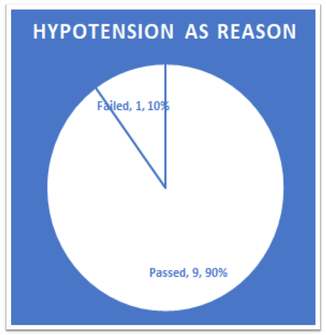

Fig 2.

- **PPV of Baseline Cortisol:** Baseline cortisol levels were analyzed with aim of identifying levels predictive of AI as confirmed by subsequent ACTH-stimulation testing (Figure 3).
  - **100% of patients with baseline AM cortisol >10** later had a normal or 'passing' ACTH-stimulation
  - **>90% of patients with baseline cortisol levels <5** had a significant or 'failing' test
  - PPV were less consistent those with baseline cortisol levels in the 5-10 range therefore suggesting a higher utility and **potential value of confirmatory testing in this subset.**

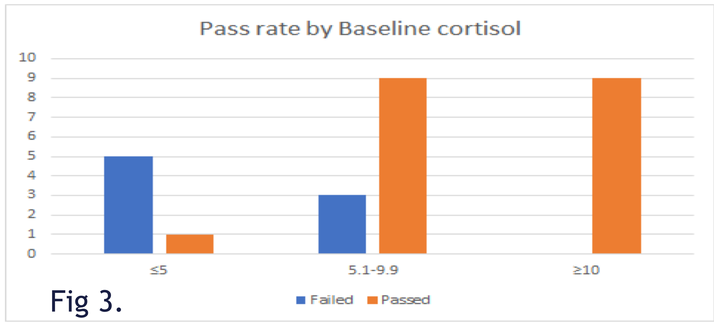

Fig 3.

Next Steps and Lessons Learned

While this data is limited and represents a small subset of patients, it is supportive of the need for a standardized institutional protocol for adrenal function. It is the aim of our project to streamline the intricate process of adrenal function testing in the hospital setting while minimizing costs of testing, reducing LOS, enhancing patient safety and improving clinical outcomes.

We have devised a provider-driven ACTH-stimulation order set that is educational, user-friendly and aimed at standardizing adrenal function testing. Within the body of this order set will be succinct and relevant information regarding indications for testing, variables that can confound results and cost of each component of testing requested (cortisol, ACTH, ACTH-stimulation). The order set (summary below) will include procedural instructions regarding optimal timing/sample processing and information regarding result interpretation.

Pretesting Considerations: Identify alternative diagnoses that may confound results and consider degree of suspicion for AI

Procedure
1. Baseline serum cortisol and ACTH levels (7-10A)
2. Inject 250 mcg cosyntropin (ACTH) intravenously (or IM if unable to obtain IV access) immediately after baseline labs
3. Obtain 60-minute cortisol level (time-marked)

Interpretation of results:
A rise in cortisol level to greater than 18 ug/dl within 60 minutes demonstrates a normal result.
A rise in cortisol to less than 18 ug/dl demonstrates an abnormal response(. If insufficient response to cosyntropin (syntethetic ACTH), the patient may have suppressed adrenal gland function and may benefit from glucocorticoid replacement.)
An elevated baseline ACTH level with low cortisol is suggestive of *primary* adrenal failure.