Using a neonatal phototherapy light to breakdown icteric interference

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A novel approach to a classic problem.

Introduction

A common issue encountered within the clinical biochemistry laboratory is icteric interference. This is when elevated bilirubin levels produce spectral interference that deems various analytical tests invalid. The most affected test is creatinine which is vital in the assessment of renal function and calculation of EGFR. This poses risk in various patient groups such as in liver failure patients, those with bile duct blockages or neonates. The answer to this problem may have already been solved, neonates who are jaundiced are treated with phototherapy light. When we expose our samples to the same light can we remove interference and generate corrected results?

Hypotheses

1) When exposed to a phototherapy lamp serum bilirubin levels and icteric indices levels decrease.
2) When exposed to a phototherapy lamp serum creatinine levels are unaffected in non-icteric samples
3) When exposed to a phototherapy lamp serum creatinine levels will rise in icteric samples and these changes are due to interference removal.

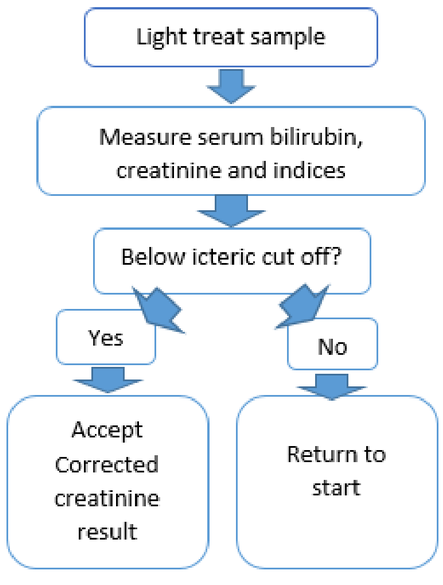

Figure 1: Flow chart showing testing protocol

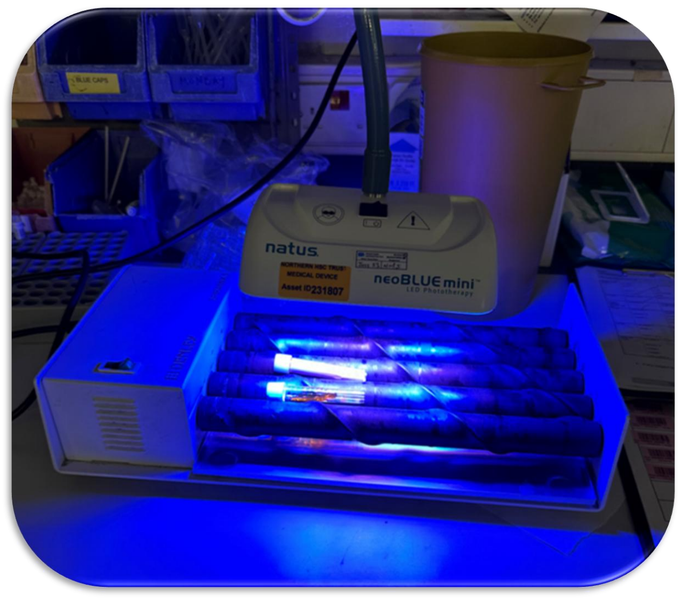

Figure 2: Phototherapy lamp and rotary mixer setup.

Methodology

Two aliquots of 250 microlitres are placed in clear false bottom tubes. One acts as the control, which was kept in the dark between analysis and the other sample is placed upon a rotary mixer underneath a neonatal phototherapy lamp. At regular time intervals creatinine, total bilirubin and serum indices were measured.

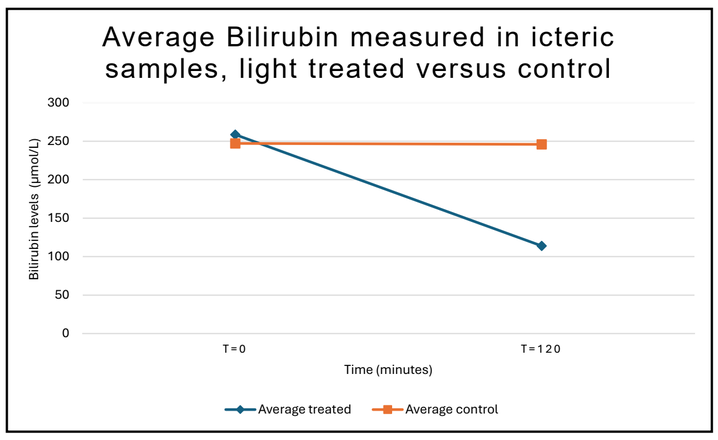

Figure 3: Graph showing average bilirubin levels with phototherapy treatment versus dark control (n = 11).

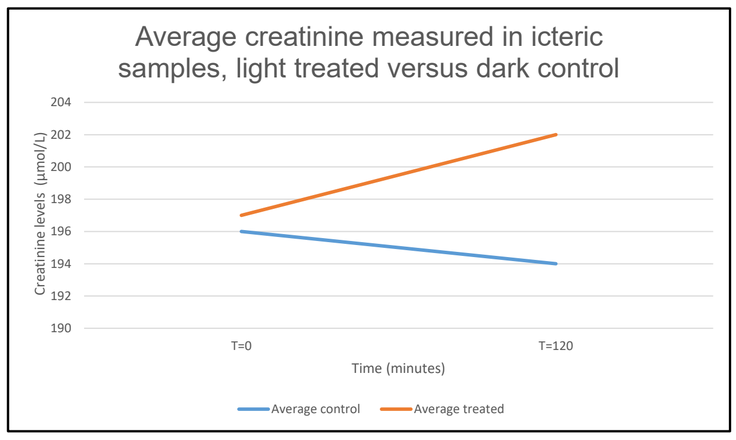

Figure 4: Graph showing average creatinine measured in icteric sample , light treated versus control (n = 11).

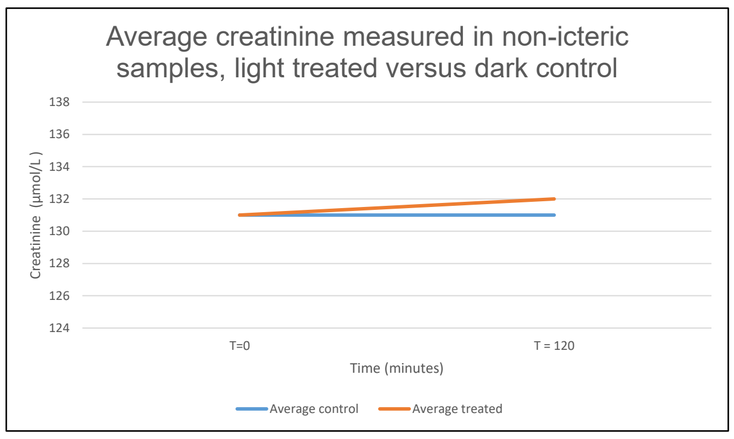

Figure 5: Graph showing average creatinine measured in non-icteric samples, light treated versus control (n=35).

Results

Figure 3 shows that as time passes under the lamp, bilirubin levels decrease. This is due to the conversion of bilirubin to urobilinogen. The breakdown of the bilirubin, the yellow pigment, leads to a “clearing” of the sample, this pigment is converted to a clear substance, which provides a lesser spectral impact. Figure 4 shows that as the icteric creatinine is treated the measured values increase, due to the breakdown of the bilirubin, however there is a decrease in the measured creatinine within the control group, this may be attributed to analyser variation or degradation of the samples. Figure 5 shows a very negligible difference between light treated and control creatinine measurement, this would infer that significant changes are due to bilirubin breakdown and that creatinine itself is negligibly affected by light treatment.

Conclusions

- The phototherapy lamp successfully breaks down bilirubin to urobilinogen and therefore lowers icteric interference.
- The phototherapy lamp leads to no significant change in creatinine in non icteric samples.
- When icteric samples are light treated creatinine levels increase due to the removal of icteric interference.

Pros and cons of methodology

Pros	Cons
• No dilutions necessary. • Simple to carry out. • Avoids disrupting sample matrix or lowering creatinine below level of detection.	• Care must be taken with samples as labels block light and therefore samples are better labelled by marker. • Process can be time consuming.

Future directions

Icteric interference impacts other analytes, further testing needs to be carried out on these tests, including total protein and troponin, testing both icteric and non-icteric samples.

Reference
Vera, M.D., Koch, C. and El-Khoury, J.M. (2023). Resolving icteric interference by a novel photoisomerization device: Bilibox. 115, pp.112–115. doi:https://doi.org/10.1016/j.clinbiochem.2022.07.004

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